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UN Environment Guide for Energy Efficiency and Renewable Energy Laws

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UN ENVIRONMENT GUIDE FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY LAWS

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UN Environment Guide for Energy Efficiency and Renewable Energy Laws

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UN ENVIRONMENT GUIDE FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY LAWS

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Foreword

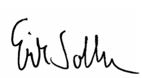
The Renewable Revolution

A revolution in the way we generate energy is driving a complete overhaul of the sector and its regulation. For the first time in history, most of our new energy capacity comes from renewable sources. What's more, in the nine years since first publishing this handbook, investment in the sector has nearly doubled. In response to such dramatic developments, this revised edition explores the latest laws promoting efficient and renewable energy projects.

The progress being made in the development and deployment of renewable energy is real cause for celebration around the world, from the Africa Renewable Energy Initiative to project funding from Asia-Pacific Economic Cooperation. The plummeting price of solar and wind energy makes them competitive with fossil fuels or nuclear options. Larger offshore wind projects create fewer environmental problems. A growing number of rooftops are becoming sources of power. Smart-grids, micro-grids and affordable storage provide more reliable distribution for developed urban areas and disadvantaged rural ones. Major improvements in power efficiency, technology and management are reducing waste, cost and emissions.

In fact, as access to renewable energy expands, so do the social, economic and environmental benefits, making it vital to the success of the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. However, realising the full potential of this sector requires careful legislation. Therefore, the handbook provides options for emerging areas, such as the geothermal industry, but also highlights many examples where legislation is already proving effective, including the creation of efficiency standards and labelling for consumer products and increasing rural access to clean, safe options for cooking and heating.

To maintain the necessary pace of progress, decision makers at all levels of both the public and private sector need the best legal tools and information. This handbook remains the only comprehensive review of laws relating to efficient and renewable energy. I hope that in providing a source of practical information, it will inspire many other legal experts to share their experience as we address the incredible challenges and opportunities ahead.



Mr. Erik Solheim,
Under-Secretary General of the United Nations and Executive Director,
United Nations Environment Programme

About the Guide

This Guide is written as a sequel to the 2007 UN Environment Programme Handbook for Legal Draftsmen on Environmentally Sound Management of Energy Efficiency and Renewable Energy Resources (the Handbook).[1] This Guide, as the Handbook, is written in response to needs expressed, particularly by energy efficiency and renewable energy project initiators, government officials, energy managers, project developers and particularly developing country energy legal draftsmen, asking for assistance in drafting legislative provisions for promotion and implementation of sound energy efficiency and renewable energy programs.

The Guide describes the key legal issues associated with efficiency and renewable energy resource development, and presents legislative options from both developed and developing countries for dealing with them, including sample excerpts from legislation.

A new section is included describing available mechanisms for financing energy efficiency and renewable energy projects. Another section has been added providing case studies analysing the laws of a variety of countries, namely from Colombia, the Philippines, Pakistan, South Africa, Ghana and Korea.

A very significant addition is a DVD containing a *UN Environment Compendium of National Laws and Regulations and Policy Documents on Renewable Energy and Energy* Efficiency. It contains:

- Full texts of laws and regulations on energy efficiency and renewable energy;
- Articles and notes on relevant national laws;
- Sources of such laws and regulations
- Laws and regulations on related areas such as climate change and the environment;
- Links to other materials on relevant laws and regulations .

The Guide is designed to be user-friendly. Accordingly, it has been written as a stand-alone document, not requiring back and forth reference between the Guide and the Handbook. As was stated in the Handbook, "the focus here is on national legislation, but encompasses national constitutional provisions, regulations and state and local laws where they are the key determinants of the promotion of efficiency and renewable resources. Emphasis is placed on adaptation to local country needs and conditions."

The Guide is divided into seven sections. Section One, *Issues of General Application,* contains legislative information on issues pertinent to all energy efficiency and renewable energy applications. Section Two, *Energy Options,* describes the choices to made evaluating energy efficiency and renewable energy in the context of the other available energy resources. Section Three, *Project Financing,* describes a range of financing methods and resources that have been used successfully

1 United Nations Envt Programme, Handbook for Drafting Laws on Energy Efficiency and Renewable Energy Resources (2007), http://www.unep.org/delc/Portals/119/publications/UNEP_Energy_Handbook.pdf.

to fund projects. Section Four, *Energy Efficiency,* relates the energy efficiency laws requisite for successful projects in the various sectors of the economy. Section Five, *Renewable Energy,* addresses legislation for each type of renewable energy. Section Six, *Rural Applications,* deals with the special legal needs for bringing useful energy to rural areas in developing countries.

Section Seven, *Case Studies,* contains case studies from Colombia, the Philippines, Pakistan, South Africa, Ghana and South Korea analysing the laws adopted by these countries to enable renewable energy and efficiency projects. Case studies from China, India, Brazil, Indonesia, Morocco, the Philippines, Pakistan and Indonesia can be found in the book by Richard Ottinger et. al., *Renewable Energy Law and Development: Case Study Analyses,* Edward Elgar, UK 2013, see: http://www.e-elgar.com/shop/renewable-energy-law-and-development; available at http://www.amazon.com/Renewable-Energy-Law-Development-Analysis/dp/1782546634.

It is the premise of the Guide that the prime goal of most developing countries is to provide for their people adequate food supplies, housing, health care, clothing, education and jobs to foster economic development, and that affordable, clean energy supplies are essential to accomplishing these goals.

Adrian J. Bradbrook, Lal Kurukulasuriya, Richard Ottinger, Karl R. Rábago, Mark Radka, Editors

Acknowledgements

The Guide is a product of the United Nations Environment Programme hereinafter referred to as the UN Environment. The objective of the UN Environment in developing this Guide is to provide countries, especially developing countries and countries with economies in transition, with up to date information and guidance in the formulation of national policies and legal frameworks for further expanding the use of renewable energy and achieving greater energy efficiency. Our warmest thanks go to Elizabeth Maruma Mrema, Director, Law Division UN Environment Programme and her colleague, Ms. Sylvia Bankobeza, Legal Officer, for their invaluable guidance and encouragement.

Richard Ottinger, Guide organizer, editor-in-chief and co-author, is Dean Emeritus of Pace Law School, Founder of the Pace Energy & Climate Centre, Co-Chair of the IUCN World Commission on Environmental Law's Energy Law & Climate Change Specialty Group co-sponsoring his work on the Guide, and Former Member of the U.S. Congress 1964-1984, chairing its Energy Conservation and Power Subcommittee. The help of his RAs, Sarah Main and Conor Strong was invaluable.

Warmest thanks To co-editors/authors, Adrian Bradbrook, Bonython Professor Emeritus, Adelaide Law School and his RA, Rebecca Mahony; Mark Radka, Head, Energy Climate and Technology Branch, Economy Division, UN Environment Programme and Lal Kurukulasuriya, International Environmental Law Consultant and former Chief of the UN Environment-Environmental Law Programme, who contributed the extremely useful attached DVD Compendium of National Laws and Regulations and Policy Documents on Renewable Energy and Energy Efficiency, as well as partnering and offering guidance on the editing of the Guide. Also thanks to the Pace Energy & Climate Center and its Executive Director, Karl Rabago, for hosting this effort and for his good counsel and editorial assistance. He also reviewed the entire manuscript for errors consistency issues.

Great gratitude is owed to the co-authors, all of whom contributed their time gratis in the areas of their expertise as a public service for this Guide and to their research assistants: Ethan Rogers, Senior Program Manager, Industry, American Council for an Energy-Efficient Economy (ACEEE) and his RA, Peter Black of NYU; David R. Hodas, Distinguished Professor of Law, Widener University; David Goldstein, Co-Director, Energy Program, Natural Resources Defense Council (NRDC); Katherine ("Kit") Kennedy, Director, Energy and Transportation Program, Energy & Transportation Program, Natural Resource Defense Council (NRDC) and her RAs, Peter Black and Sarah Main; Phillip Musegaas, Legal Director, Potomac Riverkeeper; Alexandra S. Wawryk, Senior Lecturer, Adelaide University Law School and her RAs Damian Etone and Michela Estelle Okninski; Dr. Teresa Malyshev, Analyst responsible for biomass issues, Renewable Energy Unit, Energy Technology Collaboration Division, International Energy Agency; Dr. Ibibia Lucky Worika, Professor of Law and Acting Dean, Faculty of Law, University of Port Harcourt, Nigeria and his RA, Uzuazo Etemire; John Bowie, energy consultant, Palo Alto, California, former Energy & Climate Law Centre Advisor, Pace Energy & Climate Centre.

Executive Summary

This UN Environment Guide for Energy Efficiency and Renewable Energy Laws is a sequel to the *UN Environment Programme Handbook for Legal Draftsmen on Environmentally Sound Management of Energy Efficiency and Renewable Energy Resources* that has been, since its publication in 2007, the only comprehensive, world-wide resource available to project initiators for information on the laws of energy efficiency and renewable energy.

The Guide. The Guide is intended to advise government energy officials and project developers, implementers and funders, of the laws adopted throughout the world to facilitate initiation of sound and sustainable energy efficiency projects. The timing of this sequel is important because so much of momentous importance has happened in the energy for development field since the 2007 Handbook publication, with the adoption by the UN General Assembly of Sustainable development Goals including Goal 7 on affordable and clean energy to provide clean, affordable and sustainable energy to all the peoples of the world; passage of the Paris Climate Change agreement; and the plummeting price of efficiency and renewable energy measures, all resulting in burgeoning demand for efficiency and renewable energy programs throughout the world. It is vital that the resulting initiatives be successfully implemented, requiring knowledge of the enabling laws which this Guide presents.

Issues of General Application. The Guide starts with addressing issues of general application relevant to all energy efficiency and renewable energy initiatives. For example, the chapter first demonstrates the importance of laws requiring environmental assessments of the impacts of the various options for meeting required energy needs of the public. This is followed by an account of the importance of laws requiring full public disclosure of the results of the environmental assessments and of the benefits and costs of proposed projects, with full public participation in projects from the planning stage through to project implementation. Laws regulating the pricing of projects and those protecting customers from provision of defective products and faulty installation and developer failures and misdeeds are also covered. The chapter also addresses laws demonstrating various means of enforcement of environmental laws, emphasising enabling citizen organizations to act, through the courts if necessary, to assure enforcement of environmental laws, and laws to provide for health and safety during project implementation. Last but not least, the chapter discusses provisions for education and training of those who are responsible for execution of projects, as well as the judges and prosecutors involved in enforcement.

Financing. The new section on project finance is an important addition, since financing is of critical importance to the decision to undertake projects and the ability to provide the resources necessary to complete sound and sustainable projects. The lifetime costs of most efficiency and renewable energy projects have been significantly reduced since the publication of the 2007 Handbook, making most renewable energy projects economically advantageous, and enhancing their contribution to economic development. However, financing still requires laws to incentivise development because the multi-billion dollar subsidies for fossil fuel and nuclear energy tilt the economic playing field, and the externality risks and harms to public health and the environment from pollution caused by combustion of fossil fuels almost never included in their pricing. Furthermore, the sometimes

high up-front costs of renewable energy equipment and many efficiency investments, laws such as those enabling utility financing with repayment over time through utility bills or municipal financing with repayment through a property tax surcharge can make a significant difference to project affordability.

Helpful Resources

The International Renewable Energy Agency in Abu Dhabi has excelled in assisting developing countries and their communities to establish sound, sustainable and successful renewable energy programs. A particularly useful tool for program initiators is its Navigator Project, accessible at https://navigator.irena.org/Pages/default.aspx, that gives walk through assistance on preparation, staffing, equipment acquisition and verification, construction, and, uniquely, follow up advice to project initiators. This is an invaluable new resource.

Paragraph H of the Financing Section Three above contains a compendium of financing resources for efficiency and renewable energy projects and finance referral services.

Other chapters also contain valuable source information.

Energy Options' Selection. In deciding whether to undertake an efficiency or renewable energy project, a decision usually has to be made regarding which of the available energy supply and demand options are best, in the context of other options such as for fossil fuel or nuclear powered electricity. The advantages and disadvantages of each are discussed in this chapter.

Energy Efficiency. Energy efficiency - providing the same energy services, but using less energy - is generally the quickest and most economic means of satisfying energy needs. Most efficiency investments have very fast paybacks, often, within one or two years. Yet, demand side management of energy use has too often been neglected, despite the opportunity for significant savings. A general review illustrating the many legal options available for promoting efficiency is followed by chapters examining in more detail the legal options for improving *efficiency in industry, appliances, buildings and road transportation.*

Industrial Efficiency. In industry, the biggest efficiency savings are achievable by use of combined heat and power (CHP, also called cogeneration), using conventional electricity generating systems to also produce steam or hot water for use in industrial processes – or in reverse, using the waste heat from industrial processes to produce electricity. CHP can increase the efficiency of an average power plant from 30-35% to 60%, sometimes even up to 80%. The other big energy saving in industry can be achieved by replacing fixed speed motors with variable speed motors that can match the load they must meet. The same is true for consumer products like LED (light emitting diode) lamps that last 50 times longer than incandescent light bulbs and 10-12% longer than compact fluorescent lights, using 90% less energy, and hence costing much less to use, and emitting just 10% the heat. Legislative provisions in this field include establishment of standards and efficiency labelling and ratings, good examples being the Energy Star program and LEED ratings in the United States. Legislative provisions are included to provide for information dissemination, application of standards at the international, national and state level, labelling requirements, R&D funding, and tax incentives.

Appliance Efficiency. Appliance efficiency standards can also produce significant energy savings. The biggest home appliance energy users are refrigerators, washers and dryers, hot water heaters, air conditioners and space heaters. Legislation for standards, ratings and incentives can promote significant energy savings in the development and use of these appliances. Various legal options for promoting such energy savings are discussed.

Building Efficiency, Building efficiency also can achieve very large savings. Building codes are the prime legislative regulatory measure, followed by ratings of efficiency. In the U.S. an industry association operates a LEED rating system that offers four certification levels for new construction: Certified, Silver, Gold and Platinum, that correspond to the number of credits accrued in five green design categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. Some legislation requires one of these LEED ratings as a condition for funding. There are similar rating systems in many other countries.

Road Transportation Efficiency. Road transportation efficiency offers one of the largest possibilities for savings. Vehicle emission standards and inspections are applied throughout the world with great benefits in reducing levels of air pollution, but few developing countries address fuel efficiency. A great deal of vehicle efficiency R&D is funded by governments. Most legislation covers cars and light trucks; increasingly, heavy trucks are also being targeted. Several US states, cities and towns have zero emission goals and a requirement that a specified percentage of passenger vehicles be zero emission vehicles, e.g. electric cars. Taxes and license fees can provide efficiency incentives. Some jurisdictions provide fast lane privileges to efficient vehicles. Some have buy-back laws that provide government payments for trading in of inefficient vehicles.

Renewable Energy. The chapter on renewable energy begins with detailed information on the benefits of renewable energy, the barriers to its adoption, and the means of overcoming those barriers. It describes the tools available for promoting renewable energy, such as through renewable portfolio standard mandates; economic incentives including feed-in tariffs, public benefit funds, and other producer and consumer subsidies; removal of fossil fuel subsidies; and tax incentives. Net metering and the advent of distributed and community renewable energy are also discussed, as well as the means that some utilities and regulatory commissions use to oppose renewable energy programs, such as the setting of high access barriers and prohibitive rates to inhibit solar installations by customers, particularly when the rates of the utilities involved are dependent on sales. The importance of full disclosure and public participation in rate-setting is also emphasized. There follow chapters, each with detailed discussion, of hydroelectric energy, fuel cells, solar and wind energy, energy from biomass, and geothermal energy.

Hydroelectric Energy. This chapter discusses the environmental advantages and disadvantages of large hydroelectric dams, their benefits from absence of polluting emissions, and their disadvantages from possible environmental and social risks in their construction and operation. These risks have led the World Commission on Dams to recommend against construction of large hydroelectric projects and prescribe extensive safeguards that should be observed if such construction nevertheless is pursued. The chapter deals in detail with the problems in construction of large dams and reservoirs including displacing people and their livelihoods and health hazards from emissions from decaying debris and collapse, and the impacts on fisheries and other affected biota. Small hydro a run-of-the-river hydro projects minimize these risks while enjoying the pollutionless benefits.

Solar & Wind Energy. The chapter on solar and wind energy first addresses solar energy. After reciting the many advantages of solar energy, it emphasizes the need for legal measures to assure that the solar panels being sold to consumers will be safe and of high quality, will be installed correctly, and that the up-front costs of purchase and installation will be recovered by savings in energy bills over a reasonably short period of time. Laws requiring equipment to meet published standards are referenced. Laws also requiring that installers be licensed or approved by a government registry. Provisions for inspecting and testing equipment are described. Other legislation is cited including a requirement that the equipment provider provide warranties relating to the quality of the equipment and making it illegal for suppliers to make false claims about equipment or its performance. Enforcement provisions are provided and provisions protecting solar access.

With respect to wind energy, the first step has to be legislation providing for mapping to assure that adequate wind resources exist in the areas for project location. Laws may prevent location in some areas but set aside certain low population areas where wind farms are authorized. Areas in migratory bird flyways may be declared off limits to avoid bird and bat deaths or restricted in times of migration… Laws often provide for assessing the impacts of wind farms and prescribing the characteristics of allowed turbines. Environmental Impact assessments are usually required, with public hearings to allow for community input. Noise limits may be specified. Environmental justice concerns need to be met. The general approach to equipment quality standards, inspection and enforcement provisions are the same as provided for solar installations. Special provisions for offshore wind applications are covered to provide for navigation, shipping, fishing, safety and visual protections.

Biomass Energy. There are many sources of biomass that can be used to provide energy, ranging from agricultural and wood crops or residues, to landfill methane, to processing wastes that can be used to produce biogas. Biomass fuels can be used for many purposes, for home heating and cooking, for generating electricity, and to fuel vehicles. These resources can be particularly valuable to developing countries because they are home grown and often inexpensive, relieving poor societies from expensive and highly polluting imported fossil fuels. However, there are strong caveats to use these biomass resources in ways that are sustainable and environmentally sound. The down side is that biomass can be used in ways that endanger people in their homes, degrade cropland, compete with food production, promote deforestation, and threaten biodiversity. This chapter describes the laws that are needed and have been enacted, both to promote the use of biomass and to regulate its use so as to protect the public and the environment.

Geothermal Energy. While this chapter indicates an enormous worldwide geothermal potential, it finds no comprehensive legislation addressing its development, so it is largely devoted to suggesting what such legislation might contain. The chapter covers the definition of resources to be addressed; ownership of the resource, found generally to be by the State even on private land; exploration permit conditions including fees, duties, terms, drilling conditions and the size of the block covered; production leases, including the size, rights of lessees, compensation to property owners, assignments, closure and termination obligations; and environmental protections, including responsibilities re blowouts, subsidence, earthquakes and other environmental damages.

Rural Applications. The last chapter deals with legislation addressing the special needs of people living in rural areas, primarily in developing countries, who often lack access to electricity and

modern cooking and heating fuels. It is observed that access to energy is essential for economic development and that renewable energy is playing a growing and significant role in satisfying this need, with the potential to do much more. In far too many rural areas the only forms of energy are firewood, agricultural residues, dung, coal and imported kerosene. Cooking and heating with these traditional fuels is hazardous and debilitating for women and children in particular. The chapter chronicles what is being done to bring affordable renewable energy to rural populations, featuring measures being adopted in India, China, Nigeria and Ghana.

Case Studies & DVD. There follows in depth case studies for Columbia, the Philippines, Pakistan, South Africa, Ghana and South Korea of the energy efficiency and renewable energy laws each of them have enacted.to facilitate their sustainable energy progress. A DVD is included presenting the full text of laws promoting energy efficiency and renewable energy from around the world, and leading studies in the field.

Conclusion. The adoption of the UN General Assembly Sustainable Development Goals, particularly Goal #7 "Renewable Energy: Ensure access to affordable, reliable, sustainable and modern energy for all," and the Paris climate change agreement to which virtually all the countries of the world made "Intended Nationally Determined Contribution (INDC)" pledges to be satisfied largely by transition from fossil fuels to sustainable energy alternatives, both are resulting on plans for very large additions of efficiency and renewable energy initiatives. The laws for achieving these goals in a safe, sound, sustainable manner will be vital to the success of these endeavours. This Guide, presenting the experience of countries around the world with these laws and legal options, is designed to help assure that the projects initiated will be successful.

SECTION ONE
Issues of General Application

Richard L. Ottinger*

There are a number of legislative requirements important for environmental management of the energy sector. While the market place will influence much of the transition required for adoption of efficiency measures and the use of renewable energy resources, government regulations are needed to accelerate this transition and to assure against economic disruptions during the transition. And the market place generally is inadequate to provide for the environmental, safety and health needs of society deriving from energy resources or for their costs to the public, so regulatory measures are necessary.

The laws reviewed in this section apply to all energy media, and are particularly important for promotion of energy efficiency and renewable energy. Very significant among these are the legal requirements Environmental Assessments ("EAs", also sometimes called Environmental Impact Statements). EAs usually include requirements for disclosure, community and public involvement through public hearings in the formulation of projects, their design and implementation, and their enforcement. Other issues of general application important to energy efficiency and renewable energy are education, training, and accurate pricing.

CHAPTER 1A. ENVIRONMENTAL ASSESSMENTS

What are the Options for Environmental Assessment (EA) Coverage and Requirements?

Environmental assessments (EAs) provide information to all parties of interest on project impacts on the environment, alternatives that may achieve the project objectives while alleviating or eliminating such impacts, and means of mitigating impacts. Done well, EAs offer objective comparisons of the costs and benefits of energy resources capable of meeting developmental, environmental and social needs.

See: Legislation regarding EA purposes:

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United States: National Environmental Policy Act (NEPA) (1982), CEQ Regulations, Sec. 1502.1: Purpose. -The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses. An environmental impact statement is more than a disclosure document. It shall be used by Federal officials in conjunction with other relevant material to plan actions and make decisions.

Statute and regulations at **https://ceq.doe.gov/ceq_regulations/regulations.html**.

EAs are very important to the determination of whether traditional fuels, renewable energy, or efficiency resources will be used. The decision on whether to build a new coal-fired power plant or instead to invest in efficiency and renewable energy measures may often be greatly influenced by the comparative environmental impacts as disclosed by an EA.

EA legal requirements may be provided in national, state or municipal legislation for each as to their own projects that may have a significant effect on the environment. They may be required only for "major" projects or projects over a stated dollar amount. More restrictive requirements result in fewer projects that will be covered by EAs. On the other hand, less restrictive requirements may result in proliferation of expensive EAs for small projects with insignificant impacts.

A good example of EA legislation can be found in the below Belize EA statutes.

Belize- Belize Environmental Law, PART V, Environmental Impact Assessment

20. (1) Any person intending to undertake any project, programme or activity that may significantly affect the environment shall cause an environmental impact assessment to be carried out by a suitably qualified person, and shall submit the same to the Department for evaluation and recommendations.

(2) An environmental impact assessment shall identify and evaluate the effects of specified developments on-

(a) human beings;
(b) flora and fauna;
(c) soil;
(d) water;
(e) air and climatic factors;

(f) material assets, including the cultural heritage and the landscape;
(g) natural resources;
(h) the ecological balance;
(i) any other environmental factor which needs to be taken into account.

(3) An environmental impact assessment shall include measures that a proposed developer intends to take to mitigate any adverse environmental effects and a statement of reasonable alternative sites (if any), and reasons for their rejection.

(4) Every project, programme or activity shall be assessed with a view to the need to protect and improve human health and living conditions and the need to preserve the reproductive capacity of ecosystems as well as the diversity of species.

(5) When making an environmental impact assessment, a proposed developer shall consult with public and other interested bodies or organizations.

(6) The Department may make its own environmental impact assessment and synthesize the views of the public and interested bodies.

(7) A decision by the Department to approve an environmental impact assessment may be subject to conditions which are reasonably required for environmental purposes.

(8) Any exercise of the powers of the Department under subsections (6) and (7) is an exercise of a disaster preparedness related power within the meaning of section 13 (1) of the Disaster Preparedness and Response Act.

21. The Minister may make regulations prescribing the types of projects, programmes or activities for which an environmental impact assessment is required and prescribing the procedures, contents, guidelines and other matters relevant to such an assessment.

Full text at: **http://www.iacseaturtle.org/docs/marco/belize/Belize%20-%20Environmental%20Protection%20Act%20(Subsidiary).pdf.**

In March 2007, Belize amended its Environmental Impact Assessment regulations to include Environmental Compliance Plans for approved projects, institute a Limited Level Environmental Study, establish environmental application fees for projects, and improve Schedules requiring EAs for different categories of projects.[2]

In July 2014, the Belize Ministry of Forestry, Fisheries and Sustainable Development (MFFSD) developed an Environmental Management Framework for application to projects in key biodiversity areas in Belize. The Environmental Management Framework identified required environmental management measures that project authorities must observe in planning, designing, and implementing

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2 Dep't of the Environment, Legislation: The Environmental Protection Act Chapter 328 of the Substantive Laws of Belize Revised Edition 2000, DOE.gov.bz (2013), http://www.doe.gov.bz/index.php/legislation.

projects. The Framework aims to enhance the effectiveness of the EA system through "(1) increased coordination for improved environmental management and development, [and] (2) integration of environmental screening tools and processes."[3]

See also:

Brazil - Constitution of the Federal Republic of Brazil, Article 225

All have the right to an ecologically balanced environment, which is an asset of common use and essential to a healthy quality of life, and both the Government and the community shall have the duty to defend and preserve it for present and future generations…

Paragraph 1, section IV - In the manner prescribed by law, for the installation of works and activities which may potentially cause significant degradation of the environment, a prior environmental impact study, which shall be made public…

Full text at **http://english.tse.jus.br/arquivos/federal-constitution**

In 2015, a group of Brazilian EIA specialist published a study evaluating the effectiveness of Brazil's Environmental Impact Assessment System. The study revealed that, while the current system plays a key role in mitigating environmental impacts and enhancing project designs, changes were needed to streamline procedures, strengthen institutions, and improve integration and planning tools. The Brazilian Association of State-level Environmental Agencies, the National Industry Confederation, and the Electricity Sector's Environmental Forum have proposed specific ways to improve the system's main issues, which include low-quality of EIA reports and statements, excessive bureaucracy, time-consuming procedures, growing litigation, weak public participation, lack of institutional capacity, and inefficient follow up. The suggestions provided by these agencies are not publicly available; however, the 2015 study provides an overview and discussion.[4]

For other country examples of EA requirements **see**:

- Philippines: **http://www.lawphil.net/statutes/presdecs/pd1977/pd_1152_1977.html; http://www.lawphil.net/statutes/presdecs/pd1977/pd_1151_1977.html; http://www.lawphil.net/statutes/presdecs/pd1978/pd_1586_1978.html**
- European Union: *http://ec.europa.eu/environment/eia/eia-legalcontext.htm*
- South Africa: **https://www.environment.gov.za/sites/default/files/legislations/nema_eia2014regulations_g38282.pdf**

For a database of compiled EIA Regulations see: https://eialaws.elaw.org/

3 Ministry of Forestry, Fisheries and Sustainable Development, Management and Protection of Key Biodiversity Areas of Belize: Environmental Management Framework 20 (July 31, 2014), http://www.pactbelize.org/Portals/0/docs/KBA-Environmental-Management-Framework.pdf.

4 Alberto Fonseca & Luis Enrique Sanchez, Pressures for change in Brazil's EIA System 1-2, 35th Annual Conference of the International Association for Impact Assessment (April 2015), http://conferences.iaia.org/2015/Final-Papers/Fonseca,%20Alberto%20-%20Pressures%20for%20change%20in%20Brazil%E2%80%99s%20EIA%20system.pdf.

Some jurisdictions require different levels of assessments depending on the significance of the environmental impacts.

See: Australia's hierarchy of requirements:

Australia – Environment Protection and Biodiversity Conservation Act 1999 (amended July 2015), Part 8, Sub. B, Section 87:

Minister must decide on approach for assessment, Minister must choose one assessment approach:

The Minister must decide which one of the following approaches must be used for assessment of the relevant impacts of an action that the Minister has decided is a controlled action: (a) assessment by an accredited assessment process; (aa) assessment on referral information under Division 3A; (b) assessment on preliminary documentation under Division 4; (c) assessment by public environment report under Division 5; (d) assessment by environmental impact statement under Division 6; (e) assessment by inquiry under Division 7.

Full text at **https://www.comlaw.gov.au/Details/C2015C00422**.

EA legislation may require that the assessments be performed by the sponsoring agency, a government agency, or by a private consultant independent of the project sponsor. If performed by the sponsoring agency, it may be legislatively required to employ an independent consultant who may have to be approved by an applicable regulatory agency. The objectivity of an EA will be affected by the selection requirements.

EA legislation may require assessment of whether pollution resulting from the project will meet applicable pollution standards and the extent and precise nature of damage that the project may cause to human health and the environment.

In some jurisdictions, the laws provide that the impacts on certain segments of the population be considered. Thus, in the Philippines, specific consideration is required of the impact on indigenous communities, on women and on population growth as follows:

Philippines: DENR Administrative Order No. 96-37 December 02, 1996

A. Environmentally Critical Projects, Sec. 9.0 Contents of the EIS

j. For projects located in ancestral lands or domains, as defined under DAO No. 2, series of 1993, or subsequently by law, of indigenous communities, a specific chapter in the socioeconomic impact assessment shall be devoted to a discussion of indigenous peoples' concerns and possible socio-economic, political and cultural impacts of the proposed project on such people.

k. For projects or undertakings with significant impact on women, a specific chapter in the

socio-economic impact assessment shall be devoted to a discussion and consideration of gender issues.

l. For projects or undertakings with significant impact on population, a specific chapter on the socio-economic impact assessment shall be devoted to a discussion of the relationship among population, development, and the environment. Some or all of the foregoing items may, when appropriate, be presented in a format using the checklist approach.

Full text at: http://www.oneocean.org/download/db_files/denr_ao_96-37.pdf.

The latest revisions of the Philippines' Environmental Impact Statement system are reflected in the Department of Environment and Natural Resources (DENR) Administrative Order No. 30-2003, available at: http://lamp.denr.gov.ph/pol03/DAO/dao30.pdf.

Notwithstanding the country's EA legislation, the legal framework for the EIS system remains "shaky and inadequate," due to the lack of a comprehensive framework addressing the complexity of the system in the seminal legislation.[5]

EA legislation may require consideration of the cumulative impacts of the project combined with the impacts of other projects in the geographical area (e.g. a number of industrial or power projects on the same stretch of a river).[6]

EA legislation may require consideration of and comparisons to alternatives to the project (e.g. different site locations or use of different technologies). They may require the assessment of measures to mitigate the impacts of a project.[7] More extensive scope requirements provide greater assurance that all environmental impacts will be covered, but they also can add considerably to the cost of and delays of a project.[8]

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5 See. PD 1586, available at: *http://www.lawphil.net/statutes/presdecs/pd1978/pd_1586_1978.html*; Explanatory Note to An Act to Establish the Philippine Environmental Assessment System, and For Other Purposes, Rep. Bill No. 08 (2010) (Phil.), http://congress.gov.ph/download/basic_15/HB00008.pdf.

6 See National Environmental Policy Act, 42 U.S.C. § 1508.25 (1978) (requiring the scope of an EIS contain cumulative actions. "Cumulative impact" is defined in 42 U.S.C. § 1508.7 as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.").

7 See Counsel on Environmental Quality Regulations Implementing NEPA, 42 U.S.C. § 1502.1 ("[An environmental impact statement] shall provide full and fair discussion of the significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on specific environmental impacts and alternatives…").

8 See E.J McMahon & Michael Wright, Streamlining SEQRA: How to Reform New York's "Environmental" Planning Law 2, 10 (Empire Ctr. for Pub. Policy, 2013), *http://www.empirecenter.org/wp-content/uploads/2013/12/SEQR-FINAL.pdf* (noting that New York's SEQRA requires a wider scope than its federal counterpart, NEPA, often resulting in a project's increased time and expense).

CHAPTER 1B. DISCLOSURE AND PUBLIC PARTICIPATION

How can full disclosure and meaningful public participation be assured?

Public participation in projects is essential. For example, if a project is proposed to put a solar collector in a community, with the expectation that the community will pay for the costs of the collector in whole or in part over some period of time, the project will be doomed to failure if the people in the community have not been thoroughly informed of the costs, benefits, and operation of the device. They must have agreed that the project will satisfy their perceived needs and that they will participate, contribute to payment of the costs, and perhaps perform simple maintenance.

Public participation may be achieved through legislation requiring public educational meetings and hearings before, during, and/or after the project is initiated. It is also is typical and important for Environmental Assessment legislation to include requirements for public hearings, that the sponsoring agency publish the EA results, and that public comments are permitted on projects for a given period of time.

See the following legislation with respect to public comments and public involvement:

United States- CEQ Regulations, Sec. 1503.1 Inviting comments.

(a) After preparing a draft environmental impact statement and before preparing a final environmental impact statement the agency shall:

1 Obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved or which is authorized to develop and enforce environmental standards.

2.Request the comments of:

(i) Appropriate State and local agencies which are authorized to develop and enforce environmental standards;

(ii) Indian tribes, when the effects may be on a reservation; and

(iii)Any agency which has requested that it receive statements on actions of the kind proposed.

3 Request comments from the applicant, if any.

4 Request comments from the public, affirmatively soliciting comments from those persons or organizations who may be interested or affected.

Sec. 1506.6 Public involvement.

Agencies shall:

(a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.

(b) Provide public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected…

Full text of laws and regulations at: https://ceq.doe.gov/.

Some jurisdictions require that the sponsoring agency address EA findings of environmental concerns. See: the Netherlands' requirement:

Netherlands Environmental Law

§7.6 Section 7.24- Any person may make comments on an environmental impact statement during a public hearing, which shall be held at a time and place fixed by the competent authority for that purpose. The competent authority shall publish the time and place of the public hearing at least two weeks beforehand…

Section 7.26(2) The Committee shall take the comments and Recommendations submitted in accordance with Sections 7.23, 7.24 and 7.25 into consideration in its report.

Full text at *http://www.asser.nl/upload/eel-webroot/www/documents/national/netherlands/EMA052004.pdf.*

Similarly the City of Shenyang, China passed an Environmental Public Participation Law in 2004 requiring a transparent public EA process. The law requires the solicitation of public comments and responses thereto. Other cities in China are now considering similar provisions.[9]

The Ukraine passed a particularly stringent public participation law. The Ukraine Law on Protection of Natural Environment (1991) provides for procedural rights of access to information, public participation and judicial review. The public can participate, and has a duty to participate, by sending written comments, proposals and recommendations, and even by including public experts on expert commissions. With the aim of taking public opinion into account, the developer or responsible state body must conduct public hearings and the conclusions of the agency must take into account public opinion and must be made publicly available.[10] The extent of application of the

Netherlands Environmental Law

§7.9 Section 7.39- The competent authority that has taken a decision, in the preparation of which an environmental impact statement was drawn up, shall investigate the effects of the activity concerned on the environment, either during or after its completion.

Section 7.42(1) - If it appears from the investigation referred to in Section 7.39 that the effects of the activity are considerably more damaging to the environment than was anticipated when the decision was taken, the competent authority shall take such measures at its disposal as it sees fit in order to limit the said effects as much as possible or to remedy them.[1]

9 See: http://www.ecegp.com/files/3/13T%20Study%208%20Assessment%20and%20Case%20Study%20on%20Public%20Participation%20in%20Environmental%20Protection%202015.pdf.

10 See: http://zakon5.rada.gov.ua/laws/show/1264-12, Ukraine Law on Protection of Natural Environment, Section II Environmental Rights and Duties of Citizens, Art. 9: Environmental rights of citizens of Ukraine and Art. 10, guaranteeing citizen's environmental rights.

Ukraine provisions cannot be ascertained now in the aftermath of the country's internal disruptions.

In some jurisdictions, the agency may even require remediation of the impacts revealed by the EA such as the following:

In order to have meaningful public participation, the public needs full access to all available information concerning the project. Legislation thus can provide a right for any person to access government information concerning a project, including records, communications, and private contracts with government agencies, subject to the exclusion of proprietary information. The right may be accessed by petition, and denial of any information can be subject to judicial review. State and local governments may have similar legislation. The scope of the access to information may be limited to exclude matters relating to national security and personnel.[11] In February 2010 under the framework of the then UN Environment Programme Governing Council Special Session held in Bali, Indonesia, countries adopted Guidelines for the Development of National Legislation on Access to Information, Public Participation and Access to Justice in Environmental Matters (Bali Guidelines).

There even is an international treaty declaring a right to access of government information: The Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention). The Aarhus Convention is a new kind of environmental agreement that links environmental rights and human rights. The Aarhus Convention declares the relationship between people and governments in environmental matters, especially access to information, public participation in decision-making, and access to justice. See Article 1 of the Aarhus Convention below:

Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice on Environmental Matters (EU June 1998)

Article 1- OBJECTIVE

In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.

Full text at: http://www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf.
See also: http://www.unece.org/env/pp/welcome.html.

11 See the U.S. Freedom of Information Act: www.usgs.gov/foia/.

CHAPTER 1C ENFORCEMENT

How Can Environmental Requirements Be Enforced?

In some jurisdictions sponsors are required to remedy environmental problems revealed by EAs, as indicated in the Netherlands' statute cited above. Most often, however, environmental requirements and enforcement provisions are found in specific legislation providing standards for emissions of air, water, toxic and other pollutants, storage and cleanup requirements, etc. Legislation can require inspection of project facilities, monitoring of compliance by the appropriate government agency, meaningful fines for violations, or criminal sanctions for intentional infractions that endanger people's lives, livelihoods or property. Requirements of periodic publication of the nature and quantity of toxic emissions can be included. It is important that sufficiency of government agency action is reviewable in the courts and that legislation provide for injunctive relief as well as penalties. Authorization for citizens to sue government agencies to enforce compliance with environmental laws has been very effective in the United States.

See: Regarding enforcement, see the following:

Belize- Belize Environmental Law, Chapter 328: Environmental Impact Assessment Regulations

28. (2) Any person who contravenes the provisions of these [environmental impact assessment] regulations commits an offence, and shall be liable on summary conviction to a fine not exceeding two thousand dollars or to imprisonment for a term not exceeding twelve months, or to both such fine and imprisonment.

Full text at: *http://www.belizelaw.org/web/lawadmin/index2.html.*

Citizen suit authorization for enforcement of environmental laws, including EAs, can be a very effective means of enforcement, particularly since government regulators are often reluctant to bring actions against regulated parties with whom the regulating agency develops close relationships. In these statutes, affected citizens or citizen groups may be extended the right to sue and be allowed to collect attorney's fees either for successful actions against a project, or in some jurisdictions, just for raising substantial environmental, health, and/or safety issues in a litigation, even if they do not prevail.

See: The citizen suit provision in the United States Clean Water Act is as follows:

United States – Clean Water Act, Section 505, 33 U.S.C. § 1365

(a) Except as provided in subsection (b) of this section and section 1319(g)(6) of this title, any citizen may commence a civil action on his own behalf—

1. against any person (including (i) the United States, and (ii) any other governmental instrumentality or agency to the extent permitted by the eleventh amendment to the constitution) who is alleged to be in violation of (A) an effluent standard or limitation under this chapter or (B) an order issued by the Administrator or a State with respect to such a standard or limitation, or

2. against the Administrator where there is alleged a failure of the Administrator to perform any act of duty under this chapter which is not discretionary with the Administrator. The district courts shall have jurisdiction, without regard to the amount in controversy or the citizenship of the parties, to enforce such an effluent standard or limitation, or such an order, or to order the Administrator to perform such act or duty, as the case may be, and to apply any appropriate civil penalties under section 1319(d) of this title…

(d) The court, in issuing any final order in any action brought pursuant to this section, may award costs of litigation (including reasonable attorney and expert witness fees) to any prevailing or substantially prevailing party, whenever the court determines such award is appropriate. The court may, if a temporary restraining order or preliminary injunction is sought, require the filing of a bond or equivalent security in accordance with the Federal Rules of Civil Procedure.

Full text at: *https://www.law.cornell.edu/uscode/text/33/1365.*

The general authorization for citizens to sue administrative agencies for their transgressions, including EIA actions, and the judicial authorization for the scope of review in such cases is as follows:

United States- Administrative Procedures Act, 5 U.S.C. § 552:
§ 702. Right of review

A person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute, is entitled to judicial review thereof. An action in a court of the United States seeking relief other than money damages and stating a claim that an agency or an officer or employee thereof acted or failed to act in an official capacity or under color of legal authority shall not be dismissed nor relief therein be denied on the ground that it is against the United States or that the United States is an indispensable party. The United States may be named as a defendant in any such action, and a judgment or decree may be entered against the United States: Provided, That any mandatory or injunctive decree shall specify the Federal officer or officers (by name or by title), and their successors in office, personally responsible for compliance. Nothing herein (1) affects other limitations on judicial review or the power or duty of the court to dismiss any action or deny relief on any other appropriate legal or equitable ground; or (2) confers authority to grant relief if any other statute that grants consent to suit expressly or impliedly forbids the relief which is sought.

§ 706. Scope of review

To the extent necessary to decision and when presented, the reviewing court shall decide all relevant questions of law, interpret constitutional and statutory provisions, and determine the meaning or applicability of the terms of an agency action. The reviewing court shall –

(1) compel agency action unlawfully withheld or unreasonably delayed; and

(2) hold unlawful and set aside agency action, findings, and conclusions found to be -

- (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law;
- (B) contrary to constitutional right, power, privilege, or immunity;
- (C) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right;
- (D) without observance of procedure required by law;
- (E) unsupported by substantial evidence in a case subject to sections *556* and *557* of this title or otherwise reviewed on the record of an agency hearing provided by statute; or
- (F) unwarranted by the facts to the extent that the facts are subject to trial de novo by the reviewing court.

In making the foregoing determinations, the court shall review the whole record or those parts of it cited by a party, and due account shall be taken of the rule of prejudicial error.

Full text at: https://www.archives.gov/federal-register/laws/administrative-procedure/.

CHAPTER 1D. PRICING

How Should the Prices of Energy Resources Be Accurately Assessed?

To be accurately assessed and compared, the full life cycle costs of each resource should be compared, including costs of extraction and equipment manufacture, fuel cost, operational costs, and waste disposal and land restoration where applicable.

Subsidies that lower the true price of the resource should be added back in.

Life cycle costs should be utilized, not just initial costs, so that, for example, the lack of fuel costs over the life of renewable energy or energy efficiency projects can be considered when comparing them to the costs of projects using traditional fuels.

EAs may mandate that the entire cycle of project impacts be considered from the impacts of equipment production to the impacts of waste disposal at the end of a project. The United Nations and its World Bank now require full cost accounting of proposals and projects, as do a number of U.S. states. The State of Maine's requirement below is a good example.

Some jurisdictions require "integrated least cost planning" by which the appropriate government agency requires that, before resources can be acquired, all competent resources be divulged based on the costs and benefits of each, including life-cycle cost and externality costs (e.g. the costs to society of early deaths, illnesses and the costs of environmental degradation).

Recent studies have estimated the costs to society from power plant pollution.[12] While these figures lack absolute precision, they are far better than ignoring the costs altogether, which has the effect of allotting them a clearly inaccurate zero value.

Measures also need to be adopted to prevent fraud, collusion, corruption and monopolization.

12 See Paul R. Epstein et. al., Full Cost Accounting for The Life Cycle of Coal, 1219 Ann. N.Y. Acad. Sci. 73-98 (2011) (estimating the external life-cycle costs of coal extraction, transporting, processing, and combustion waste streams).

Maine Statutes, Title 5 §1764: Life-cycle costs

1. Bureau of General Services to adopt rules and procedures. The Bureau of General Services shall adopt rules, including energy conservation guidelines that conform as a minimum to the energy efficiency building performance standards adopted by the Department of Economic and Community Development for conducting an energy-related life-cycle costs analysis of alternative architectural or engineering designs, or both, and shall evaluate the efficiency of energy utilization for designs in the construction and lease of public improvements and public school facilities.

2. Life-cycle costs. Any life-cycle costs must include:

A. The reasonably expected energy costs over the life of the building, as determined by the designer, that are required to maintain illumination, power, temperature, humidity and ventilation and all other energy-consuming equipment in a facility.

B. The reasonable energy-related costs of probable maintenance, including labor and materials and operation of the building, replacement costs over the expected life of the facility and any other ownership cost issues identified by the Bureau of General Services; and

C. A comparison of energy-related and economic-related design alternatives. The Bureau of General Services may direct the designer to select, include and develop life-cycle costs for any viable alternatives that should be considered.

3. Determination of life-cycle costs. To determine the life-cycle costs, the Bureau of General Services shall adopt rules that include but are not limited to:

A. The orientation and integration of the facility with respect to its physical site;

B. The amount and type of glass employed in the facility and the directions of exposure;

C. The effect of insulation incorporated into the facility design and the effect on solar utilization to the properties of external surfaces;

D. The variable occupancy and operating conditions of the facility and subportions of the facility;

E. Energy consumption analysis of the major equipment of the facility's heating, ventilating and cooling system, lighting system, hot water system and all other major energy-consuming equipment and systems as appropriate. This analysis must include:

(1) The comparison of alternative systems;

(2) A projection of the annual energy consumption of major energy-consuming equipment and systems for a range of operations of the facility over the life of the facility; and

(3) The evaluation of the energy consumption of component equipment in each system, considering operation of the components at other than full or rated outputs; and

F. The cost-effectiveness of integrating wind or solar electricity generating equipment into the design and construction of the facility.

Full text at http://janus.state.me.us/legis/statutes/5/title5sec1764.pdf.

CHAPTER 1E.
EDUCATION AND TRAINING

How Can Education and Training Be Provided?

Education of the public is vital to let the people affected know the costs and benefits of energy efficiency and renewable energy measures proposed for adoption compared to the cost of other options, including demand management. Education of the public builds the political support necessary for enactment of appropriate legislative measures and informs the public of the options available to them, such as residential energy audits, insulation, purchase of L.E.D. or compact fluorescent light bulbs and efficient appliances, and the financial mechanisms available to make these measures affordable. This educational process really should start at the primary and secondary school level and continue as a part of professional and technical training for those whose jobs will involve energy related-decisions.

Education is particularly important for architects, [13]engineers, builders, commercial enterprise managers, trades people, and government officials at all levels, to inform them of the legal requirements that have been adopted to prevent pollution and to promote carbon dioxide reductions; they should be informed of the costs and benefits of the measures they can take either voluntarily or pursuant to legal requirements. It is important that retail sales staff, contractor installers, and maintenance/ service personnel understand the benefits of efficient products and processes and can personally benefit from promoting these products to end users.

Much of this education must be conducted or contracted by governments, creating a legislative framework for this task and appropriating the funds for appropriate staff to do mailings, conduct workshops and conferences, and do media education work. As commercial enterprises learn of the economic advantages of measures that can be profitable for them, they also will participate in the educational efforts. NGOs advocating for the clean energy measures available also perform an important part of the educational efforts. Many NGOs have created Internet sites and list services to inform advocates and the public of renewable and efficiency resource opportunities and advantages. Political leaders can play an important educational role as well.

Laws are also needed to require providers of equipment to train local workers on how to operate and maintain it and how to work with local residents to enable to use it efficiently and so it will satisfy their needs.

13 The usual means of compensating architects and engineers worldwide, as a percentage of building and equipment costs, has the perverse incentive of discouraging least cost solutions. It has been estimated that this incentive design has led the U.S. to misallocate about $1 trillion in air conditioning equipment and the energy needed to operate it than had the buildings been optimally designed to produce the same or better comfort at least cost. AMORY LOVINS & HUNTER L. LOVINS, MAKING SENSE AND MAKING MONEY 18, (Rocky Mountain Institute, 1997), http://www.rmi.org/Knowledge-Center/Library/C97-13_ClimateSenseMoney.

CHAPTER 1F
REGULATORY FRAMEWORKS

What Are the Regulatory Options?

In some jurisdictions, national or state government agencies own and operate energy facilities, production, transmission and distribution. In these situations, legislation will be needed to impose environmental, safety, performance and pricing requirements on the relevant agencies. In countries providing for private ownership and operation of energy facilities, there are two principal methodologies for regulation: (1) command and control and (2) market- regulations. Often a combination of both methodologies is used.

Command and control regulations may require renewable portfolio standards specifying that a certain percentage base of power come from renewable energy sources. Regulations also may require that certain energy equipment, performance, safety and environmental conditions be met, subject to penalties for failure to meet them. Examples covered include requirements for EAs, environmental regulations (e.g. providing limits on power plant pollution emissions), miles per gallon specifications for vehicles sold within a jurisdiction, appliance efficiency standards, lighting standards motor standards and building efficiency codes.

Market-based provisions covered at the national level include taxes on pollution or carbon emissions (that can account for externalities of polluting fuels), incentives for renewable and efficiency resources, and emission trading “cap and trade” regulations under which a cap is placed on the level of emissions of specified pollutants and each polluting facility is allocated a specified emission allotment; then if a facility lowers its emission of the pollutant below its allocation, it can sell the resulting pollution allowances, or if its emissions exceed its allotment, it can purchase allowances from another facility that has available excess allotments. This cap and trade system permits pollution reductions at lower costs to the emitters.

Usually at the state or municipal level, regulation of electric energy is performed by a statutorily created Utility Regulatory Commission empowered to set rates where utilities are regulated and to set conditions for electricity sales where the utility system has been privatized. Some municipal governments have Energy Commissions that also set local energy policies.

CHAPTER 1G
Project Information Resources

Project Help Information

Paragraph H of the Financing Section Three above contains a compendium of financing resources for efficiency and renewable energy projects and finance referral services.

The International Renewable Energy Agency in Abu Dhabi has excelled in assisting developing countries and their communities to establish sound, sustainable and successful renewable energy programs. A particularly useful tool for program initiators is its Navigator Project, accessible at https://navigator.irena.org/Pages/default.aspx, that gives walk through assistance on preparation, staffing, equipment acquisition and verification, construction, and, uniquely, follow up advice to project initiators. This is an invaluable new resource.

SECTION TWO
ENERGY RESOURCE OPTIONS

Richard Ottinger

1. TRADITIONAL ENERGY RESOURCES

Energy is essential for economic development. Its value is not intrinsic, however. Its value is in the services it can also provide. In rural areas, these services consist primarily of creating heat for cooking food and warming homes in cold climates. It can also provide electricity for lighting homes and community centres, permitting night time reading and study for students; refrigeration to keep foods fresh and to permit safe storage of medicines; radios that can transmit educational and entertainment programs; transportation to bring agricultural goods to market and permit access to urban areas; and for agricultural irrigation. In more developed areas, energy services include electricity and direct use of fuels for running factories and businesses, electricity for home appliances, fuels for modern transport, etc.

Energy also is an essential ingredient in meeting the Sustainable Development Goals of lifting the standard of living for the billions of the earth's population that now suffer abject poverty, live in unhealthy environments, lack basic health services, suffer gender inequality, and whose children lack primary education. Indeed, energy is required as the engine to support all economic and social development. Yet some one and a half billion people today lack modern energy services and an additional two billion have grossly inadequate energy.

No form of energy is entirely free from monetary and environmental costs. These costs may make certain energy supplies prohibitively costly or environmentally unacceptable. The challenge for achieving sustainable development is to select energy media and end-use technologies that are best suited to community needs, most affordable and least environmentally damaging. A brief discussion of prevailing energy resources follows.[14]

- Firewood and Dung: Poor rural areas generally do not have electricity today. The primary source of energy in these areas is animal dung and firewood for cooking, usually collected by women and children at great cost to their time, severely limiting the opportunity for women to perform more useful economic roles in society and for children to have the opportunity for education. The collection and burning of firewood and dung also has grave environmental consequences in depletion of forests and in pollution, particularly where the firewood or dung is burned in confined housing areas. Night lighting, if available at all, is provided through expensive, inefficient and polluting use of kerosene lamps. Ploughing of land and pumping of drinking water generally utilizes inefficient human or animal power, and animal wastes are used as fertilizers.

14 Note that electricity is not an energy resource, but rather a product derived from energy resources. Electricity is produced though use of some of the various energy sources mentioned in this presentation.

- **Coal:** Coal is available and widely used for energy in many developing and developed countries. Its widest use is for production of electricity and to power industrial production. In some countries, such as China, it is also used for cooking of food and heating homes. Where coal is available in a country, the high costs of importing other fuels are avoided. But coal is also the most environmentally hazardous of energy fuels. The burning of coal emits large quantities of sulfuric oxide pollutants that pose human health hazards and acid rain that destroys aquatic life; it emits nitrous oxides, also hazardous to health, that combine with solvents in the air to form urban smog, a principal cause of lung diseases; it emits mercury that when discharged into waters accumulate in fish and cause human brain damage; and it emits the largest quantities of carbon dioxide that is the principal cause of global warming. Also, the mining of coal is environmentally damaging. Deep mining of coal veins is very hazardous to the health and safety of miners. Mountain top mining devastates the land and ecology of affected areas. The pollutants from burning coal can be mitigated somewhat by washing the pollutants from the coal before burning. Much research is being done in developed countries to find ways to economically gamify coal, using the coal gas as a less polluting energy fuel and to remove and sequester the carbon dioxide from coal combustion.
- **Oil:** Oil is used today primarily as a vehicle fuel, though in some places it is also used for production of electricity and as an industrial fuel. Oil combustion produces substantial emissions of sulfuric and nitrous oxides and carbon dioxide, though less than coal. As vehicle transportation increases, its pollutants have become a prime source of environmental and health hazards in much of the world. As the demand for oil increases in both developed and developing countries, the price of oil has increased dramatically in recent years, causing many non-producing developing countries to have to devote a large proportion of their hard currency to its importation. Recent studies indicate the supply of affordable oil has peaked and will continue to decline. Much of the world's remaining oil reserves are found in unstable Mid-Eastern countries, creating concerns about the security of future supplies. Oil production, pipeline and ship transportation also are vulnerable to pirate and terrorist interruptions.
- **Natural Gas:** Natural gas, often found in conjunction with the exploration for oil, is a fossil fuel that has the pollution emissions of coal and oil, except to a lesser degree. Natural gas now is the fuel of choice in developed countries for production of electricity because of its relative economy and lower pollution problems. Natural gas also has begun to be used in bus fleets as a vehicle fuel. There has been some speculation in the trade press whether supplies of natural gas, though greater than oil, will be sufficient to fulfil the growing demand, and it is predicted that much of the supply in the future will have to come from liquefied natural gas (LNG) delivered by ship. Natural gas exploration and pipelines have a bad history of explosions. Natural gas consists of methane and its pipelines and exploration have been shown to have large methane leaks. Since methane is a potent greenhouse gas 85 more potent than carbon dioxide, the leakage is an extraordinarily contributor to global warming. Also its pipelines and ship are highly vulnerable to terrorist attacks.
- **Nuclear:** Nuclear power is used primarily today for production of electricity, but also some for desalination of seawater. Its main advantage is that no carbon dioxide or other air pollutants are emitted from the operation of reactors, though a great deal of energy, generally from coal or oil with all their pollutants, is used for the mining of uranium and to refine it into usable uranium oxides. The main environmental problem with nuclear plants is that no way has been

found to economically and safely dispose of the radioactive nuclear wastes that are a bi-product of plant operations; they mostly are sequestered in spent nuclear waste pools of water maintained on the plant site or in on-site cement air-cooled dry casks above ground. A great deal of research, so far unsuccessful, has been devoted to permanent storage of the wastes. Also, nuclear plants are highly vulnerable to terrorist attacks. While the plants themselves are somewhat protected by vast cement domes, said by the industry to be able to protect them from a plane crash, the spent fuel pools, which contain much more radioactive material than the plants themselves, and the control rooms that can be used to shut down a plant, both are outside these containment vessels. Since most nuclear plants are built near population centres, the exposure to them of deadly terrorist attacks is great. Nevertheless, several countries, most notably France and Japan, are heavily dependent on nuclear power. A further environmental problem with the plants is that the huge amount of water they require is sucked in at rates that kill large numbers of fish and larvae; closed loop cooling towers need to be required to prevent this phenomenon. Breeder reactors that reprocess spent fuel into plutonium for use in further power production are operated in France, but they have not been shown to be economic and pose great weapons proliferation risks; the International Atomic Energy Agency has stated that there is no way to protect plutonium from weapons' diversion. Lastly, nuclear power plants usually are very large and expensive, thus beyond the means of many developing countries. Even in developed countries, nuclear plants are more expensive to build and operate than coal or gas-fired plants, the main reason that no new plants have been built in the United States for decades. And the plants require high levels of technical expertise 24-7 to run safely, not usually available in developing countries.

- **Hydrogen:** Hydrogen is a derived energy resource, obtained by the separation of hydrogen from water or natural gas. Technically, hydrogen is not an energy source but an energy carrier; it takes energy to derive hydrogen. However, it is a completely clean fuel if used in a fuel cell and a very low polluting fuel if burned directly in an internal combustion engine. Much research presently is being done, primarily in Europe, on finding economical ways to produce hydrogen from renewable sources like solar or wind – an ideal combination since it would eliminate the problems of the intermittent nature of solar and wind power. In the U.S., the automobile industry and the government are conducting considerable research on producing an effective and economic fuel cell system (which involves a chemical reaction and no combustion or related pollutants at all), but present predictions are that conclusion of this research will take around 20 years. Hydrogen atoms are much lighter than those in gasoline, and thus vehicles would have to carry greater quantities of hydrogen to go the same distance as they can on gasoline. An expensive delivery system would have to be established before a hydrogen economy for vehicles could be established. Such a system would be vulnerable to terrorist attacks the same as oil and gas pipelines are now. There is the possibility, however, that hydrogen could be produced on board vehicles. Hydrogen also could be used as a stationery source fuel.

Energy is essential for sustainable development. But at the same time, employment of traditional energy resources is the cause of the severe pollution that is asphyxiating city residents, particularly in the developing countries, killing their forests and lakes, poisoning their water supplies, and facing the world with the prospective catastrophes associated with global warming. Furthermore, these traditional energy sources are very expensive and are eroding the capital needed in developing countries to provide essential social services.

SECTION THREE
FINANCING PROJECTS

John Bowie*

1. INTRODUCTION

This Section deals with guidance to government officials and private project developers proposing to initiate energy efficiency and renewable energy projects, on the variety of laws that have been passed world-wide to assist with the financing of such projects and contact information on available financing sources.

While energy efficiency projects share with renewable energy the problems of inadequacy of funding resources, competition with highly subsidized fossil fuel and nuclear energy, and lack of sufficient familiarity by commercial funders with their benefits, many efficiency measures have such short payback periods that they can obtain commercial funding.

Renewable energy projects, however, face unique financing challenges. Specifically, these projects may incur high up front capital costs and perceived risk. However, renewable energy projects offer much lower operating costs than fossil fuel or nuclear energy projects, resulting in minimal lifetime energy costs for consumers. Their principal financing challenge, however is the large fossil fuel and nuclear subsidies, particularly if these subsidies are not offset by renewable energy and energy efficiency incentives, and the more so if the large externality costs of fossil and nuclear power generation are not considered.[15]

A major challenge for policy makers is how to best manage the upfront capital costs and risk allocations, while capturing the benefits of reduced operating costs and environmental advantages.

Typical renewable energy project capital costs include a variety of different factors. Project costs include hard and soft costs. Hard costs include the actual physical infrastructure, property, and labour required to acquire and install the equipment. Soft costs may include costs for planning and consultancy, feasibility studies and permitting, education of the public to be served, and training of local personnel.

A project will also carry a cost of capital. The weighted cost of capital ("WACC") is the weighted average return to investors. The cost of capital can represent 20 to 50% of the level zed cost of electricity in an average wind or PV project. Fossil and nuclear fuelled power capital costs are much higher, so cost of capital is a place where policy makers can favourably shift the financial equation towards new renewable energy projects and draw new investment to the field.[16]

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15 *Increasing Global Renewable Energy Market Share: Recent Trends and Perspectives* 9 United Nations Department of Economic & Social Affairs, Expert Group on Renewable Energy, (Dec. 12, 2005)

16 Corinna Kleßmann, Increasing the effectiveness and efficiency of renewable energy support policies in the European Union, dissertation (January, 2012)

A. Section Structure

The focus of this section is to provide policy makers, particularly those in emerging economies, with examples of laws and policies that have been successfully implemented to provide financing for energy efficiency and renewable energy projects. In addition, the chapter also discusses successful contractual frameworks for renewable project development that can further enhance access to finance and credit streams.

The general structure of this section will first to briefly discuss direct institutional financing. The next section will look at policy tools that can help small-scale renewable developers and their customers access financing. The following section will review corporate and contractual structures that enhance renewable energy value propositions and increase access to credit. The section will conclude with a general discussion of how laws relating to high-level policies such as grid interconnection, internalizing the costs of carbon emissions, and reducing subsidies to the fossil fuel industry, can have a positive downstream effect on renewable energy finance.

B. Direct Government Financing

1. Investment Grants

Investment grants are investments by governments or international or private donors that can be used to decrease the upfront costs of renewable energy projects. Simply put, they are one of the most direct policy tools to increase renewable energy development. While such investments are a useful tool in accelerating any nascent market, they may not always be adequately available or be a viable option for governments or international institutions faced with hard choices on how to use limited investment resources.

A listing of financing resources and organizations assisting efficiency and renewable energy initiatives to find funding for their projects is found in paragraph H at the end of this section.

2. Investment Subsidies

Investment subsidies are soft loans with interest rate subsidies that improve the cash flow and ease the investors' access to debt finance that can help encourage new renewable energy projects.[17] Subsidies on project costs can reduce debt ratios and increase the viability of projects. Subsidies have helped many nascent renewable energy sectors gain traction and develop into thriving businesses competing for significant market share.

3. Public-Private Ventures

Public-private joint ventures or the direct participation of state-owned companies in renewable energy projects can serve as effective tools to increase developers' access to funds.[18] Public-private partnerships simultaneous provide access to capital and distribute project risk, making investment more attractive.[19]

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17 Ibid.
18 Valentina Dinica, *Support systems for the diffusion of renewable energy technologies – an investor perspective.*
19 Valentina Dinica, *Support systems for the diffusion of renewable energy technologies – an investor perspective.*

In addition to partnership models, public sector participation can provide "patient equity" – equity funding with return requirements that are delayed in time or lower in profitability than normal commercial thresholds.[20] Similar to the benefits of other forms of public investment, "patient equity" can make a project more attractive to private investors by defusing risk and expanding investment return windows.[21]

In all cases of public investment, there is an added benefit of market confidence from policy makers toward the renewable energy sector. Market stability encourages private sector investment.

4. Renewable Energy Bonds

Government bonds can be an effective tool for promoting renewable energy. Traditional bonds are instruments of indebtedness of the bond issuer to the bond holder, representing an obligation of the issuer to repay the holder interest and the principal at a later maturity date. Governments can issue traditional bonds for renewable energy projects. In addition to traditional bonds, governments can issue tax credit bonds to encourage private sector lending for renewable energy projects. With a 'tax credit bond" the issuer does not make interest payments. The federal government provides a tax credit to the bondholder in lieu of interest payments.[22]

The United States created clean renewable energy bonds ("CREBs), which is a special type of bond, known as a "tax credit bond" that offers cooperatives the equivalent of an interest-free loan for financing qualified energy projects for a limited term.[23] In short, CREB bondholders take a tax credit instead of an interest payment.[24] As a result, CREBs allow borrowers to borrow at 0% interest. [25] Qualified issuers are "clean renewable energy bond lenders, cooperative electric companies or government bodies.[26] Under such regimes, the federal tax body (in the case of CREBs, the Internal Revenue Service) allocates bond volume on a project-by-project basis. Renewable Energy Bonds create another venue for policy makers to mobilize investment in renewable energy.

5. Public Risk Insurance

Governments and international institutions also can provide insurance against various project risks, often to assure against the risks of host country economic or political instability[27]

Project risk insurance can help to induce investment in projects by commercial lenders, reducing the risk of their investments. They also reduce operating expenses for renewable energy initiatives, increasing the long-term financial viability of the project. One of the major hurdles in renewable energy investment is confidence in new technology. [28] Public insurance options can help diffuse the cost associated with the perception of new technology. In addition, the provision of public insurance

20 See Renewable Energy World, http://www.renewableenergyworld.com/articles/2010/10/public-private-partnerships-can-help-finance-renewable-energy-projects.html.
21 Maria Vagliasindi, Revisiting Public-Private Partnerships in the Power Sector.
22 Kleßmann, supra note 18.
23 Ibid.;
24 See http://energy.gov/savings/residential-energy-efficiency-tax-credit
25 Previous iterations of the CREB program allowed a dollar-for-dollar reduction, while more recent iterations of the program reduce the credit rate to 70%. U.S. Department of Energy, Clean Renewable Energy Bonds, http://www.energy.gov/savings/clean-renewable-energy-bonds-crebs
26 Oswald, supra note Error! Bookmark not defined..
27 See Green Rhino Energy, http://www.greenrhinoenergy.com/finance/renewable/risks.php.
28 Kleßmann, supra note Error! Bookmark not defined..

options helps decrease the cost-of-capital, while increasing the attractiveness of renewable energy developments. For an in-depth review of insurance and risk mitigation, refer to the National Renewable Energy Laboratory whitepaper on *Continuing Developments in PV Risk Management: Strategies, Solutions, and Implications.*[29]

C. Special Financing Provisions for Small Scale Renewable Energy Projects

The following section will discuss laws that enable policies that can be implemented specifically to create opportunities for investment between individuals and lenders, and will focus on alternative paths for finance and bill collection for projects that occur at a residential or small commercial level.

1. On-Bill Financing

On-bill financing is one of the most promising tools for use in energy efficiency and renewable energy finance.[30] Under on-bill-financing a utility or municipality effectively provides a loan for the hard-to-raise up front initial capital to finance projects.[31] Repayment of this loan is then amortized and distributed as a charge on the customer's monthly utility bill or, in the case of municipality financing, a surcharge on the property tax.[32] The energy savings from the financed energy efficiency or renewable measures will offset in whole or in part the repayment charges.

In addition to solving the problem of having to raise substantial amounts to pay for efficiency and renewable energy equipment, on-bill-financing eliminates the obstacles to their investment caused by landlord-tenant disincentives and those caused by the transient nature of home ownership or rentals because the repayment obligation attaches to the utility bill or property tax,[33] passing on the advantages of the energy savings and the obligations for repayment to successor lessees or property purchasers.

Several jurisdictions have implemented or are considering on-bill financing for renewable energy including recently passed legislation in Hawaii.[34] The National Conference of State Legislatures has assembled a comprehensive table of on-bill financing legislation, available through its website. California utility Pacific Gas & Electric Company has published a Customer and Contractor Handbook for On-Bill Financing.[35]

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29 Travis Lowder, Michael Mendelsohn, and Bethany Speer, Continuing Developments in PV Risk Management: Strategies, Solutions, and Implications, (2013) http://www.nrel.gov/docs/fy13osti/57143.pdf
30 Natural Resources Defense Council, On-Bill Financing Programs, Overview and key considerations for program design (July 2013), http://www.nrdc.org/energy/on-bill-financing-programs/files/on-bill-financing-IB.pdf
31 Casey J. Bell, Steven Nadel, & Sara Hayes, On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices, (Dec. 8, 2011) http://www.aceee.org/research-report/e118.
32 Casey J. Bell, Steven Nadel, & Sara Hayes, On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices, (Dec. 8, 2011) http://www.aceee.org/research-report/e118.
33 Ibid.
34 Hawaii Senate Bill 1087,
35 National Conference of State Legislatures (NCSL), Table: State Legislation for On-Bill Financing. http://www.ncsl.org/research/energy/on-bill-financing-cost-free-energy-efficiency-improvements.aspx

2. Microfinance

Microfinance systems provide loans to individuals and small businesses lacking access to traditional banking and financial services. [36]The original application of microfinance was to provide loans to very poor families, but this practice has gradually grown to include a broader range of small level financing.[37] Different microfinance providers have emerged, including non-governmental organizations (NGOs), cooperatives, government agencies and community-based development groups.[38] A wide variety of microfinance products and services have rapidly expanded to renewable energy installations and infrastructure, helping to bring new energy online in previously underserved communities.

Bangladesh: Grameen Bank Act (1983) (Ordinance No. XLVI of 1983)

An important element of microfinance is creating a clear delineation in the purpose of the bank. Specifically, this could be a designation of qualified loan applicants. For instance, the Grameen Bank Act of 1983 defined "landless persons" as part of the statutory definition of qualified applicants.

> (h) "landless person" means any person who or whose family owns less than fifty decimals of cultivable land or who or whose family owns property, both movable and immovable, the value of which does not exceed the value of one acre of cultivable land according to the prevailing market price in the union in which the person normally resides;

The statutory act of creating a micro financing bank could use different parameters to identify qualified applicants. However, it is essential that qualified applicants gain access to banking services beyond just loans including savings, insurance, and money transfer, through the microfinance institution.

> "The Bank shall provide credit with or without collateral security, in cash or in kind, for such term and subject to such conditions as may be prescribed, to landless persons for all types of economic activities including housing, but excluding business in foreign exchange transaction, and may carry on and transact the several kinds of business hereinafter specified…"[1]

36 Consultative Group. to Assist the Poor, What is microfinance?, http://www.cgap.org/about/faq/what-microfinance (last visited June 15, 2014)

37 See Microfinance and Renewable Energy: Investing in a Sustainable Future, WISIONS of Sustainability (2006), available at http://www.gdrc.org/icm/environ/mf-renewablenergy.pdf. Specific examples from this report include: Revolving Fund for the Implementation of Small Hydro Schemes, Rural Housing Energy legislation, Rural Energy Enterprise Development Initiative, rural biogas plants. See also Anojl Viswanathan, Energy Services for the Base of the Pyramid: The Role of Microfinance Institutions (2009), available at http://www.slideshare.net/anoj.viswanathan/microfinance-and-renewable-energy.

38 Handbook of Key Global Financial Markets, Institutions and Infrastructure (Gerard Caprio & Doublas W. Arner eds., 2012). Other entities such as credit unions, commercial and state banks, insurance and credit card companies, tele-communications and wire services, post offices, and other points of sale, have emerged as viable candidates to provide microfinance services.

The Grameen Bank in Bangladesh continues to exemplify the potential of microfinance. Grameen Bank was created by state ordinance in 1983, which established the major provisions and functions of the bank. Since its inception, the bank has spun off new operating units, including a special unit, Grameen Shakti, devoted to increasing access to renewable energy.[39] The Grameen Bank has grown and changed over the course of its lifetime, adapting to numerous challenges and shifts in the market.[40]

Microfinance has successfully created a pathway for funding for small-scale renewable energy programs. The Grameen Bank has demonstrated extraordinary rates of repayment and vastly increased access to capital in underserved communities.[41]

3. Distributed Finance – Internet Lending

The Internet is rapidly creating new avenues for fundraising and investment. Individual borrowers can now present their ideas directly to individual lenders, circumventing traditional financial institutions. Direct connections between lenders and borrowers promote transparency while reducing transaction costs.

In addition to the benefits of increased transparency and wider investor exposure, Internet funding options are also opening new markets. Cellular data infrastructure means that rural projects may have Internet access before reliable electricity. This novel paradox presents an opportunity for financing renewable energy projects. Direct lending between investors and borrowers through the Internet, frequently called peer-to-peer (P2P) lending (and related crowd funding),[42] has potential to expand renewable energy in novel ways to developing settings.

4. Peer-to-Peer Funding

Peer-to-Peer (P2P) lending allows individuals and companies to invest without going through a traditional intermediary such as a bank. [43] This lending typically takes place online on a peer-to-peer lending website that connects lenders and borrowers. P2P lending is typically a direct relationship between one lender and one borrower. It allows potential investors to choose projects in which they are interested, promoting involvement, while providing both parties with the ability to minimize overhead transaction costs.[44]

5. Crowd funding

Crowd funding has also been successfully used to finance solar power projects. Crowd funding aggregates numerous individuals through an Internet lending source to support a project. Individual

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39 Grameen Shakti, Home, http://www.gshakti.org/
40 Evaristus Mainsah, Schuyler R. Heuer, Aprajita Kalra and Qiulin Zhang, Grameen Bank: Taking Capitalism to the Poor (2003).
41 Grameen Bank, supra note 43.
42 Crowdfunding, Merriam-Webster Online, http://www.merriam-webster.com/dictionary/crowdfunding (last visited June 16, 2014).
43 Rupert Jones, Is peer-to-peer lending too good to be true? The Guardian (Feb. 14, 2014), http://www.theguardian.com/money/2014/feb/15/peer-to-peer-lending-nicola-horlick.
44 Ibid.

loans may be small, but in the total aggregated amount may be a substantial loan. Mosaic is an Internet platform that connects multiple investors to solar projects through the Internet.[45] Under this model of crowd funding, as solar projects produce and sell electricity, investors are paid back with interest.

D. Tariff and Price Structures for Utilities

The following section will look at electricity price structures that enhance the value of renewable energy, particularly small-scale renewable energy. The following list is not all-inclusive; there are rate design tools too numerous to relate that can enhance or inhibit renewable energy.

1. Feed-in Market Designs

In general, feed-in policies support renewable energy finance by encouraging or mandating the addition of electricity produced from renewable resources. These policies do not involve direct spending by governmental actors. Instead such policies function by guaranteeing long-term prices or price structures.[46] Long-term contracts based on feed-in policies help renewable energy developers by increasing returns and helping to diminish risk.

2. Feed-in Tariffs

Feed-in tariffs are a tool that provides a guaranteed kWh price for renewable energy.[47] Feed-in tariffs are policy driven long-term purchase price mandates for the purchase of renewable energy

Germany: Stromeinspeisungsgesetz German Energy Law – Feed-in Tariff Model

The goal of the Germany Energy Law is to ensure safe, cost-effective, consumer-friendly, efficiency and environmentally-friendly supply of power and gas, as well as efficient and unrestricted competition and safeguarding of an effective and reliable operation of power grids. Best practices include, but are not limited to:

- Guaranteed access to the grid;
- Stable, long-term purchase agreements;
- Duration sufficiently long to provide stability.
- Payment levels based on the costs of generation.
- Payment levels may be constant, or could be subject to digression to account for technical progress and cost reductions.

For additional information, refer to the German Energy Law, *Stromeinspeisungsgesetz*, and accompanying secondary sources and analysis.

45 Mosaic, About Mosaic, https://joinmosaic.com/about-mosaic (Apr. 22, 2014).
46 National Renewable Energy Laboratory, Feed-In Tariffs, http://www.nrel.gov/tech_deployment/state_local_governments/basics_tariffs.html (last visited Mar. 28, 2016).
47 Ibid.

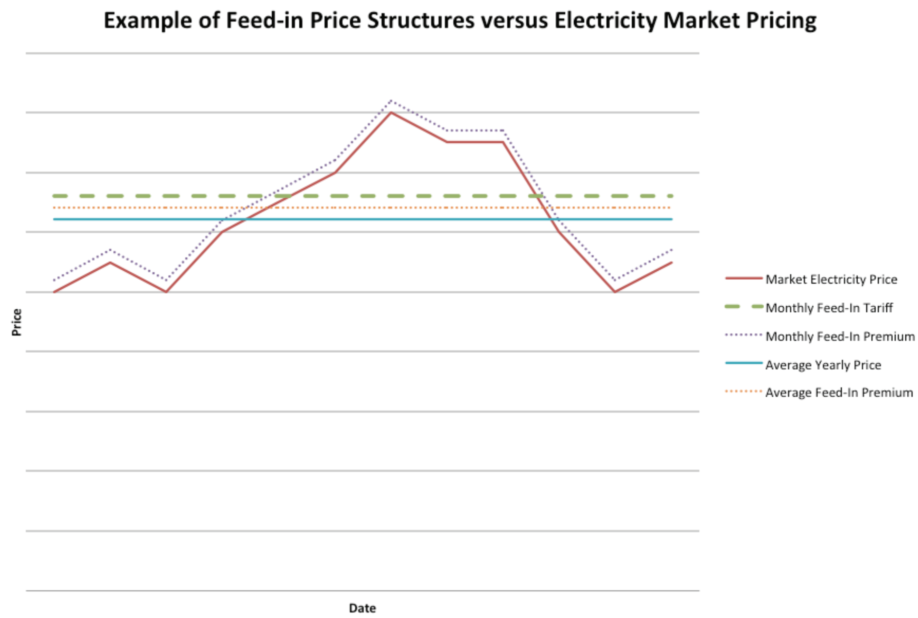

Figure 1 – Conceptual Example of Feed-in Price Structures for Renewable Energy. The figure provides an illustration of how different programs function in relation to one another. The graphic does not provide specific market data or rates.

electricity.[48] Typically, the specific long-term price will be established by the regulator and will exceed the average commodity cost of electricity. Germany is the pioneer in very successful use of feed-in tariffs to promote renewable energy. An excerpt from Its basic law follows.

The widely cited German feed-in tariff program created the standard for feed-in rules.[49] Feed-in tariffs have also been adopted in Switzerland, Italy, Denmark, India, Spain, Greece, Sri Lanka, Sweden, Portugal, Norway, Slovenia, France, Latvia, Algeria, Austria, Brazil, Czech Republic, Indonesia, Lithuania, Cyprus, Estonia, Hungary, South Korea, the Slovak Republic, Israel, Nicaragua, China, Turkey, Ecuador, Ireland, Argentina, Thailand, Albania, Bulgaria, Croatia, Macedonia, Uganda, Kenya, Philippines, Poland, Ukraine, Switzerland, South Africa, the United Kingdom, parts of Canada, parts of Australia, and parts of the United States. Policy makers can differentiate the level of payment for each kilowatt by the technology type, location, size, and other factors.[50] After several iterations, the program has settled on several market-setting rules to guard against negative price impacts on non-participating customers and excessive utility service charges.

48 Ibid.
49 For more information, see Overview Renewable Energy Sources Act, for the most recent overview of the German Feed-In Tariff program. http://www.germanenergyblog.de/?page_id=283
50 Ibid.

3. Feed-in Premiums

Feed-in premiums are long-term rate structures that refer to the average yearly electricity market price, and add on a premium based on the type, location, and other characteristics of the generation.[51] While this tool potentially rewards renewable energy developers when electricity market prices increase, it also exposes them to risks of overall market decline.[52] Studies have found that "if a predictable feed-in premium is applied instead of [other renewable energy schemes] this can reduce the levelized generation cost by more than 10%.[53]

Constant premiums create an incentive to generate electricity during peak demand, when market prices are highest.[54] Diesel generators, among the most polluting genres, frequently provide peak power. Incentivizing solar energy peak generation helps renewable energy compete, avoid peaking diesel generation pollution, and helps with one of the largest impacts on carbon emissions. Policy makers can limit the market volatility of feed-in premiums by creating price floors and caps.[55] Such limits protect consumers from large price spikes during peak hours, and protect investors over longer terms by ensuring prices never diminish beyond a certain fixed floor.

4. Net Metering

Net metering is a utility rate structure that requires the utility to purchase from a renewable energy customer any electricity produced in excess of the customer's usage…Net metering is an effective tool to encourage small-scale renewable development by allowing customers to turn their generation into actual reductions on their electricity bills.[56] Different variations of net metering programs have been implemented in several different countries and jurisdictions.[57]

E. Special Financing Provisions for Mid- to Large-Scale Renewable Energy Projects

The following section will discuss laws enabling tools and policies that promote renewable energy projects that service more than one customer. Such projects typically require large amounts of funding, and thus require a different set of financing tools. These tools can encompass more traditional financing methods, such as power purchase agreements, through more innovative mechanisms such as community choice aggregation.

1. Community Microgrid Projects

Community renewable energy projects at the village level, with micro grid distribution, tend to be anchored by large community structures such as hospitals, military installations, schools, village

51 Ibid.
52 Kleßmann, supra note Error! Bookmark not defined..
53 Ibid. Other schemes with volatile price structures may include renewable energy certificate schemes, described in a later section of the chapter.
54 Ibid.
55 Ibid.
56 See Interstate Renewable Energy Council, IREC MR-NM2009 Model Net-Metering Rules (2013).
57 Recent policies have also attempted to create a more granular pricing structure attaching different rates to production and consumption, creating the "value of solar" tariffs.

halls, or community centres that can afford to provide important financial help for solar projects.[58] Frequently, such critical infrastructure receives at least some government support. The larger institution anchors help to support electricity for community residential use.[59]

Electricity distribution at the village or town scale permits larger capital projects that can attract more traditional investors to finance significant portions of a project. Changing demographics drawn to an expanding region may use more electricity (e.g. air conditioning and refrigerators), in turn providing more return on investment. Institutional electricity customers may be able to raise funds from commercial sources more readily and can carry a higher debt-capital ratio than can an individual customer, making investment more attractive. As critical infrastructure receives power, additional opportunities for smaller community customers emerge to capitalize on the expanded capacity.

In addition to encouraging potentially larger projects, a village scale grid also may facilitate financing due to less risk of non-payment. The village scale may also make collecting payments on debt easier, including the fact that some stakeholders and investors may be the same people. Increased scale and greater numbers of users requires a more complex billing infrastructures that may not be otherwise affordable. Non-payment risks may even be less than in large grid communities due to peer pressures in intermediate village communities.[60]

Community scale electric generation usually requires investment in a distribution infrastructure.[61] The decision to invest in community renewable energy dictates planning for mini grids or ordinary grid expansion. Providing for grid financing, however, can increase costs, and the complexity of these arrangements requires more and higher qualified staff. On the other hand, the scale and efficiency of such projects may result in lowering of costs.[62]

Microgrids have numerous benefits in terms of resilience, efficiency and reduced maintenance costs, so much so that there is currently a movement in developed nations to redevelop along the lines of a microgrid model.[63] The local nature of a microgrid encourages economic opportunities to spring up around the grid. Innovative companies have capitalized on this synergy to build renewable energy power grids that work in tandem with entrepreneurial programs.[64] Also importantly, community energy projects are usually much less affected by major grid outages due to storms, overloads or systemic problems frequently experienced on large grids. For example, several microgrid projects remained operational during Hurricane Sandy despite widespread blackouts and system failures. Implementation of community and microgrids can thus increase system resiliency and reduce system problems frequently experienced in developing areas.

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58 Daniel Schnitzer, et al., United Nations Foundation, Microgrids for Rural Electrification, (Feb. 2014).
59 Ibid.
60 Kale Seagraves, How Grameen Bank uses peer pressure, Poverty News Blog (Aug. 06, 2010), available at http://povertynewsblog.blogspot.com/2010/08/how-grameen-bank-uses-peer-pressure.html, citing Rana Foroohar, A Bank from Bangladesh Brings Microlending to U.S., Newsweek (July 19, 2010 11:33AM), available at http://www.newsweek.com/bank-bangladesh-brings-microlending-us-74333.
61 Daniel L. Bond, Daniel Platz & Magnus Magnusson, Financing small-scale infrastructure investments in developing countries, DESA Working Paper No. 114, United Nations, Dept. of Economic & Social Affairs (May 2012), available at http://www.un.org/esa/desa/papers/2012/wp114_2012.pdf
62 Ibid.
63 See TechNavio, Global Microgrid Market 2012-2016 (July 26, 2013), available at http://www.technavio.com/report/global-microgrid-market-2012-2016 ("TechNavio's analysts forecast the Global Microgrid market to grow at a CAGR of 25.7 percent over the period 2012-2016").
64 Ibid.

Community microgrid projects have been implemented in the United States, India, Portugal, Indonesia, Denmark, Kenya, Spain, Australia, Equatorial Guinea, St. Helena, Japan, Canada, Greece, South Korea, and many more countries. The publication, Microgrid Projects, provides a comprehensive map of the global progress of microgrids along with project size, resource composition and type of customer.[65]

2. Community Choice Aggregation

Community Choice Aggregation (CCA) is an energy purchase and distribution tool that allows a municipality to engage its constituents in the purchase of electricity on an opt-out basis.[66] In a CCA program, municipalities pass an ordinance that allows a municipality to aggregate its customers and act as a market participant.[67] The enabling statute allows the municipality to include people in its jurisdiction within the customer aggregation area to initiate a renewable energy or energy efficiency program for the entire aggregation area on an opt-out basis (allowing anyone in the aggregation area to opt out of the arrangement).[68] The most basic CCA programs aggregate customers and initiate programs on an opt-out basis, acquire their information and bundle their purchasing capacity.

California: Assembly Bill No. 117 – Electrical restructuring: aggregation

AB 117 (1) to "authorize customers to aggregate their electrical loads as members of their local community with community choice aggregators…[and] authorize community choice aggregator to aggregate the electrical load of interested electricity consumers with its boundaries."

§331.1 "community choice aggregator means…(a) any city, county, or city and county whose governing board elects to combine the loads of its residents, businesses, and municipal facilities in a communitywide electricity buyers' program…(b) any group of cities, counties, or cities and counties whose governing boards have elected to combine the loads of their programs, through the formation of a joint powers agency."

§366.2 (a)(3) "if a customer opts out of a community choice aggregator's program, or has no community choice program available, that customer shall have the right to continue to be served by the existing electrical corporation or its successor in interest."

A community choice aggregator must file an implementation plan that includes the organization structure, rate and cost setting procedures, dispute resolution standards, rights and responsibilities, and cost recovery.

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65 Microgrid Projects, Mapping the Global Progress of Microgrids, http://microgridprojects.com/?Search=&Status=all&Location=all&Type=all&price_range_min=0&price_range_max=75000&order-by=featured&pageid=107

66 See generally Local Power Inc., Community Choice, Lessons Learned & Best Practices (2009).

67 Pacific Gas and Electric has cooperated to implement successful CCA projects. PG&E Electric Rule No. 23 lays out specifics for community choice aggregation service. See Pacific Gas & Electric, Electric Rule No. 23, Community choice Aggregation Service, Cal. P.U.C. Sheet No. 25527-E. http://www.pge.com/tariffs/tm2/pdf/ELEC_RULES_23.pdf

68 California Assembly Bill No. 117, Electrical restructuring: aggregations. http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200120020AB117

CCAs function like a municipal power authority, allowing the CCA municipality to acquire and manage energy resources serving its customers. Through the CCA, a municipality can bargain for lower energy prices for electricity that suits the community's energy needs. The most advanced models of CCA allow the municipality to encourage and manage the deployment of energy resources, allowing local choice and greater penetration of community renewable energy.

CCA allows communities to control the choice of their energy supply while working through existing delivery systems. The newest CCAs use this potential to design community wide electricity load reduction through investments in energy efficiency and renewable energy.[69] Localizing a community's choice of energy supply allows the CCA to capitalize on distributed renewable energy resources in a more direct way than traditional utility distribution. Currently, CCAs are mostly limited to U.S. state and local jurisdictions, but could be implemented as a complement to investor-owned utilities in other jurisdictions.[70]

F. Private Sector Financing, Contracts, and Corporate Structures

While the principle focus of this chapter is to provide policy makers with examples of laws that can increase access to renewable energy, many mid-to-large scale projects are financed through variations on more traditional contract and corporate law. Policy makers in emerging economies hoping to support renewable energy finance should be acquainted with some of the following topics to support greater renewable energy market penetration. This short section offers only a handful of the various private sector tools that can be used to accelerate financing to renewable energy projects. Government's most important role in these structures is to provide stability in policies, reliable enforcement of contracts, and fair application and enforcement of permitting…

1. Power Purchase Agreements ("PPA")

Power Purchase Agreements are contractual arrangements in which a wholesale energy company or other party purchases exclusive rights to all or part of an energy provider's electricity.[71] PPAs allow the facility owner to secure a revenue stream from the project necessary to finance it and determine the quality of credit.[72] The terms of PPAs address issues such as the length of the agreement, the commissioning process, the purchase and sale of energy, price, curtailment, credit and insurance.[73]

PPAs are a standard financing mechanism for the grid-based power market, enabling wholesale purchasers, retailers and customers to buy and sell electricity through a utility's distribution system.[74]

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69 See e.g. Sonoma Clean Power, SCP provides residential and business customers across the county with the option of using environmentally friendly power generated by renewable sources at competitive rates. See also Citizens for Local Power, Taking Control of our energy supply: Community Choice Aggregation for municipalities, Summary of Information Forums Held in Ulster Count, NY, on Sept. 29, 2014, and in Sullivan County, NY, on Sept. 30, 2014.

70 States that have passed CCA laws include California, Illinois, Maryland, Massachusetts, New Jersey, Ohio, and Rhode Island. See Green Power Network, Community Choice Aggregation, http://apps3.eere.energy.gov/greenpower/markets/community_choice.shtml

71 See e.g. Bonneville Power Association, Exhibit C. Example of a Purchase Power Agreement, (2002), available at http://www.bpa.gov/power/pgc/wind/EX_C_PPA_2.pdf (example of a Power Purchase Agreement, Executed by the U.S. Department of Energy acting by and through the Bonneville Power Administration).

72 Daniel A Yarano, Biomass Magazine, The Basics of a Power Purchase Agreement, (last visited June 20, 2014, 12:15PM) available at http://biomassmagazine.com/articles/2119/the-basics-of-a-power-purchase-agreement/

73 Ibid.

74 See New York City Energy Efficiency Corporation, NYCEEC Opens Field for Successful Retrofit Financings at 125 Maiden Lane, http://www.nyceec.com/wp-content/pdf/125ml_casestudy.pdf

Innovations to these contracts are providing an excellent tool to augment and encourage renewable investment.[75] Similar to other programs that finance renewable electricity, PPAs reduce the overall financing cost of renewable installations. In particular, a PPA allows renewable energy companies to diffuse the risk associated with selling their electricity directly to customers.[76]

The US Environmental Protection Agency (EPA), outlines specific recommendations for some Solar Power Purchase Agreements.[77] This subset of (USEPA) involves a financial arrangement in which a third-party developer owns, operates, and maintains a photovoltaic (PV) system, and a host agrees to site the system on its property and purchase the system's electric output from the developer for a predefined period.[78] The developer under the solar PPA (SPPA) arrangement is also known as a "solar services provider."[79] SPPA arrangements enable host customers (those purchasing the power) to navigate many of the traditional barriers to adoption, including high capital costs, system performance risks, and design complexities.[80]

2. Project Finance or Limited Recourse Finance

Project finance is a mechanism through which developers create a stand-alone company devoted to the development of a specific project. Project financing allows lenders to finance a project based solely on the individual project's risks and future cash flows.[81] One of the primary benefits of project financing is that the debt is held at the level of the Project Company and not on the corporate books of the sponsor.[82] The arrangement allows Sponsors to protect their assets from the potential bankruptcy of the project, making it more likely for sponsors to invest in renewable energy project.

Project financing is a document-intensive process with high transaction costs, making it only effective for large-scale projects that serve a large population. In addition, such projects are most effective when they are linked to long-term power purchase agreements that cover all or a significant portion of their output.[83] Due to the factors of scale, contract complexity, and administrative costs, project financing is generally only suitable for large investors and projects.

3. Mezzanine Financing

Mezzanine finance combines debt and equity financing. Through mezzanine financing, a lender receives the right to convert a debt interest to an ownership interest in the event that the loan is not repaid. Typically mezzanine finance is used in the expansion of an existing company. A mezzanine loan may be a cheaper way of replacing some of the additional equity that would be needed if other forms of debt access were insufficient to fund or expand projects.[84]

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75 Power Purchase Agreement, supra note 170.
76 See Ibid.
77 U.S. Environmental Protection Agency, Solar Power Purchase Agreements, available at http://www.epa.gov/green-power/buygp/solarpower.htm
78 U.S. Environmental Protection Agency, Solar Power Purchase Agreements, http://www.epa.gov/greenpower/buygp/solarpower.htm (last visited June 18, 2014).
79 Ibid.
80 Ibid.
81 Chris Groobey, John Pierce, Michael Faber, and Greg Broome, Wilson, Sonsini, Goodrich & Rosati, Project Finance Primer for Renewable Energy and Clean Tech Projects, Professional Corporation, https://www.wsgr.com/PDFSearch/ctp_guide.pdf
82 Ibid.
83 Ibid.
84 UN Environment , Private Financing of Renewable Energy, A Guide for Policy makers, (2009) http://fs-UN Environment -centre.org/sites/default/files/media/financeguide20final.pdf

4. Venture Capital and Private Equity Funds

Venture Capital Funds will typically engage during early stage or growth stages of technology companies, and will usually take an ownership stake in project. Later stage company and project development may interest Private Equity Firms. Private Equity typically expects a three to five year return on investment, although some types of private equity firms specializing in infrastructure may take a longer-term approach to returns. [85]

5. Yield Companies (Yieldcos)

Yield companies, or "Yieldcos," are publicly traded corporations that own and operate wind and solar power plants.[86] As a publicly traded corporation, a Yieldco enables sophisticated investors to own a share in renewable energy production. Ownership of renewable energy plants provides Yieldcos with a steady stream of revenue at low cost.[87] The steady revenue stream helps the Yieldco buy new plants from developers at favourable terms. The relationship between a Yieldco and a renewable energy developer allows developers to "recycle" their capital.[88] Selling an existing plant to a Yieldco makes it cheaper to raise equity for subsequent plant investments.[89] Because the YieldCo owns a variety of renewable energy plants, investors are able to reduce risks by benefiting from diversification. In many ways, Yieldcos represent the realization of a mature renewable energy market, providing the investor with the possibility of steady and solid yields.[90]

G. Finance Support through Market Regulation Policies

Beyond direct spending and individual lending pathways, there are several tools that policy makers have successfully used to accelerate private market growth of the renewable energy sector. Support policies that work through market regulation provide long-term price signals that are favourable to renewable energy investment. Such policies can include aspirational goals such as targets, quotas and portfolios, and grid interconnection regulations. Finally, sudden regulatory shifts or uncertainty in government can increase the cost of renewable finance due to policy risk.

1. Renewable Energy Targets and Mandates

Policy makers can begin to establish a support framework for renewable energy development by creating a target or mandate, often called a "Renewable Energy Portfolio Standard" (RPS). An RPS requires a utility to purchase a certain percentage of its electricity as renewable energy.

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85 Ibid.

86 See Alex Anich, The Emerging YieldCo Landscape, Renewable Energy World.com (Oct. 24, 2013), http://www.renewableenergyworld.com/rea/blog/post/2013/10/the-emerging-yieldco-landscape.

87 See e.g. NRG Yield, Inc., Company Overview, MarketWatch.com (June 5, 2014, 1:35PM), http://www.marketwatch.com/investing/stock/nyld). [hereinafter "NRG Yield Stock Info"] NRG Yield, Inc. operates as a dividend growth-oriented company, which owns and operates a portfolio of power generation assets and thermal infrastructure assets. I formed to serve as the primary vehicle, through which NRG Energy, Inc. will own, operate and acquire contracted renewable and conventional generation and thermal infrastructure assets.

88 Ehren Goossens, Expect More Renewable Energy Yieldcos Seeking Cheap Equity, Abengoa Says, RenewableEnergyWorld.com (Apr. 7, 2014),)http://www.renewableenergyworld.com/rea/news/article/2014/04/expect-more-renewable-energy-yieldcos-seeking-cheap-equity-abengoa-says.

89 Ibid

90 Rocky Mountain Institute A Rock that Churns out Cash: Solar YieldCos, (July 17, 2013), http://blog.rmi.org/blog_2013_07_17_a_rock_that_churns_out_cash_solar_yieldcos.

A target date and percentage sends a market signal for investor confidence. While targets are aspirational, even they help to outline and benchmark policy success. There are numerous examples of renewable energy targets from nations around the globe.[91]

Language establishing targets may serve an aspirational purpose, which can then inform further policies. For instance, in its policy framework for climate and energy, the European Union set itself three targets:

- Greenhouse gas emissions reductions of 20% by 2020
- A 20% renewable energy share by 2020
- 20% improvement in energy efficiency[92]

RPS mandates and targets vary from country to country, and even state to state. In terms of finance, the main purpose of them is twofold. First, they serve as a driver for new policies that increase investment. Second, they help to inspire confidence and visibility in the new renewable market place. In short, they help policy makers to shift the market towards renewable energy development.

2. Grid-Level Market Factors

There is a vast list of factors that could impact renewable energy finance through downstream and collateral market effects. The following section will discuss these factors as guideposts for policy makers looking for further topics that could aid in supporting access to finance in a growing renewable energy market.

Transmission grid policies are a major upstream factor in renewable energy finance. Large-scale renewable energy projects are frequently located far from where they are being used, and thus rely on high-voltage transmission infrastructure to deliver the power. In order to support the financial viability of renewable energy projects, policy makers should avoid allocating transmission costs to project developers. In addition to transmission cost allocation, policy makers may have the opportunity to define rules for priority dispatch. Giving priority dispatch to renewable energy projects will increase the value proposition of PPAs and increase the developers' access to finance.[93] In addition, grid policy makers may have the opportunity to implement curtailment rules. Curtailment is when a generator is forced to cease production because generation exceeds transmission capacity. Guarding renewable power projects against curtailment is another tool policy makers can use to increase the PPA value proposition for project finance.[94] Finally, policy makers can increase the financial viability of renewable energy projects by decreasing transaction costs and application periods for project interconnection and approval.

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91 There are Renewable Portfolio Standards in Australia, China, the European Union, Germany, Japan, the Republic of Korea, the United States, and numerous state level portfolio standards and mandates.

92 Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, A policy framework for climate and energy in the period from 2020 to 2030.

93 As a general note, some jurisdictions may be subject to laws, which prohibit grid access discrimination. See e.g. Public Utilities Regulatory Policies Act, Pub. L. 95-617, 92 Stat. 3117, Nov. 9 1978).

94 Kleßmann, supra note..

H. Funding Resources

Many governmental and non-profit organizations provide concise resources for financing opportunities and guides for applications. The following section will provide information on where project initiators can access funding resources and information on efficiency and renewable energy financing to start projects.

1. Project Finance Organizations

There are numerous government and private organizations that make grants or loans to fund energy efficiency and renewable energy projects.

For large projects the most prominent funders are the World Bank,[95] its International Finance Corporation,[96] and its regional affiliated banks; the Asian Development Bank,[97] the African Development Bank[98] and the Interamerican Development Bank.[99] The World Bank and International Finance Corporation are also accredited to administer the Green Climate Fund emanating from the Paris Climate Change Agreement.[100] The World Bank offers a variety of financing instruments that may be suitable for large scale development projects. Financing programs also are available for policy development, market development, and individual projects.

Also for financing primarily large projects there is the Abu Dhabi Fund for Development that has been investing primarily in African renewable energy projects.[101]

National banks tend to loan within their own countries, like the National Banks of India[102] Smaller individual national lenders include such as Thailand's ENCON Fund[103] and Vietnam's Renewable Energy Development and Network Expansion and Rehabilitation for Remote Communes Sector Project.[104]

There are a variety of U.S. agencies that fund projects including the Agency for International Development and the U.S. Department of Energy.[105]

The Overseas Private Investment Corporation (OPIC) is the U.S. Government's development finance institution, which helps mobilize private capital to solve critical development challenges. OPIC

95 The World Bank, http://www.worldbank.org/en/projects-operations/products-and-services www.ifc.org/.
96 www.adb.org/.
97 www.afdb/en/.
98 http://www.iadb.org/en/inter-american-development-bank,2837.html.
99 http://www.worldbank.org/en/topic/climatechange/brief/green-climate-fund;
100 http://www.worldbank.org/en/topic/climatechange/brief/ifc-accredited-to-green-climate-fund. For the Green Climate Fund, See: http://unfccc.int/cooperation_and_support/financial_mechanism/green_climate_fund/items/5869.php.
101 www.abudhabi.ae/portal/public/en/departments/department_detail?docName=ADEGP_DF_95302_EN&_adf.ctrl-state=m1n59s8f5_4&_afrLoop=6664003428155931#!
102 www.iloveindia.com/finance/bank/nationalised-banks/
103 See Eric Jue, Brad Johnson, Anmol Vanamali, and Center for Clean Air Policy (CCAP), Case Study: Thailand's Energy Conservation (ENCON) Fund, (Oct. 2012)
104 See Nam, Pham Khanh; Quan, Nguyen Anh; and Binh, Quan Minh Quoc, International Institute for Sustainable Development, Investment Incentives for Renewable Energy in Southeast Asia: Case study of Viet Nam (Dec. 2012)
105 The U.S. Department of Energy offers numerous grants. Although international projects may be ineligible, policy makers could utilize Grants Policies and Guidance, Resources and forms to streamline their own projects. See U.S. Department of Energy, Grants & Contracts Support, http://science.energy.gov/grants/.

covers financing opportunities, political risk insurance, and support for private equity investment funds.[106]

The U.S. Department of the Treasury also offers resources for community development. The Small Business Lending Fund provides capital to small businesses, offering a useful resource in the implementation of on-site and mid-scale renewable energy projects.[107]

The European Commission offers numerous avenues for funding and project development. The Directorate-General for International Cooperation and Development (DG DEVCO) implements a wide framework of international cooperation with partner countries. DG DEVCO offers several different funding instruments aimed at different policy objectives and partner countries outside of the EU.[108]

The United Nations Environment Programme Finance Initiative offers training, tools, and resources to understand the impacts of environmental considerations on financial performance.[109] The collaboration between private sector and UN Environment seeks to find innovative approaches for finance and sustainability.

Several regional initiatives have also outlined plans to increase financing for renewable energy. The African Union announced the Africa Renewable Energy Initiative, which will direct $20 billion to renewable energy projects.[110] Asia-Pacific Economic Cooperation (APEC) also offers opportunities for funding projects.[111] ASEAN Centre for Energy also provides resources for members on creating renewable energy programs and information on planning and finance.[112]

2. Finance Information Services

There also are organizations that assist in identifying efficiency and renewable energy project funding, such as Energy Funding 123,[113] and the Renewable Energy International Institute (REIL) and its Renewable Energy and Energy Efficiency Partnership (REEP)[114] The Terra Viva Grants Directory provides an updated list of current and upcoming grants.[115]

3. Conclusion

Energy efficiency and renewable energy are essential elements to fostering economic development. Laws that create opportunities for favourable financing and project development are critical to

106 See Overseas Private Investment Corporation, https://www.opic.gov/
107 U.S. Department of the Treasury, Resource Center – Overview for Community Development Loan Funds, https://www.treasury.gov/resource-center/sb-programs/Pages/Overview-for-CDLFs.aspx
108 European Commission, Directorate-General for International Cooperation and Development (DG DEVCO), European Development Fund, https://ec.europa.eu/europeaid/funding/funding-instruments-programming/funding-instruments/european-development-fund_en
109 UN Environment Finance Initiative, http://www.unepfi.org/.
110 UNFCCC, Joint Statement on Advancing of the Africa Renewable Energy Initiative. (2015), http://newsroom.unfccc.int/media/547433/africa-renewable-energy-initiative-statement.pdf. For more information on financing renewables in sub-Saharan Africa, see Financing Renewable energy in developing countries, Drivers and barriers for private finance in Sub-Saharan Africa (Feb. 2012).
111 Asia-Pacific Economic Cooperation (APEC), Applying for Fundshttp://www.apec.org/Projects/Applying-for-Funds.aspx
112 ASEAN Centre for Energy, Renewable Energy Information Portal (2016), http://aseanrenewables.info/
113 http://www.energyfunding123.com/
114 www.reep.org
115 See e.g. Terra Viva Grants Directory, http://www.terravivagrants.org/Home/funding-news/energy.

supporting the development of the efficiency and renewable energy markets. Policy makers can simultaneously reduce subsidies for fossil fuels and regulate carbon, which will further increase the value of these options. The creation of long-term, stable policies promoting their financing will generate social and economic benefits in addition to contributing to the fight against climate change.

SECTION FOUR - ENERGY EFFICIENCY

CHAPTER 4A
THE IMPORTANCE OF ENERGY EFFICIENCY

Richard Ottinger*

Energy efficiency is demonstrably the most effective and economically advantageous means to provide the services desired by energy users. It is defined as measures to provide the same (or higher) level of energy services (such as thermal comfort and high-quality lighting) at reduced energy consumption and cost. Energy efficiency measures in the end use, manufacturing and transmission of electricity replace the need for fossil fuel resources and virtually always produce a net economic benefit, often substantial.[116] Efficiency measures also can reduce the great costs and risks of dependence on oil imports.

It has been calculated that 61% of all primary energy used is lost in various stages of conversion and use, and that over 60% again is lost or wasted at the end-use stage.[117] The International Panel on Climate Change (IPCC) in 2013 made a similar calculation, finding that almost 70% of all primary energy used is wasted.[118] Energy efficiency measures can economically avoid a large percentage of this waste.

The requirements for efficiency measures generally can be found or produced domestically. Moreover, by improving the efficiency, measures often result in enhanced competitiveness of domestic products in our global economy.

These efficiencies and savings have demonstrated their ability to achieve dramatic energy and economic savings through tried and proven laws and regulations providing for efficiency incentives, information, efficiency standards and labelling measures. The laws facilitating these energy efficiency measures are critical to their promotion.

The chapters below in this section explore in detail energy efficiency opportunities and the legislation that has been passed to achieve them in the areas of industrial, appliance, building and road transportation efficiency.

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116 A 1997 Alliance to Save Energy study found a U.S. energy efficiency savings potential of 26% of carbon emissions and 15% of primary energy by 2010, saving 13% of national energy costs and $85 billion per year and creating nearly 800,000 net new jobs. Lovins, A. & L.H., Making Sense and Making Money, Rocky Mountain Institute (November 13, 1997) at p. 10; Alliance to Save Energy (ASE), American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Tellus Institute and Union of Concerned Scientists, Energy Innovations: A Prosperous Path to a Clean Environment, ASE (Washington, DC, June 1997).

117 Barry Fischer, US Wastes 61-86% of its Energy, CLEAN TECHNICA (Aug. 2013), http://cleantechnica.com/2013/08/26/us-wastes-61-86-of-its-energy/ (citing a 2012 Lawrence Livermore National Laboratory study).

118 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CHAPTER 7: ENERGY SYSTEMS, ANNUAL REPORT 5 (2013), http://www.ipcc.ch/pub/reports.htm.

CHAPTER 4B
INDUSTRY AND COMMERCE

Ethan Rogers*

1. INTRODUCTION

Industrial production is the backbone of economic output in almost all countries. Over the past decades, industrial production also has been growing in most countries. Industrial energy use can be broken down into that of the energy-intensive industries (e.g. primary metals, pulp and paper, primary chemicals, oil refining, building materials) and the non-energy intensive industries (e.g. services, electronics and food). Energy use in the energy intensive sector is dominated by the production of a few major energy –intensive commodities such as steel, metal casting, paper, cement, and chemicals.

Markets in the industrialized countries show a shift away from producing commodities and towards custom manufacturing, service oriented activities and other less energy-intensive industries, however. Data centres and other Internet supporting companies have become significant energy consuming businesses in the last decade; however, energy-intensive industries probably will remain the largest energy consumers in the next decade.

In 2013, the industrial sector was responsible for 42.3% of electricity, 37.2% of natural gas, 8.4% of oil, and 78.9% of coal consumption in the world.[119]

A common breakdown of industrial energy use distinguishes energy use for processes (called process-specific) and other services like energy use for buildings, utilities and boilers (called cross-cutting). The wide variety of processes makes it difficult for policy makers and legislators to design a single set of policies, laws and regulations to manage all aspects of industrial energy use. Hence, industrial energy policies are often directed at overall goals, or at specific processes and elements of the industrial production and energy consumption process.

This chapter will first provide a background to characterize energy efficiency policies, regulations, and programs to encourage energy efficiency in industry and commerce. This is followed by a discussion of key examples of performance standards and labelling regulations, energy and pollution taxation, and developing and regulating markets for energy efficiency and demand response. The next sections in this chapter will explain and give examples of different types of technical and financial assistance programs and policies and programs to encourage investments in CHP.

II. ENERGY EFFICIENCY MEASURES

A Characterization of Policies, Regulations, and Programs

Policies targeting the industrial and commerce sectors often focus on changing market dynamics and removing barriers to greater investment in energy efficient practices and technologies. Markets

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119 International Energy Agency. 2015. Key World Energy STATISTICS. Paris, France: IEA

can be altered by regulations that limit or prohibit the sale of certain devices or by policies that encourage the purchase of more efficient devices. Markets can also be influenced by taxes and tax incentives.

There are many barriers to the implementation of energy efficiency improvement measures. Research on such barriers indicates a great diversity in the understanding of opportunities, knowledge of how to determine economic benefit, and ability to implement. Companies may not be aware of more efficient devices and processes. They may not have the financial sophistication to properly value future benefits and risks, and they may not have the financial resources to make such investments. In addition, the structure and goals of an organization may eschew long-term benefits for short-term gains, a feature which can work against optimizing energy use.[120]

Laws and their implementing regulations (herein after referred to as "laws" unless otherwise specified) try to overcome or reduce the barriers to energy-efficiency improvement. Laws try to accomplish this by limiting certain actions like purchasing inefficient equipment or creating pollution, while many laws seek to accelerate the uptake of energy efficient equipment and upgrading of buildings by establishing labelling requirements and creating awareness programs. Other laws have improved worker awareness of opportunities and ability to calculate the benefits of energy efficiency by facilitating the training of workers and implementation of systematic organizational approaches to energy management. Some laws create financial assistance programs to help organizations with limited resources to make investments in energy efficiency that they would not have been able to make on their own. These laws can have the added benefit of enabling companies to stay in business which in turn enables them to continue to contribute to the tax base and keep workers employed.

Voluntary ⟷ **Mandatory**

Information Dissemination and Demonstration

Technical and Financial Incentive Programs

Audits and Assessments

Reporting and Benchmarking

Agreements and Targets

Performance Labels and Standards

Environmental Regulation and Taxation

Figure 1: Characterization of Industrial Energy Efficiency Policies

120 Russell and Young 2012. Understanding Industrial Investment Decisions. Washington, DC: ACEEE. http://aceee.org/research-report/ie124

Government standards exist along a continuum with voluntary action on one end and compulsory requirements on the other. Figure 1 illustrates where on this scale the policy, program and regulatory actions discussed in this chapter fall. The experiences of many countries indicate that a successful industrial energy-efficiency policy approach integrates a variety of policies, regulations, and programs. Taking a portfolio approach addresses the diversity of industrial energy uses, size of facilities, and stakeholders' use in the industrial sector. These countries have created a portfolio of policies and regulations to require a minimum amount of efficiency and voluntary programs to encourage even more.

Several countries have passed broad, comprehensive legislation that addresses energy use. Germany has a low industrial energy intensity relative to other countries, in part due to the many policies it has enacted to reward and drive greater efficiency in its manufacturing sector. For example, in 2012, Germany established voluntary energy-savings targets for manufacturers to improve their energy efficiency by 1.3% per year.[121] However, its advances in industrial efficiency are largely driven by its economic incentives. Germany has programs that support greater energy efficiency in manufacturing production processes by providing subsidies for upgrading technology and equipment. Germany also targets small and medium-sized enterprises, helping them improve the efficiency of their facilities by providing 30% of the funding for energy-efficient motors, pumps, air-conditioning systems, and compressed air devices.

Italy has shown a commitment to energy efficiency in its industrial sector by establishing energy savings targets, requiring plant energy managers to meet these targets, and mandating periodic energy audits. A market-based energy efficiency certificate scheme ("white certificates") is the key tool for achieving the industrial sector's energy efficiency savings target, which has been set at 5.1 million tons of oil equivalent (Mtoe).[122]

Italy also has a large share of installed combined heat and power (CHP) due to its policies to advance CHP.[123] Also known as cogeneration, CHP systems are an energy-efficient method of generating both electricity and useful thermal energy in a single, integrated system. In 1992, Italy adopted a resolution known as "CIP6," which was a kind of feed-in tariff that spurred the development of CHP across the country by ensuring premium prices for the production of energy for the first eight years of generation. More recently, Legislative Decree No. 20/2007 called for an increase in the use of high-efficiency cogeneration in industry and created incentives for CHP and other technologies including high-efficiency motors and inverters, and mechanical vapour compression.[124]

Japan has developed a mix of regulatory measures, voluntary actions, and financial incentives that have encouraged energy efficiency in its industrial sector. The Act Concerning the Rational Use of

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121 IEA, Policies and Measures Database, Energy Efficiency, Financial support for investments in cross sectional technology: http://www.iea.org/policiesandmeasures/energyefficiency/?country=Germany

122 Italian Energy Efficiency Action Plan (EEAP) 2014: https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_italy.pdf. A "white certificate" scheme is one in which firms are required to achieve certain energy efficiency targets, but may alternatively meet their obligations by purchasing "white certificates" which represent surplus energy efficiency achievements of other firms. Such schemes resemble cap and trade regulation, incorporating a market-based trading mechanism to provide incentives for firms to exceed the targets. See Max Dupuy, David Crossley, and David Moskovitz (Regulatory Assistance Project), Market-Based Mechanisms and Supporting Policies to Achieve Energy Efficiency, Energy Consumption, and Carbon Emissions Reduction Goals: https://www.raponline.org/document/download/id/868 (Mar. 2011).

123 Electrical CHP capacity makes up 22.8% of Italy's share of total power capacity. https://www.wec-indicators.enerdata.eu/industrial-chp.html#/chp-power-capacity.html

124 ABB: https://library.e.abb.com/public/25e989a42ad4c799c1257be800549d00/Italy.pdf

Energy introduced mandatory energy efficiency requirements for designated industries in 1978 and the Act continues to serve as the foundation of Japan's energy efficiency policy. It requires companies to appoint an energy manager and report on the status of energy consumption every year.

In 2008, a revision to the Act introduced a benchmarking system for obligating businesses to achieve specific energy efficiency targets that must be met in the medium (2015) and long-term (2020). These requirements are supported by a tax incentive scheme, which provides a special depreciation rate for all businesses investing in specified energy conservation and efficient equipment. Low interest loans are also available for the installation of cogeneration systems.

The Japan Business Federation (Keidanren)'s "Voluntary Action Plan on the Environment" was a pillar of Japan's energy efficiency efforts until the policy ended in 2012. It included a comprehensive, non-binding target to reduce CO2 emissions and established voluntary agreements with industrial companies.[125]

B. Energy Efficiency Policy and Regulation Options for Industry and Commerce

The transition to greater efficiency is a journey for each sector of an economy. It starts with awareness of opportunities and then proceeds to education on how to finance and implement projects. Governments can assist and accelerate this normally occurring economic activity with an array of promotion, standards and labelling programs. The next step is to require minimum energy performance for devices. Such regulations start with common devices such as light bulbs and motors and then progress to more complex devices like boilers, pumps, fans, and air conditioners. Ultimately entire industries may be required to invest in and implement specific equipment and practices that minimize energy use and pollution.

The next step may be to implement pollution or energy taxes to reduce pollution. If properly designed these can compensate for market failures to account for pollution externalities, and in doing so make less polluting and more energy efficient processes more competitive with conventional technologies. Revenues from such taxes can also be used to fund the information dissemination and labelling programs described in this section and the voluntary programs discussed in the next section.

C. Information Dissemination and Labelling Programs

Information dissemination is often a task aided by the public sector. Information programs are designed to assist energy consumers to understand and employ technologies and practices to use energy more efficiently. These programs aim to increase consumers' awareness, acceptance, and use of particular technologies or utility energy conservation programs. Examples of information programs include educational brochures, hotlines, videos, home energy rate systems, design assistance programs, energy audits, energy use feedback programs, and labelling programs.

The U.S. Energy Policy Act of 1992 specifically addresses information as described below.

125 IEA Policy Database: http://www.iea.org/policiesandmeasures/pams/japan/; ABB country summary (p.5): https://library.e.abb.com/public/cd8e2662ae4b1340c12579d0004f1b13/Japan%20Energy%20efficiency%20Report.pdf ; IIP Database: http://iepd.iipnetwork.org/country/japan#relevant-policies ; IEA Country Summary – 2008 (see p.67): http://www.iea.org/publications/freepublications/publication/Japan2008.pdf

United States: Energy Policy Act of 1992

The Energy Policy Act in the United States specifically addresses information dissemination as part of the legislation:

Funding for State programs to support audits and promote energy efficiency.

SEC. 132. PROCESS-ORIENTED INDUSTRIAL ENERGY EFFICIENCY.

(b) GRANT PROGRAMME.—

(1) USE OF FUNDS. — The Secretary shall, to the extent funds are made available for such purpose, make grants to States, which, consistent with State law, shall be used for the following purposes:

(A) To promote, through appropriate institutions such as universities, nonprofit organizations, State and local government entities, technical centers, utilities, and trade organizations, the use of energy-efficient technologies in covered industries.

(B) To establish programs to train individuals (on an industry-by-industry basis) in conducting process-oriented industrial assessments and to encourage the use of such trained assessors.

(C) To assist utilities in developing, testing, and evaluating energy efficiency programmes and technologies for industrial customers in covered industries.

(2) CONSULTATION. — States receiving grants under this subsection shall consult with utilities and representatives of affected industries, as appropriate, in determining the most effective use of such funds consistent with the requirements of paragraph (1).

(3) ELIGIBILITY CRITERIA. — Not later than one year after the date of the enactment of this Act, the Secretary shall establish eligibility criteria for grants made pursuant to this subsection.

Full text at: http://thomas.loc.gov/cgi-bin/query/z?c102:H.R.776.ENR

Information needs are strongly determined by the type and sophistication of the customer. Therefore, program designers should take intended customers' needs and challenges into consideration when developing new programs. Information about a customer group's energy uses and technical challenges can often be found in trade literature. Other important sources of information are equipment manufacturers and the people who work in and serve the target sector. Considerable thought should also be given to how the information will be disseminated. Options include printed materials, websites, blog posts, email blasts, trade shows, articles in trade publications, and engagement with professional societies.

D. Energy Efficiency Standards

Regulatory programs have proven effective in promoting energy efficiency gains by overcoming information barriers. Examples include appliance energy efficiency regulations, automobile fuel

economy standards, commercial building standards, and minimum energy performance standards (MEPS) for commercial and industrial equipment. In such programs, the government passes a requirement that all products (or an average of all products sold) meet some minimum energy efficiency level. Energy efficiency standards are applied in many countries for various energy uses. Standards can be performance-based, i.e., they do not mandate how the manufacturer is to meet them (i.e., what technologies or design options to use) and are used for many mass-produced products.

Motor systems are used throughout any industrial operation. A motor system generally consists of an appliance, drive train and the motor. Motor systems consume over 60% of industrial electricity use in the United States, and nearly 70% in Europe. The share of motor electricity use will vary by sector. In the U.S. almost 25% of industrial motor electricity use is used by pumping systems, 14% by fans, 16% by compressed air systems and 23% for material processing. Other uses (e.g. material handling and refrigeration) represent over 23% of motor electricity use. Motors usually are efficient, and a well-designed; a well maintained motor has conversion efficiencies of over 90%. However, older and inefficient motors may have much lower efficiencies and the overall efficiency the total motor systems is even lower when the losses from the driven load, such as pumps, fans, and compressors, are considered.[126]

System losses can be reduced through an analysis of the operating characteristics of a motor system. For example, adjustable speed drives better match speed to varying load requirements for motor operations. There are various technologies to control the motor. The systems are offered by many suppliers and are available worldwide. Adjustable speed drives (ASDs) may be used for any industrial motor system that has variable loads. ASDs are used in a wide array of applications. Savings are determined by the flow pattern and loads of the particular motor system. The savings may vary between 15 and 50%.[127] The payback period may vary widely depending on the size of the motor system and use pattern.

Motor efficiencies can be improved by reducing the losses in the form of heat associated with converting electricity into mechanical motion. Motor standards are key in achieving this. Motor standards have been introduced in Australia, Brazil, Canada, China, Japan, Malaysia, Mexico, Poland, Taiwan, the European Union, and the United States.[128] The U.S. has pioneered the use of motor efficiency standards. The U.S. 2007 Energy Independence and Security Act ("EISA")[129] contains standards that apply to integral horsepower, general purpose AC-induction motors from 1 to 500 hp. These motors constitute 30% to 40% of all motors sold in the relevant horsepower classes. The standards vary from minimum efficiency levels of 80% for small motors to 95% for large motors. The standards apply to all motors sold in the U.S. Domestically manufactured motors and foreign motors imported as bare motors or embedded in a piece of equipment are all covered by

126 Paul Waide, Conrad U. Brunner et al., Energy-Efficiency Policy Opportunities for Electric Motor-Driven Systems. International Energy Agency Working Paper, Paris 2011; Anibal T. de Almeida et. al., EUP Lot 11 Motors, 2008; Rita Werle, Conrad U. Brunner, Rolf Tieben: Swiss motor efficiency program EASY: results 2010 - 2014, in proceedings of the ACEEE Industrial Summer Study 2015.

127 Nadel, S., N. Elliott, M. Shepard, S. Greenberg, G. Katz, and A. de Almeida. 2002. Energy-Efficient Motor Systems: A Handbook on Technology, Program, and Policy Opportunities, 2nd Ed. Washington, DC: ACEEE: http://aceee.org/sites/default/files/publications/ebook/energy-efficient-motor-systems.pdf.

128 Young, R., S. Hayes, M. Kelly, S. Vaidyanathan, S. Kwatra, R. Cluett, G. Herndon. 2014. 2014 International Energy Efficiency Scorecard. Washington, DC: ACEEE. http://aceee.org/research-report/e1402

129 42 U.S.C. § 17001 et seq.

this law.[130]

Accredited and independent testing laboratories should be able to provide the testing services to certify the motors. In the U.S. a manufacturer or private testing laboratory must certify that the motors are in compliance with the EPAct standards, after which the U.S. Department of Energy (U.S. DOE) provides a Compliance Certification number to that manufacturer. The Compliance Certification number must be displayed on the permanent nameplate of the motor. The manufacturer has the option to add a trademark logo that indicates compliance. Nominal efficiency information must also be displayed in motor catalogues and in marketing materials.[131]

E. Examples of National Minimum Energy Performance Standards for Motor Systems:

The European Union (EU) Ecodesign Framework Directive of 2009 created the legal basis for any Minimum Energy Performance Standards (MEPS) for energy-related products by countries within the EU.[132] The Directive seeks to protect the environment by reducing the potential environmental impact of energy-related products. It created a basis for standardizing and harmonizing the performance standards of appliances and devices across Europe. An overview of the most recent global motor MEPS is contained in *Energy Efficiency Roadmap for Electric Motors and Motor Systems* (EMSA 2015).[133] See also Konstantin Kulterer, Rita Werle et al., Policy Guidelines for Electric Motor Systems - Part 2: Toolkit for Policy Makers, October 2014.Two examples of countries that recently enacted performance standards for motors are China and Australia.

Australia: Energy rating for electric motors:
http://www.energyrating.gov.au/products/electric-motors

China: Energy label for electric motors:
www.energylabel.gov.cn

By contrast, the U.S. established the basis for creating energy efficiency standards for commercial and industrial motors with the Energy Security and Conservation Act in 1999.

130 NEMA Summary and Analysis of the Energy Independence and Security Act of 2007. National Electronic Manufacturers Association (NEMA); see 42 U.S.C. § 6311(13).
131 Id.
132 Directive 2009/125/EC of the European Parliament and of the Council of 21, October 2009. http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0125&from=EN
133 Energy efficiency roadmap for electric motors and motor systems, by 4E for IEA through the Electric Motor System Annex (EMSA). November 2015.

United States: The current U.S. motor standards were introduced in 1999 and updated several times, most recently in 2012.

Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures, Labelling, and Certification Requirements for Electric Motors.[2]

Summary of the Final Rule

[This] rule . . . amends the current DOE test procedures and definitions for electric motors and small electric motors. These changes will not affect the measured efficiency of this equipment. Instead, these changes will primarily clarify certain terms, language and the scope of energy conservation standards for electric motors. They will also minimize any potential ambiguity contained in the test procedures for electric motors and small electric motors.

* * *

[This] rule clarifies the scope of existing energy conservation standards for electric motors (10 CFR 431.25). . . . and updates the references to (1) NIST Handbook 150–10, ''Efficiency of Electric Motors,'' and the associated NIST Handbook 150–10 checklist, (2) IEC standards documents, (3) CSA C390, (4) CSA C747, (5) NEMA MG1, and (6) IEEE Standard 112 throughout subpart B of 10 CFR part 431.

10 C.F.R. § 431.25 Energy conservation standards and effective dates.

(a) Except as provided for fire pump electric motors in paragraph (b) of this section, each general purpose electric motor (subtype I) with a power rating of 1 horsepower or greater, but not greater than 200 horsepower, including a NEMA Design B or an equivalent IEC Design N motor that is a general purpose electric motor (subtype I), manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016, shall have a nominal full-load efficiency that is not less than the following:

[Table omitted]

(b) Each fire pump electric motor that is a general purpose electric motor (subtype I) or general purpose electric motor (subtype II) manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016, shall have a nominal full-load efficiency that is not less than the following:

[Table omitted]

(c) Except as provided for fire pump electric motors in paragraph (b) of this section, each general purpose electric motor (subtype II) with a power rating of 1 horsepower or greater, but not greater than 200 horsepower, including a NEMA Design B or an equivalent IEC Design N motor that is a general purpose electric motor (subtype II), manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016, shall have a nominal full-load efficiency that is not less than the following:

[Table omitted]

(d) Each NEMA Design B or an equivalent IEC Design N motor that is a general purpose electric motor (subtype I) or general purpose electric motor (subtype II), excluding fire pump electric motors, with a power rating of more than 200 horsepower, but not greater than 500 horsepower, manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016 shall have a nominal full-load efficiency

that is not less than the following:

[Table omitted]

(e) For purposes of determining the required minimum nominal full-load efficiency of an electric motor that has a horsepower or kilowatt rating between two horsepower or two kilowatt ratings listed in any table of energy conservation standards in paragraphs (a) through (d) of this section, each such motor shall be deemed to have a listed horsepower or kilowatt rating, determined as follows:

(1) A horsepower at or above the midpoint between the two consecutive horsepowers shall be rounded up to the higher of the two horsepowers;

(2) A horsepower below the midpoint between the two consecutive horsepowers shall be rounded down to the lower of the two horsepowers; or

(3) A kilowatt rating shall be directly converted from kilowatts to horsepower using the formula 1 kilowatt = (1/0.746) horsepower. The conversion should be calculated to three significant decimal places, and the resulting horsepower shall be rounded in accordance with paragraph (e)(1) or (e)(2) of this section, whichever applies.

(f) The standards in Table 1 through Table 4 of this section do not apply to definite purpose electric motors, special purpose electric motors, or those motors exempted by the Secretary.

(g) The standards in Table 5 through Table 7 of this section apply only to electric motors, including partial electric motors, that satisfy the following criteria:

(1) Are single-speed, induction motors;

(2) Are rated for continuous duty (MG 1) operation or for duty type S1 (IEC);

(3) Contain a squirrel-cage (MG 1) or cage (IEC) rotor;

(4) Operate on polyphase alternating current 60-hertz sinusoidal line power;

(5) Are rated 600 volts or less;

(6) Have a 2-, 4-, 6-, or 8-pole configuration,

(7) Are built in a three-digit or four-digit NEMA frame size (or IEC metric equivalent), including those designs between two consecutive NEMA frame sizes (or IEC metric equivalent), or an enclosed 56 NEMA frame size (or IEC metric equivalent),

(8) Produce at least one horsepower (0.746 kW) but not greater than 500 horsepower (373 kW), and

(9) Meet all of the performance requirements of one of the following motor types: A NEMA Design A, B, or C motor or an IEC Design N or H motor.

(h) Starting on June 1, 2016, each NEMA Design A motor, NEMA Design B motor, and IEC Design N motor that is an electric motor meeting the criteria in paragraph (g) of this section and with a power rating from 1 horsepower through 500 horsepower, but excluding fire pump electric motors, manufactured (alone or as a component of another piece of equipment) shall have a nominal full-load efficiency of not less than the following:

[Table omitted]

(i) Starting on June 1, 2016, each NEMA Design C motor and IEC Design H motor that is an

electric motor meeting the criteria in paragraph (g) of this section and with a power rating from 1 horsepower through 200 horsepower manufactured (alone or as a component of another piece of equipment) shall have a nominal full-load efficiency that is not less than the following:

[Table omitted]

(j) Starting on June 1, 2016, each fire pump electric motor meeting the criteria in paragraph (g) of this section and with a power rating of 1 horsepower through 500 horsepower, manufactured (alone or as a component of another piece of equipment) shall have a nominal full-load efficiency that is not less than the following:

[Table omitted]

(k) For purposes of determining the required minimum nominal full-load efficiency of an electric motor that has a horsepower or kilowatt rating between two horsepower or two kilowatt ratings listed in any table of energy conservation standards in paragraphs (h) through (l) of this section, each such motor shall be deemed to have a listed horsepower or kilowatt rating, determined as follows:

(1) A horsepower at or above the midpoint between the two consecutive horsepowers shall be rounded up to the higher of the two horsepowers;

(2) A horsepower below the midpoint between the two consecutive horsepowers shall be rounded down to the lower of the two horsepowers; or

(3) A kilowatt rating shall be directly converted from kilowatts to horsepower using the formula 1 kilowatt = (1/0.746) horsepower. The conversion should be calculated to three significant decimal places, and the resulting horsepower shall be rounded in accordance with paragraph (k)(1) or (k)(2) of this section, whichever applies.

(l) The standards in Table 5 through Table 7 of this section do not apply to the following electric motors exempted by the Secretary, or any additional electric motors that the Secretary may exempt:

(1) Air-over electric motors;

(2) Component sets of an electric motor;

(3) Liquid-cooled electric motors;

(4) Submersible electric motors; and

(5) Inverter-only electric motors.

Full text and tables of final rule and codification in CFR available at https://www.gpo.gov/fdsys/pkg/FR-2012-05-04/pdf/2012-10434.pdf and http://www.ecfr.gov/cgi-bin/retrieveECFR?n=pt10.3.431#se10.3.431_125, respectively.

Typically, the U.S. DOE relies upon the market participants (e.g. manufacturers, motor purchasers) to identify potential violations. When U.S. DOE receives written information on a potential violation it will investigate the potential violation following a prescribed procedure for enforcement as spelled out in the EPAct final rule. Enforcement can include testing and may result in penalties or an order to take the motors off the market.[134]

F. Energy and Pollution Laws, Regulations and Taxation

There is compelling evidence that firms substantially under-invest in energy efficiency or, stated differently, demand high returns to make such investments. A large number of standard accounting procedures are available for firms to determine the economic feasibility and profitability of an investment. Many investors use instruments, such as simple payback period, rate of return, or net present value to evaluate energy efficiency projects. When energy prices do not reflect the real costs of energy, consumers under-invest in energy efficiency. Energy prices, and hence the profitability of an investment, are also subject to large fluctuations. The uncertainty about energy price, especially in the short term, seems to be an important barrier. The uncertainties often lead to higher perceived risks and, therefore, to more stringent investment criteria and a higher hurdle rate.

Markets are a powerful and fundamental force in wide-scale implementation of energy efficiency. Subsidies that depress prices of fossil and nuclear energy provide a significant disincentive for energy efficiency. The removal of this barrier is an important step toward creating an investment climate in which energy efficiency can prosper. Worldwide, consumer energy prices typically do not reflect the full costs of energy production, transmission, and distribution because these prices are often subsidized. Furthermore, the energy prices do not include environmental costs. This creates an externality – a situation in which a price conveys incomplete signals as to the true societal cost of a resource.

Consider, for example, the costs of operating a cement factory. In order to make cement, the factory requires electricity, labour, lime and other raw materials, and a fuel with which to fire a kiln. The plant also requires a means of waste disposal, including the airborne pollutants and greenhouse gases that are generated via the combustion of fuel to fire the kiln.[135] Through anthropogenic climate change and other adverse effects, the emission of greenhouse gases and other air pollutants via such combustion of fuel imposes costs on society. However, without a taxation scheme or other regulatory device, the emitter will directly bear only a fraction of these costs. The overwhelming majority of the costs will be spread throughout society. Therefore, the cost to the cement plant of firing its kiln does not reflect the full costs to society. The plant can thus remain profitable while society suffers a net loss of welfare.[136]

The free market will not properly signal the externality cost of pollution on its own. It is necessary to introduce a correction in the form of regulation or taxation. Taxes can be assessed on the energy use or pollution created. The former functions similar to a use tax while the latter functions as a

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134 10 C.F.R. § 431.383; see also NEMA Summary and Analysis of the Energy Independence and Security Act of 2007. National Electronic Manufacturers Association (NEMA).

135 Cement plants generate other pollution, including other air pollutants which are a by-product of the cement manufacturing process itself; here we focus solely on the pollution generated through the plant's consumption of energy.

136 Richard L. Revez and Michael A. Livermore, Retaking Rationality: How Cost-Benefit Analysis can Better Protect the Environment and Our Health (2008.

penalty or fine for emitting pollution. In the industrial sector, an energy tax can be assessed as fuel is purchased, while a pollution tax will be assessed on measured or calculated emissions.

Most countries have some form of energy taxation such as on gasoline. However, some countries have started to use energy or carbon taxes to make energy-efficiency improvement more attractive, and to require polluters to pay for the societal costs of their emissions. Much of the earliest action implementing energy taxation policies to incentivize efficiency and emissions reductions occurred in the EU, which has had a directive in force since 2003 establishing certain minimum requirements for energy taxation in the EU.[137]

India has recently enacted a number of fuel pricing reforms to encourage energy efficiency. It began by removing price controls on diesel and gasoline which had amounted to an implicit subsidy. Then, as the global price of oil began to decline, it increased the excise duty on these fuels. Because this coincided with the oil market decline, major shocks to the economy were avoided. India estimates that these pricing reforms will result in a reduction of eleven million tons of CO_2 emissions in less than a year. At the same time, India doubled its tax on coal. This increase, however, is probably insufficient to send the correct price signal: the tax is the functional equivalent of a levy of $1.00 USD per ton of CO_2, increased from $0.50 USD per ton.[138]

Carbon taxation is but one of many means of correcting price signals to reduce greenhouse gas emissions. Other types of regulation may be better suited (or at least more politically feasible) to countries depending on their needs. China, the world's largest emitter of greenhouse gases, opted for a cap-and-trade program over carbon taxation, reflecting what some commentators viewed as a desire for more centralized control of energy policy.[139]

G. Mandatory Practices and Investments

To achieve environmental or economic goals, some countries require larger energy users to implement certain practices and install certain types of equipment. For example, every country in the European Union (EU) must comply with the Energy Efficiency Directive (EID) which requires energy audits and management plans for all large companies.[140] Other countries with mandatory programs include China, India, Indonesia and Turkey.

China: Top-10,000 Energy-Consuming Enterprises, implemented in the framework of the 12th Five-Year Plan: Within the framework of that program, the designated enterprises are required to appoint energy managers.

https://library.e.abb.com/public/1ec04ca97f31b433c1257be800535916/China.pdf.

India: In the framework of the Energy Conservation Act (2001), large industrial

137 European Union Council Directive 2003/96/EC of 27 October 2003 restructuring the community framework for the taxation of energy products and electricity. http://eur-lex.europa.edu/LexUriServ/LexUriServ.do?uri=CELEX-:32003L0096:en:HTML

138 Ministry of Finance, Government of India, Economic Survey 2014-15 at 122-28 (2015).

139 Mark L. Clifford, "China's Xi Jinping Announces Cap-and-Trade Carbon Program: Will it Work?" Forbes, http://www.forbes.com/sites/mclifford/2015/09/30/chinas-xi-jinping-announces-cap-and-trade-carbon-program-will-it-work/#3c-c919781b56 (Sep. 30, 2015).

140 IIP Network 2016. "Industrial Efficiency Database, United Kingdom, UK-4: Energy Efficiency Directive". http://iepd.iipnetwork.org/policy/energy-efficiency-directive-2

energy consumers in nine sectors have to implement energy audits, appoint certified energy managers and report energy consumption data. https://library.e.abb.com/public/478c519db9feeae1c1257be800545aee/India.pdf.

Indonesia: In 2009 the Government issued an Energy Efficiency Regulation (No. 70/2009) in which large energy consumers (i.e., consuming more than 6,000 toe of final energy) are obliged to conduct energy audits, designate an energy manager and implement energy conservation programs. https://library.e.abb.com/public/215e27d2819ee70bc1257be800547219/Indonesia.pdf.

Turkey: In the framework of the Energy Efficiency Law, industrial establishments consuming more than 1,000 toe are obliged to report their energy consumption to the EIE and have an energy manager designated to monitor energy efficiency. In September 2012, Turkey counted more than 4,500 certified energy managers. In addition, larger companies that consume over 50,000 toe must establish energy management units. https://library.e.abb.com/public/a2c92d1d4f7f2405c1257be9002c5060/Turkey.pdf

H. Markets for Energy Efficiency and Demand Response

In addition to encouraging energy efficiency through government policies and programs, countries in North America and Europe have created energy markets that treat energy efficiency as a tradeable commodity. To understand how energy efficiency can be treated as a resource, it is useful to understand how energy markets function and how utilities have leveraged demand response to meet system needs.

In countries with large interconnected electric grids, there are many more power plants that can supply power to the network than is often needed. To determine which plants supply power, trading markets are constructed that enable the bidding in of energy resources. Bids have a capacity value, which is measured in kilowatts (kW), and a time and duration. Together this yields a volume value measured in kilowatt-hours (kWh). The more economical a power plant is to operate, the lower the bid it is able to make. Because market operators (called Independent System Operators, or ISOs) will choose the lowest cost energy to meet system needs, usually on an hourly basis, overall system costs are minimized.

In the United States and Canada, there are several energy markets that allow the trading of energy resources within a defined region. These markets are aligned with the territories of regional transmission operators (RTOs). Markets are set up to meet immediate (real-time and day-ahead), near-term and long-term capacity and volumetric needs. Some regions have forward capacity markets to secure resources for many years in the future. These markets augment or replace regional planning efforts by encouraging near-term investments with guaranteed future revenue streams.

Demand response has become an integral component of the forward capacity markets in the Northeast and mid-Atlantic parts of the US. The premise of demand response is simple: there are times when it is less expensive for a grid operator to pay a customer to turn off load than to purchase power on the wholesale market. Although price signals are passed between wholesale electricity suppliers and wholesale customers in real-time, these signals do not reach retail customers until they are billed days or even weeks later.

Wholesale prices are often set by smaller power plants (peaking plants) that run during times when the system demand is at its highest. These peaking plants cost much more to operate per unit of electricity than base load plants that run most of the time. Therefore, the overall cost of providing electricity to the grid increases as demand rises during peak hours. To keep down short-term costs of energy supplies, many utilities will establish interruptible discounted rates with large customers. To keep down long-term costs, grid operators will allow the bidding of demand response resources into wholesale markets.

Utility companies have been using interruptible power supply contracts for decades. Under a normal power supply contract, the load is "firm"; that is, the utility must supply power to the load at all times. Under an interruptible contract, the utility retains the right to curtail supply to a customer a specified amount of time per year. In exchange, the customer pays less for its power. Load curtailments are usually scheduled a day ahead although they can be issued on much shorter notice during emergencies. Since such interruptions require direct intervention from the utility, interruptible power supply contracts are sometimes offered only to large industrial customers.

Smaller businesses can monetize the benefits to the utility system of demand response and investments in energy efficiency by working with third parties that aggregate the load reduction of large numbers of customers and bid it into forward capacity markets. An aggregator will make agreements with many consumers that give it the authority to sell their ability to curtail load as a demand response in a capacity market just as a peaking plant would sell its ability to satisfy peak load. Or it may bid the reduction in load that results over time from investments in energy efficiency. These resources off-set base load generation. Figure 2 (below) illustrates the cumulative effect of demand response and energy efficiency resources on the daily load profile of the grid. The value of these resources, realized when utilized by grid operators, is split between the aggregator and its customers. Revenues from market participation can help pay for the investments in the energy efficiency measures or on-site generation that enable the reduction in load or demand response.

An important feature of demand-response systems is that they can reduce pollution and save money by avoiding the necessity of purchasing and operating peaking power equipment, most often highly polluting diesel generators.

For its part, the grid and its associated markets do not care whether the load is balanced by an increase in generation or a decrease in consumption; a demand response resource and a generator are functionally equivalent in this context. Where this is achieved through a competitive bidding process, only the lowest-cost resources that can reliably serve the projected load are selected. Since energy efficiency is often the lowest cost resource, and since it is very reliable, markets that include such resources can stimulate greater investment in energy efficiency.

Utilities need not only balance their load in real-time, but also over periods of years. Between planning, procurement, regulatory approvals, and construction, it takes years—if not a decade or more—to build a new power plant. Therefore, utilities must also ensure that they will have sufficient capacity to serve their projected loads several years into the future.[141]

141 For example, in the New England ISO and PJM Interconnect service territories the Northeast and mid-Atlantic sections of United States, forward capacity is procured three years in advance of its expected in-service date. PJM Learning Centre: Capacity Market (RPM), http://learn.pjm.com/three-priorities/buying-and-selling-energy/capacity-markets.aspx; ISO New England: Forward Capacity Market, http://www.iso-ne.com/markets-operations/markets/forward-capacity-market.

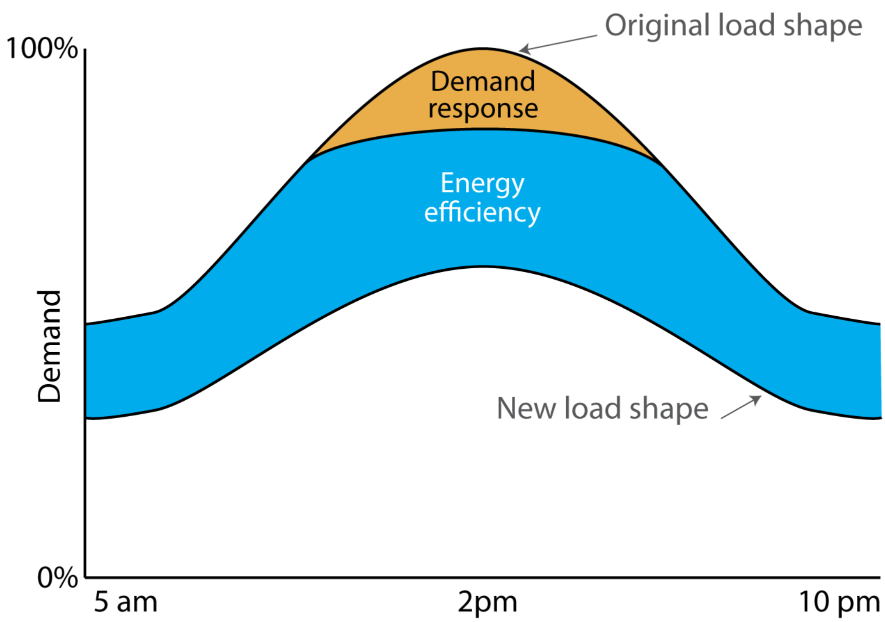

Figure 2, below, illustrates demand-response.

Figure 2. Effect of energy efficiency and demand response on daily demand curve. Source: Rogers et al. 2015.[142]

I. Programs to Encourage Energy Efficiency in Industry

While mandatory programs can achieve considerable energy savings, the diversity of industrial facilities and energy uses prevents a policy solution that can bring about the implementation of all viable energy efficiency projects. To augment mandatory efforts, many countries create financial and technical assistance programs to assist businesses to make investments that they are neither required by law to make nor likely to make on their own. Such programs can bring about considerable additional energy savings and economic benefits such as increased productivity and competitiveness.

J. Financial and Technical Assistance Programs

Most businesses, and especially manufacturing concerns, exist in very competitive markets. This puts considerable pressure on management to make only those investments that have the highest probability of success and positive return on investment. In North America, there are many programs that address this challenge by providing technical assistance to help businesses identify opportunities to save energy and then assist them in quantifying the benefits of an investment. These programs

142 Rogers, Carley, Deo and Grossberg. 2015. How Information and Communications Technologies will Change the Evaluation, Measurement, and Verification of Energy Efficiency Programs. Washington, DC: ACEEE

may also provide financial assistance to reduce the costs of the investment and thereby improve the potential return on investment. By reducing the risks and increasing the benefits of investments in energy efficiency, they facilitate the implementation of more projects and more investment.

Russia has enacted a law to promote sectoral energy efficiency programs (especially in the energy-intensive industries like steel, cement, paper or aluminium). The law also introduced incentives and tax benefits for heavy industry to replace inefficient equipment with energy-efficient machinery. Since January 2012, certain high energy efficiency facilities and technologies (in oil extraction and processing, iron ore production and paper production) are entitled to investment tax credits.[143]

Through the European Union Energy Efficiency Directive (EU EED) the European Commission provides incentives for the introduction of Energy Management Systems[144] for large companies. The EU Horizon 2020 funds support the research, demonstration and market up-take of energy efficient technologies. Funds are available to support energy efficient buildings, industries, heating and cooling equipment, and energy-related products and services, as well as for improving the attractiveness of energy efficiency investments.[145]

K. Cooperative Agreements

One type of program that aims to exceed mandatory requirements is referred to as voluntary or negotiated agreements. Voluntary agreements are essentially contracts between the government and a business that includes a commitment to action, a schedule, and an energy savings target. These agreements typically have a long-term outlook covering a period of five to ten years so that strategic energy-efficiency

Internationally, voluntary agreements have been shown to result in increased energy efficiency, with the more successful programs even doubling autonomous energy efficiency improvement rates. In addition, voluntary agreements have important longer-term impacts including changes of attitudes and awareness of managerial and technical staff regarding energy efficiency; addressing barriers to technology adoption and innovation; creating market transformation to establish greater potential for sustainable energy-efficiency investments; promoting positive dynamic interactions between different stakeholders involved in technology research and development, deployment, and market development; and facilitating cooperative arrangements that provide learning mechanisms within an industry.

The essential steps for reaching a voluntary agreement are the assessment of the energy-efficiency potential of the participants and the setting of targets. Participation by industries is motivated through the use of incentives and disincentives. Incentives such as facility audits, assessments, benchmarking, monitoring, information dissemination, and financial incentives all play an important role in assisting the participants in understanding and managing their energy use and greenhouse gas emissions. Some of the more successful voluntary agreement programs are based on the use of a mechanism to reduce disincentives such as environmental regulations or taxes for participants. Many of the more stringent agreements build on the general conditions for contracts under civic law.

143 https://library.e.abb.com/public/6ef634a1f5944b10c1257be80055b849/Russia.pdf.
144 Energy management systems such as ISO 50001, ANSI MSE 2000, and Strategic Energy Management establish a system that creates procedures for continuously monitoring energy use and improving efficiency.
145 https://ec.europa.eu/energy/en/topics/energy-efficiency/financing-energy-efficiency.

Netherlands: Long Term Agreement on Energy Efficiency 2001-2020

3.2 Long-term plans
Long-Term Energy Efficiency Plan (LTEP)

Article 3.6

1. A Trade Association or Product Board will submit a Long-Term Plan within 11 months of signing or later joining this Long-Term-Agreement or at any other time set in the LTA3 Platform upon a proposal of the EECG. In the exceptional event of the set term not being reached, a new planning will be adopted by mutual agreement between the Trade Association and the relevant ministry.

2. The Long-Term Plan must show that the total energy consumption of the Facilities governed by the Long-Term Plan is at least 1 PJ/year. That total energy consumption must consist for at least 80% of the energy consumption within the sector.

3. The Long-Term Plan includes the quantitative Energy Efficiency Improvement objective of the Enterprises affiliated to the Trade Association. That objective must amount to at least the weighted average of the Energy Efficiency objectives set forth in the Energy Efficiency Plans of the Relevant Facilities.

4. The Energy Efficiency objective referred to in paragraph 3 will be expressed in an Energy Efficiency Improvement ('EEI'). The calculation will be made pursuant to chapter 4 of Annexe LTA3. The reference year will be 1998.

5. The Long-Term Plan will include the quantitative and qualitative objectives for the implementation of Systematic Energy Management, the improvement of Process Efficiency, the Chain Efficiency and the Renewable Energy in accordance with the provisions of Articles 4.1 and 4.2.

6. The Long-Term Plan will give an overview of the manner in which the Trade Association or the Product Board intend to give substance to its obligations referred to in Article 2.2.

7. SenterNovem[1] will advise the Ministers on the Long-Term Plan, which will require the approval of the Minister relevant to the sector.

8. A Trade Association will update its Long-Term Plan not later than 1 June 2009 for the period 2009-2012, on 1 December 2012 for the period 2013-2016 and on 1 December 2016 for the period 2017-2020.

Full text available at: https://www.rvo.nl/sites/default/files/bijlagen/LTA3%20 convenanttekst%20-%2013%20juni%202008.pdf

1 SenterNovem is an agency within the Dutch Ministry of Economic Affairs that focuses on innovation in the areas of sustainability, energy efficiency and the environment.

The Netherlands Agreement program below is a good example.

A variety of government-provided incentives as well as penalties are associated with these programs. At least a dozen countries from around the world, as in Europe, Canada, the U.S., Australia, New Zealand, South Korea, and Taiwan, have established voluntary agreement programs to drive investments in energy efficiency and GHG reductions.[146] In 2003,

China initiated pilot voluntary agreements with two steel mills in Shandong Province. After the program was proven a success, it was vastly expanded to create a negotiated agreement framework targeting China's top 1000 energy-consuming enterprises, called the "Top-1000 Energy-Consuming Enterprises program". Despite the program's rapid development and implementation, it has caused reductions in energy consumption which can be measured in hundreds of thousands of gigawatt hours.[147]

Other Cooperative Agreements:

Japan[148]

AGREEMENTS: Voluntary agreements concerned more than 1,100 industrial companies, with different targets among subsectors.

INCENTIVES: Various financial and fiscal incentives have been put in place to encourage energy conservation and efficiency in industry. A tax incentive scheme provides a special depreciation rate of 30 percent of the acquisition cost for businesses investing in specified energy conservation and efficient equipment.

Canada[149]

AGREEMENTS: The program "ecoENERGY for Industry" is designed to improve industrial energy efficiency and decrease energy related industrial greenhouse gases.

INCENTIVES: This program also includes support a CHP/WHP incentive, support for energy audits; and support for companies in the implementation of the ISO 50001 norm or other energy management systems.

South Korea

https://library.e.abb.com/public/557d50223ed20a76c1257beb0044f3bc/South%20 Korea.pdf

AGREEMENTS: The Basic National Energy Plan 2008-2030 sets an energy use reduction target of nearly 17 Mtoe in industry by 2030. KEMCO promotes five-year voluntary agreements with

146 Lynn Price, Voluntary Agreements for Energy Efficiency or GHG Emissions Reduction in Industry: An Assessment of Programs Around the World, in 2005 ACEEE Summer Study on Energy Efficiency in Industry, 5-115 (2005).
147 Lynn Price et al., "The Challenge of Reducing Energy Consumption of the Top-1000 Largest Industrial Enterprises in China", Energy Policy, Volume 38: Issue 11, at 1-3, 22 (2010).
148 https://library.e.abb.com/public/11aa337e6a3d0e36c1257be80054aff1/Japan.pdf
149 https://library.e.abb.com/public/1c9d51f900ec29a5c1257be800533b5e/Canada.pdf

industrial groups;

INCENTIVES: businesses that enter into voluntary agreements or invest in energy-saving technologies are entitled to financial and technical support and tax credits covering up to 20 percent of the investment cost.

Italy

https://library.e.abb.com/public/25e989a42ad4c799c1257be800549d00/Italy.pdf
AGREEMENTS: Italy has adopted a National Energy Efficiency Action Plan 2008-2016 (NEEAP), which sets an energy savings target of about 10 percent in 2016, i.e., 126.3 TWh (10.9 Mtoe) in buildings, transport and small industries. The industrial sector must achieve 8 percent of that target.

INCENTIVES: Incentives were defined for high efficiency motors and inverters, mechanical vapour compression and, more broadly, for high-efficiency cogeneration. Voluntary agreement programs can be roughly divided into three broad categories: 1) programs that are completely voluntary, 2) programs that use the threat of future regulations or energy/greenhouse gas emissions taxes as a motivation for participation, and 3) programs that are implemented in conjunction with an existing energy/greenhouse gas emissions tax policy or with strict regulations. Overall, international experience shows that voluntary agreements are an innovative and effective means to motivate industry to improve energy efficiency and reduce related emissions, if implemented within a comprehensive and transparent framework.

L. Developing Skilled Personnel

In many industrial firms, there is a shortage of technical personnel who have the ability to identify energy efficiency opportunities, the knowledge of how to justify the investments, or the skills to implement projects. This is especially true for small and medium sized enterprises (SMEs). A literature survey and analysis by the prestigious American Council for an Energy Efficient Economy (ACEEE) in 2014 found that the availability of personnel is seen as a barrier to investing in energy-efficient equipment by many SMEs.[150]

The U.S. Department of Energy Sun Shot Initiative has launched an interesting “Solar Ready Veterans” program that trains military personnel leaving military service for a career in solar energy.[151]

In developing countries there is hardly any knowledge infrastructure available that is easily accessible for SMEs. Such knowledge is important because SMEs are often a large part of the economy in developing countries. Information and monitoring programs are often established to help remove information barriers to implement energy efficiency technologies or measures. Training programs range between completely voluntary to mandatory. Voluntary programs include informational dissemination, best practices workshops, and educational curricula at universities and trade schools.

150 Trombley, Daniel. 2014. One Small Step for Energy Efficiency: Targeting Small and Medium-Sized Manufacturers. Washington, DC: ACEEE. http://aceee.org/research-report/ie1401.

151 http://energy.gov/eere/sunshot/solar-ready-vets.

South Korea: Energy Use Rationalization Act[1]

Chapter III. Rationalization of Energy Utilization

* * *

Article 24 (Energy Management Standards, etc.)

(1) The Minister of Trade, Industry and Energy may determine and announce publicly by section the standards necessary for an efficient management of the energy by the energy users (hereinafter referred to as “energy management standards”), after consulting with the head of the administrative agency concerned.

(2) If it is deemed necessary to investigate on the energy management situation of the energy users, the Minister of Trade, Industry and Energy may conduct the investigation, and if it is found out as a result of the investigation, that any energy user fails to observe the energy management standards, he may give the person any guidance for implementation of the energy management standards (hereinafter referred to as “energy management guidance”).

Article 25 (Designation, etc. of Those Subject to Energy Management)

(1) Any energy user whose energy quantity consumed is over such standard quantity as determined by the Presidential Decree, shall report the following matters to the Minister of Trade, Industry and Energy, not later than January 31 each year, under the conditions as prescribed by the Ordinance of the Ministry of Trade, Industry and Energy:

1. Quantity of the energy consumed and the products manufactured in the previous year;
2. Estimated quantity of the energy to be consumed and the products to be manufactured in the current year;
3. Present situation of the energy using machinery and materials; and
4. Actual result of the rationalization of energy utilization in the previous year, and the program in the current year.

(2) The Minister of Trade, Industry and Energy shall designate as the person subject to the energy management, a person of those energy users subject to the report as referred to in paragraph (1), who uses the energy over such specified quantity as determined by the Presidential Decree (hereinafter referred to as “designated quantity”).

Article 26 (Record of Use, etc. of Energy)

Any person who is designated as person subject to energy management under Article 25 (2) (hereinafter referred to as “designated person subject to energy management”), shall keep a book at the energy using facilities, and prepare and preserve the record on the quantity of energy consumed, and the installation, opening, closure, etc. of facilities consuming the energy, under the conditions as prescribed by the Ordinance of the Ministry of Trade, Industry and Energy.

1 http://elaw.klri.re.kr/eng_service/lawView.do?hseq=5884&lang=ENG.

Article 27 (Revocation of Designation of Person Subject to Energy Management)

(1) If the estimated quantity of energy to be consumed as prescribed in Article 25 (1) 2 is less than the designated quantity, the designated person subject to energy management may apply for a revocation of the designation to the Minister of Trade, Industry and Energy, under the conditions as prescribed by the Ordinance of the Ministry of Trade, Industry and Energy.

(2) If the application for revocation of designation as referred to in paragraph (1) is deemed well-grounded, the Minister of Trade, Industry and Energy shall revoke without delay the designation.

(3) Even though there is no application for revocation of designation as referred to in paragraph (1), the Minister of Trade, Industry and Energy shall revoke the designation against the designated person subject to energy management, who is deemed to hold no longer any cause of designation.

Article 28 (Appointment of Energy Manager)

(1) The designated person subject to energy management shall appoint an energy manager to manage efficiently the energy, under the conditions as prescribed by the Presidential Decree.

(2) If the designated person subject to energy management appoints or dismisses an energy manager, or if the energy manager retires from office, he shall report it to the Minister of Trade, Industry and Energy, under the conditions as prescribed by the Ordinance of the Ministry of Trade, Industry and Energy.

Article 29 (Duty of Energy Manager, etc.)

(1) For the purpose of an efficient energy management, the energy manager shall discharge faithfully the affairs concerning the management of energy in conformity with the energy management standards.

(2) The designated person subject to energy management and his employees shall respect any opinion or instruction of the energy manager on the management of energy.

Various countries have experience with energy manager programs, including Korea, Japan, Thailand, Finland and Portugal, as well as Denmark and Italy. In some European countries it is compulsory for companies to have a dedicated energy manager onsite when a plant's energy use would exceed a certain amount of energy use per year.[152]

The rapid pace of development of clean energy and energy efficiency technologies can lead to a shortage of appropriate personnel on the labour market, even in developed countries. To address such shortages, countries can take affirmative steps to increase the availability of post-secondary education in science, engineering, and related fields.

152 See Energy Managers are Required Like Never Before, http://www.ihk-eforen.de/download/attachments/43253868/EUREM.NET_press-release_june_2008.pdf?version=1&modificationDate=1322226432000&api=v2 (Jun. 2008); EUREM Information Brochure, http://www.ihk-eforen.de/download/attachments/43253868/EUREM_folder-en_web.pdf?version=1&modificationDate=1350909163000&api=v2.

For example, in 2013, the United States Department of Energy released its "Energy 101 Framework", a prototype curriculum for a semester-long introductory course in energy aimed at American college freshmen.[153] The course is designed both to promote energy literacy and to entice college students to consider selecting courses of study related to the energy field, so that more skilled personnel are available to fulfil the need in the decades to come.

Additionally, in 2009 the U.S. launched the "Educate to Innovate" campaign which, among other things, aimed to provide an additional 100,000 skilled teachers in the fields of science, technology, engineering, and math ("STEM").[154] The following year, it was expanded with the announcement of several public-private partnerships to promote STEM education by, among other things, adding 10,000 more STEM teachers to the original goal of 100,000.[155]

To provide existing workers in industry with needed skills and knowledge, three federal agencies have created informational, educational and skills training programs. The U.S. Department of Energy created series of industrial energy efficiency best practices workshops along with a credentialing system for instructors. The Department of Commerce created a program that funds Manufacturing Extension Partnership Centres (MEP Centres) in each state to provide continuous improvement training and technical assistance to small and medium size manufacturers. Many of these centres also include energy efficiency and sustainable manufacturing in their training services. The Department of Labour has funded several workforce training programs that provide skills training in energy efficiency, renewable energy, and safety and environmental compliance. Most of these initiatives are secured through competitive solicitations and provided by educational institutions and private sector vendors.[156]

In Thailand, the Thai Energy Conservation Promotion Act was passed to boost the efficacy of its environmental and efficiency laws. Within this law are requirements (sections 11 and 12) for companies to hire full-time energy specialists who are to set targets, initiate audits, and keep records.

153 U.S. Department of Energy (DOE). Environmental and Energy Study Institute, "Energy 101", http://energy.gov/eere/education/energy-101, and http://www.eesi.org/files/Energy-101-Course-Framework-Summary.pdf

154 The White House, "Educate to Innovate", https://www.whitehouse.gov/issues/education/k-12/educate-innovate (Apr. 2013).

155 The White House, "President Obama Expands 'Educate to Innovate' Campaign for Excellence in Science, Technology, Engineering, and Mathematics (STEM) Education", https://www.whitehouse.gov/the-press-office/president-obama-expands-educate-innovate-campaign-excellence-science-technology-eng (Jan. 6, 2010).

156 U.S. Department of Energy. 2016. "Industrial Assessment Centres". http://energy.gov/eere/amo/industrial-assessment-centers-iacs; NIST 2016. "NIST Hollings Manufacturing Extension Partnership". http://www.nist.gov/mep/; U.S. Department of Labour, "Employment and Training Administration". https://www.doleta.gov/grants/.

Thailand: The Energy Conservation Promotion Act B.E. 2535

Division 1 Energy conservation in factories

Section 7 Energy conservation in factories means one of the following measures:

(1) Improvement in combustion efficiency of fuels;
(2) Prevention of energy loss;
(3) Recycling of energy wastes;
(4) Substitution of one type of energy by another type;
(5) More efficient use of electricity through improvements in power factors, reduction of maximum power demand during the period of the electricity system's peak demand, use of appropriate equipments, and through other approaches;
(6) The use of energy-efficient machinery or equipment as well as the use of operation control systems and materials that contribute to energy conservation; and
(7) Other means of energy conservation as stipulated in the Ministerial Regulations.

Section 9 The owner of the designated factory must conserve energy, audit and analyze energy utilization in his factory, in accordance with the standard, criteria, and procedures as provided by the Ministerial Regulations issued by the Minister under the recommendation of the National Energy Policy Council.

Section 11 In addition to provisions in Section 10, the owner of a designated factory shall have the following duties:

(1) Assign at least one person to take a full-time position at the designated factory to take full responsibility with regard to energy programs. Such person shall have the qualifications as prescribed under Section 13;
(2) Submit information on energy production, consumption, and conservation to the Energy Development and Promotion Department, according to forms and schedule prescribed in the Ministerial Regulations;
(3) Keep records of information on energy consumption and installation or modification of machinery or equipment that affects energy consumption and conservation, in compliance with the criteria and procedures prescribed in the Ministerial Regulations;
(4) Set targets and plans for energy conservation of the designated factory and submit to the Energy Development and Promotion Department, in compliance with the criteria, procedures, and schedule prescribed in the Ministerial Regulations and;
(5) Audit and analyze operations to achieve such targets and plans for energy conservation, in compliance with the criteria, procedures and schedule prescribed in the Ministerial Regulations.

Section 12 The owner of the designated factory shall arrange to have personnel responsible for energy and report to the Director General within one hundred and eighty days after the decrees prescribing designated factories under Section 8 come into effect in the case that such factory has been classified as a designated factory before the date the decrees under Section 8 come into effect, (180 days) after such factory becomes a designated factory in the case of being a designated factory on or after the date the decrees under Section 8 take effect.

Text available at: http://www.eppo.go.th/admin/cab/law/2-E.html

M. Policies and Programs to Encourage Cogeneration

Combined heat and power (CHP) systems, also known as cogeneration, generate electricity and useful thermal energy in a single, integrated system. CHP is not a technology, but an approach to applying technologies. Heat that is normally wasted in conventional power generation is recovered as useful energy, which avoids the losses that would otherwise be incurred from separate generation of heat and power. And waste heat from manufacturing processes can be used to generate electricity. Either way, this results in improved overall fuel economy and reduced emissions.

As depicted in Figure 3, the conventional method of producing usable heat and power separately has a typical combined efficiency of 45 percent, CHP systems can operate at efficiencies of 60 - 80 percent or higher. These improvements can be translated directly into emission reductions of greenhouse gases (GHG) and other air pollutants. Fuel savings can also be translated into financial savings for owners and operators of facilities that use CHP. Because of these characteristics, CHP is an important consideration when developing policies and programs to encourage energy efficiency.

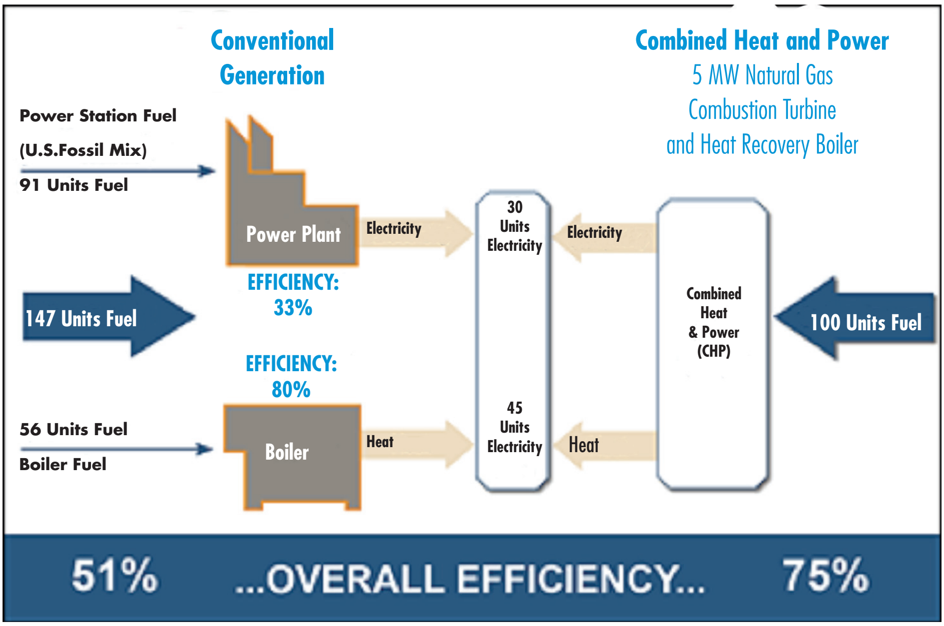

Figure 3 Efficiency of Combined Heat and Power, Source: US EPA.

CHP policies and programs come in a variety of shapes and sizes. Efforts as simple as sharing information and promoting best practices can play an important role in encouraging CHP deployment. Countries may also use more complex policy mechanisms such as long-term agreements, financial assistance, and economic incentives to eliminate barriers and enable greater CHP deployment. Such enabling policies may be designed to help countries achieve national goals or they may support regulatory mandates that effectively require CHP deployment. This section will discuss three key types of policies.

Information sharing and best practices

- *Capacity building and technical assistance* is often accomplished through information sharing, outreach, education efforts and engineering and feasibility studies.

Enabling policies and measures

- *Interconnection standards* and procedures provide straightforward and streamlined procedures for connecting to the transmission and distribution network.
- *Financial assistance* such as feed-in tariffs and power purchase agreements can provide price certainty and help finance CHP systems. Other programs that offer incentives, rebates, grants, and loans also help eliminate financial barriers and help countries meet policy goals.
- *Utility rate structures* for accessing utility services including backup, standby, and supplemental power requirements should be fair and equitable.
- *Environmental policies* can include simplified procedures for air permitting for qualified systems and output-based emissions standards can encourage CHP deployment and more fairly calculate CHP's efficiency benefits.

Mandatory regulations

- *Clean energy standards* can allow CHP to qualify as an eligible measure for meeting standards such as energy savings mandates, emissions reduction targets, or utility supply obligations, creating a guaranteed market for CHP.
- *Planning requirements* can require the consideration of CHP when building or upgrading certain types of facilities and in community energy resource planning.

Most countries supporting CHP employ a mix that includes more than one of these measures. The ability to encourage CHP is largely dependent on a country's specific political and regulatory environment and the broader energy market, as evidenced by experiences in many countries. To date most examples of successful CHP policy initiatives are from the OECD countries. The following section highlights the approaches taken by a selection of countries in Europe, Asian and North America where different combinations of policy strategies achieved good results.

N. Information Sharing and Best Practices

The government of Germany has established a national target to achieve 25% of total electricity production from CHP plants by 2020 (2009 CHP Law).[157] This target is supported by The Combined Heat and Power Act (Kraft-Wärme-Kopplungs-Gesetz — KWKG[158]), which is the key incentive program in Germany for extending the use of CHP. In the U.S. a target was set at the national level in 2012 by an executive order that set a national goal of 40 gigawatts of new CHP capacity by 2020.[159]

In the U.S., the Department of Energy has research and development and deployment provisions in various programs and national laboratories,[160] and it funds six regional CHP Technical Assistance Partnerships that educate public and private sector stakeholders and provide technical assistance.[161] Another federal agency, the US Environmental Protection Agency, established its CHP Partnership in 2001 and promotes the use of CHP to reduce air pollution and water usage.[162] Several States also have efforts to promote CHP. Described later in this section, New York State has a robust program to promote CHP best practices.

In 2012, Japan's Energy and Environment Council defined a CHP roadmap that aims to more than double existing industrial and commercial CHP capacity to 22 GW in 2030.[163]

O. Enabling Policies and Measures

There are many policies that promote CHP access to the electricity grid and to receive or provide power economically. Some of these are technical such as standardized protocols for connecting to the grid. Others are economic such as charges for connection or high tariffs to provide standby power.

Successful interconnection laws and regulations will create standards that make the connection process for distributed generation systems such as CHP transparent and straight forward and will require that any fees related to interconnection are commensurate with the generator size. They also set out the technical requirements for connection to the grid network and participation in its operation.

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157 Institute for Industrial Productivity (IIP), Industrial Efficiency Database, Germany, "GE-5: CHP Law". http://iepd.iipnetwork.org/policy/chp-law-kraft-w%C3%A4rme-kopplungsgesetz

158 Germany Federal Agency for Energy Efficiency 2014. 3rd National Energy Efficiency Action Plan (NEEAP) 2014 for the Federal Republic of Germany. https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_germany.pdf

159 Executive Order 13624 of September 5, 2012, Accelerating Investment in Industrial Energy Efficiency. Federal Register 77 (172): 54779–54781. http://www.gpo.gov/fdsys/pkg/FR-2012-09-05/pdf/2012-22030.pdf

160 The Pace Energy & Climate Center is, and has been for the past twelve years, a representative in the U.S. Department of Energy funded "CHP TAP" Program. The CHP TAP works throughout the US Northeast region to provide information and training, technical assessment, and other support to the CHP sector and potential users. See: http://energy.gov/eere/amo/chp-technical-assistance-partnerships-chp-taps.

161 DOE (US Department of Energy). 2015. "CHP Technical Assistance Partnerships." http://energy.gov/eere/amo/chp-technical-assistance-partnerships-chp-taps. Pace Law School is designated as the Northeast Regional CHP office.

162 EPA (US Environmental Protection Agency). 2015. "EPA CHP Partnership." https://www.epa.gov/chp.

163 IEA (International Energy Agency). 2013. CHP/DHC Country Scorecard: Japan. https://www.iea.org/publications/insights/insightpublications/IEAJapanScorecardMASTERFINALdraft_060913_AF.pdf

In the US, the EPAct 2005 urges all states to implement interconnection standards for CHP.[164] The UK, Netherlands, and Germany have implemented a "fit and inform" process for grid connection of micro-CHP installations.[165] This means that there is no cost for connection. In the Netherlands, the Dutch Net Code in the 1990s simplified connection rules and set out a requirement for the utilities to develop new code connection requirements.[166]

A second type of enabling policy is one that makes CHP more attractive to investors and grid operators. This is usually accomplished in the form of an economic incentive. Financial assistance can come in many forms include grants, loans, utility rate tariffs, tax incentives, and rules for market treatment of CHP.

In Germany, the energy production from CHP plants is supported by The Combined Heat and Power Act (Kraft-Wärme-Kopplungs-Gesetz- KWKG),[167] which created a program to provide incentives for the ongoing operation and modernization of existing CHP units. It allows CHP operators feeding electricity into the public transmission network to receive bonus payments on top of normal revenue at market price.[168] A federal tax exemption is also available to CHP facilities.

In India, some of the State Electricity Regulatory Commissions (SERCs) provide incentives in the form of fixed feed-in tariffs for biomass-based CHP projects, which vary by state.

In Japan, CHP deployment has increased over the past two decades and government support in the form of subsidies, grants and low-interest loans has been a main driver of this growth. Japan also revised its Electric Power Act to enable owners of large CHP plants to sell/export electricity back to the grid. In a capacity building effort. the Ministry of Economy, Trade, and Industry (METI) also identified barriers to CHP deployment and has established an office focused on promoting CHP in Japan.[169]

Utility rate structures such as feed-in tariffs can support CHP. So too can rules for grid operation that give CHP generators priority in the dispatch order. Such a rule can be part of an overall portfolio of environmental policies that encourage CHP.

Another type of policy that gives CHP preferential treatment is one that treats CHP as a clean form of energy. This is a reasonable approach since CHP produces much more energy for a given amount of fuel, saving associated pollution. Environmental policies that encourage CHP can include simplified procedures for air permitting for qualified systems' and output-based emissions standards can encourage CHP deployment and more fairly calculate CHP's efficiency benefits.

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164 Energy Policy Act of 2005. 2005. 42 U.S.C. § 15801, http://energy.gov/sites/prod/files/2013/10/f3/epact_2005.pdf; and Chittum, A. and N. Kaufman. 2011. Challenges Facing Combined Heat and Power Today: A State-by-State Assessment. Washington, DC: ACEEE. http://aceee.org/sites/default/files/publications/researchreports/ie111.pdf

165 IEA 2009. "Cogeneration and District Energy." International Energy Agency, Paris France: https://www.iea.org/publications/freepublications/publication/CHPbrochure09.pdf

166 IEA 2009. "Cogeneration and District Energy." International Energy Agency, Paris France: https://www.iea.org/publications/freepublications/publication/CHPbrochure09.pdf

167 Germany Federal Agency for Energy Efficiency 2014. 3rd National Energy Efficiency Action Plan (NEEAP) 2014 for the Federal Republic of Germany. https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_germany.pdf

168 IEA 2016. Policies and Measures, Energy Efficiency, Germany. http://www.iea.org/policiesandmeasures/pams/germany/

169 Araceli Fernandez Pales 2013. The IEA CHP and DHC Collaborative. CHP/DHC Country Scorecard: Japan. Paris, France: OECD/IEA. https://www.iea.org/publications/insights/insightpublications/IEAJapanScorecardMASTERFINALdraft_060913_AF.pdf

Under the UK's Environmental Permitting Regulations, CHP is considered a "Best Available Technique" and permit applicants are required to consider CHP when seeking an air permit to operate a power plant or industrial facility. A range of other financial incentives are available, including the CHP Quality Assurance Program, which ensures that "good quality" CHP plants receive preferential treatment when accessing these incentives. These include exemptions from several fees including, those associated with emissions from heat; through the UK's Carbon Price Support rates; exemption from the Climate Change Levy; exemption from purchasing allowances under the CRC Energy Efficiency Scheme; eligibility for 100% tax relief through Energy Capital Allowances; and eligibility for enhanced Renewables Obligation certificates for biomass CHP.[170]

Since CHP can be powered by many different types of biomass and biofuels, it can also be part of a nation's efforts to use more renewable energy. For example India is focused on bagasse and biomass-fuelled CHP. The Ministry of New and Renewable Energy (MNRE), which is responsible for defining policy and providing support for renewable energy in industrial and commercial applications, has offered support for both bagasse-based and biomass (non-bagasse) CHP since the mid-1990s.[171] The Biomass Power and Cogeneration Programme of 2005 provides a variety of financial incentives to biomass CHP projects, including 80% accelerated depreciation on certain equipment, concessional import and excise duties, and 10-year tax exemptions.

Similarly, for bagasse-based CHP projects, the federal government provides capital subsidies for CHP systems in the private sector or in sugar mill cooperatives through the Central Financial Assistance (CFA). Another government financial institution, the Indian Renewable Energy Development Agency (IREDA), also provides loans for both biomass and non-biomass CHP projects. Policies to promote CHP using conventional fuels or to encourage CHP in other industrial sectors are limited in India.[172]

P. Mandatory Regulation

The promotion of CHP in the European Union is addressed by the 2012 EU Energy Efficiency Directive (EED) (2012/27/EU). Article 14 of the EED requires each EU country to study the national potential for cogeneration and district heating and cooling and to analyse its costs and benefits by December 2015. It also requires countries to take measures to ensure cost-effective CHP is developed. Each member state is free to interpret and implement Article 14 as it chooses.[173] Several countries within the EU have implemented policies and programs that are additional to the requirements of the new EED.

Allowing CHP to qualify as an eligible measure for meeting standards such as energy savings

170 U.K. Department of Energy & Climate Change (DECC). 2014. UK National Energy Efficiency Action Plan. London: DECC. https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_united-kingdom.pdf, and Cogeneration Observatory and Dissemination Europe (CODE2) 2014. "D5.1-Final Cogeneration Roadmap Member State: United Kingdom. July 2014. http://www.code2-project.eu/wp-content/uploads/CODE2-Roadmap-UK.pdf .

171

172 India 2016. "Biomass Power/Cogen." Government of India, Ministry of New and Renewable Energy. http://mnre.gov.in/schemes/grid-connected/biomass-powercogen/; Fernandez Pales, A. and K. West. 2013. The IEA CHP and DHC Collaborative. CHP/DHC Country Scorecard: India. Paris, France: OECD/IEA. https://www.iea.org/publications/insights/insightpublications/IEA_CHP_IndiaScorecard.pdf

173 EUR-Lex 2016. "Access to European Law". http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52013SC0449; and European Parliament 2012. "Directive 2012/27/EU of the European Parliament and of the Council of 25, October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC". http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:EN:PDF

mandates, emissions reduction targets, or utility supply obligations creates a guaranteed market for CHP.

Utilities can also be required to purchase the energy production from CHP generators. This provides long-term stability for the generators and ensures that the grid is supplied with less polluting generation.

In Belgium, the government has implemented a Utility Supply Obligation (USO) that supports CHP plants with certificates based on CO2 savings rather than on electricity output.[174] Another type of policy is to mandate that CHP be considered when building new energy-intensive factories or buildings. Local energy and heat planning can help CHP by creating stable heat and cooling loads through district heating networks. In Germany, certain industries are required to consider CHP for their facility designs.[175] A similar requirement exists for certain states in the US, such as Texas where CHP must be considered for large government buildings.[176]

P. Developing a Comprehensive Approach to Supporting CHP

The Netherlands has a strong history of legislative and policy mechanisms for the promotion of CHP, perhaps more so than any other nation. The Netherlands achieved dramatic success over the past several decades through direct policy intervention on the basis of an informal CHP strategy. The Dutch Net Code in the 1990s simplified connection rules, ensuring transparency and fairness in the connection process.[177] The government sets out the requirements and the utilities develop the code, which increased the success of the initiative.

The Dutch CHP Agency also provides capacity building and technical assistance to support CHP installations. A regulatory intervention called SDE (Stimulering Duurzame Energie) was authorized in 2007 to stimulate production of CHP and this law used a modified feed-in tariff structure to incentivize CHP. While this policy was restructured in 2012 and more comprehensive support for CHP has been withdrawn, it was effective in its promotion of CHP[178]. Today, investments in CHP are currently supported by an Energy Investment Allowance and tax exemption. Bioenergy CHP receives a feed-in-premium and residential micro CHP is uniquely supported by a subsidy in the province of Gelderland.[179]

Some measures to promote CHP exist at the national level. In the United States, In addition to the national goal and programs previously mentioned, the US has a federal business energy investment tax credit (ITC).[180] It has also incentivized CHP systems by offering a credit for 10% of CHP project

174 IEA 2009. Cogeneration and District Energy. International Energy Agency, Paris France: https://www.iea.org/publications/freepublications/publication/CHPbrochure09.pdf
175 3rd National Energy Efficiency Action Plan (NEEAP) 2014 for the Federal Republic of Germany. https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_germany.pdf
176 ACEEE 2016. "State and Local Policy Database". http://database.aceee.org/state/texas#sthash.Ox9ytwFU.dpuf
177 IEA 2009. Cogeneration and District Energy. International Energy Agency, Paris France
178 IEA 2016. "Policies and Measures, The Netherlands." http://www.iea.org/policiesandmeasures/pams/netherlands/name-24872-en.php; COGEN Europe 2013. European Cogeneration Review – The Netherlands. Brussels, Belgium: COGEN Europe; http://www.cogeneurope.eu/medialibrary/2013/03/11/f436f0a5/Netherlands_ECR_preview.pdf
179 National Enterprising Netherlands. "Energy Investment Allowance (EIA). 2016. http://www.rvo.nl/subsidies-regelingen/energie-investeringsaftrek-eia;
CODE2 2014. D5.1-Final Cogeneration Roadmap: The Netherlands. http://www.code2-project.eu/wp-content/uploads/CODE2-CHP-Roadmap-Netherlands1.pdf
180 U.S. Environmental Protection Agency (EPA), Combined Heat and Power Partnership. "Business Energy Investment Tax Credit." Last Updated April 3, 2015. Accessed April 6, 2015. http://www.epa.gov/chp/policies/incentives/ubusinessenergyinvestmenttaxcredititc.html

costs, but this tax credit is set to expire December 31, 2016. The 40 GW goal is considered a very ambitious target and is a strategy that has resulted in increased awareness of CHP and built momentum at the state and federal level among regulatory agencies to implement new CHP initiatives.

While activity at the national level has been somewhat limited in the U.S., states have developed innovative approaches to encourage energy savings and emissions reductions from CHP. Twenty-two U.S. states recognize CHP in one form or another as part of an energy savings target or clean energy standard. Twenty-six states offer some form of financial incentive, rebate, or grant program to encourage CHP deployment.[181]

The following describes state-level approaches to encourage CHP, primarily by establishing clean energy standards and providing financial support and other incentives for CHP.

New York: The New York State Energy Research and Development Authority (NYSERDA) launched one of the first CHP programs in the country—the DG-CHP Demonstration Program—in 2001. NYSERDA used a competitive review process to select and fund demonstration projects that would provide the best lessons for deploying CHP throughout the market. The demonstrate program ended in 2012 and the state currently runs two incentive programs: the CHP Performance Program for customized, larger systems (greater than 1.3 MW) and the CHP Acceleration Program for smaller, pre-engineered systems (less than 1.3 MW). Both programs prioritize increasing the resiliency of buildings and infrastructure in the state and require systems to be able to operate during grid outages.

California: Two state policies set targets for CHP deployment in California. One is Assembly Bill 32, the California Global Warming Solutions Act of 2006, which includes a reduction target of 6.7 million metric tons of CO2 to be achieved specifically from CHP resources. The second is the Governor's Clean Energy Jobs Program, which calls for the addition of 6,500 MW of CHP by 2030.[182] Several mechanisms help meet these goals in California. The California Public Utility Commission's (CPUC) Self-Generation Incentive Program (SGIP), which is one of the longest-running distributed generation incentive programs in the country, offers a rebate of $0.48/watt for CHP technologies.[183] California is also the only state where CHP systems have access to a feed-in tariff (FIT), which establishes a price and approved standard-offer contracts for the purchase of excess electricity from eligible CHP generators.[184]

Massachusetts: A variety of policies encourage CHP deployment in Massachusetts, including two CHP incentive programs – one administered by Massachusetts's electric and gas utilities and one administered by the state energy office. The utility-administered program was launched in 2010 and provides incentives per kW depending on system size and level of efficiency.[185] An emphasis on right-sizing the CHP system to ensure optimal performance is one of the program's most innovative

181 Young, R., S. Hayes, M. Kelly, S. Vaidyanathan, S. Kwatra, R. Cluett, G. Herndon. 2014. 2014 International Energy Efficiency Scorecard. Washington, DC: ACEEE.
182 CEC (California Energy Commission). 2015. "Combined Heat and Power." http://www.energy.ca.gov/chp/.
183 DSIRE (Database of State Incentives for Renewable Energy). 2015. "Self Generation Incentive Program." (http://programs.dsireusa.org/system/program/detail/552
184 CPUC (California Public Utilities Commission). 2016. "CHP Feed-In Tariff." http://www.cpuc.ca.gov/General.aspx?id=5293.
185 MassSave. "Combined Heat and Power." http://www.masssave.com/business/eligible-equipment/combined-heat-and-power

aspects. CHP systems can also earn a performance incentive (per kWh) through another program in the state, the Alternative Portfolio Standard (APS).[186] One of the main innovations of this program design is its use of a clearly defined methodology for quantifying energy savings from CHP. The combination of these two programs significantly improves the economics of installing CHP and energy savings through the program are expected to increase in future years.

By virtue of its efficiency and environmental benefits, CHP is supported by many governments. Policies at a minimum can enable distributed generation technologies like CHP and renewable energy to participate with other sources of energy by creating transparent and standardized interconnection protocols. Greater investment can be facilitated with financial assistance programs and policies that recognize its economic and environmental benefits.[187]

III. CONCLUSIONS

Energy uses in industry and commerce vary widely, and so do the characteristics of the energy users and stakeholders. Hence, there is no single right way of promoting energy efficiency improvement via legislative measures. Rather, legislators considering the most effective ways of fostering energy efficiency improvement should look at a cross section of legal precedents, such as those presented in this chapter. Selecting elements from many existing or historical laws may be the best way of developing legal incentives for a particular jurisdiction. Effective approaches consider the characteristics of the stakeholders and the barriers they face in making greater investments in energy efficiency and cogeneration in the design of legal instruments.

In practice, this means that a combination of legislation that "pushes" the market towards more efficiency (e.g. minimum energy efficiency standards, taxes, and regulation) and ones that "pulls" the top-end of the market towards increased efficiency (e.g. financial incentives, voluntary agreements, and creation of energy efficiency markets) and use of cogeneration.

Furthermore, policy and legislative approaches can innovate with the changing dynamics of industrial and commercial energy use to remain effective. Energy and energy efficiency technologies are evolving at a rapid rate and policies and programs that are effective today may not be so in ten years. Therefore flexibility and long-term goals have advantages over prescriptive and short-term solutions. With a portfolio and long-term approach, countries can maximize the efficiency of their industrial and commercial sectors while also facilitating greater economic growth.

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186 DSIRE (Database of State Incentives for Renewable Energy). 2015. "Alternative Energy Portfolio Standard." http://programs.dsireusa.org/system/program/detail/4624

187 York, D., S. Nadel, E. Rogers, R. Cluett, S. Kwatra, H. Sachs, J. Amann, and M. Kelly. 2015. New Horizons for Energy Efficiency: Major Opportunities to Reach Higher Electricity Savings by 2030. Washington, DC: American Council for an Energy-Efficient Economy. http://aceee.org/research-report/u1507.

CHAPTER 4C
Appliance Efficiency

David R. Hodas*

1. INTRODUCTION

The need for electricity in developing countries is enormous, and so is the cost to build traditional electricity generation facilities and their associated infrastructure. The International Energy Agency (IEA) estimates that "1.2 billion people – 17% of the global population – remain without electricity, and 2.7 billion people – 38% of the global population – put their health at risk through reliance on the traditional use of solid biomass for cooking.[188]"

The IEA also estimates that the energy sector's capital needs from 2015 to 2040 will be $68 trillion, of which $19.7 trillion will be invested in the power sector and $21.8 will be invested in end use efficiency.[189] Most of the money will be invested in developed and rapidly developing nations such as China.[190] Given this capital squeeze, particularly in the least developed nations, rational, efficient use of electricity is essential to control electricity demand, reduce greenhouse gas emissions, provide the poor access to electricity and modern energy, and to make most efficient use of resources and capital. Although access to modern energy "plays a strong role in poverty eradication, reducing infant mortality, improving education, ameliorating gender inequality, attaining environmental sustainability, and accelerating global economic growth and prosperity,"[191] energy efficiency has the potential to fundamentally reshape and accelerate global efforts to deliver modern energy services to the world's 4 billion poorest people.[192]

One of the significant uses of electricity is the powering of appliances, equipment and lighting in residential and commercial buildings. Lighting,[193] refrigerators, computers, clothes washers and dryers,

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188 INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2015, Exec. Summary 3 (2015).

189 IEA, WORLD ENERGY OUTLOOK 2015 FACTSHEET: Global energy trends to 2040 (2015)

190 Although this huge investment will expand developing country electrification, especially in Asia, "the ranks of the electricity-deprived … will continue to swell in Africa," and 2.6 billion people worldwide will unsustainably rely on traditional biomass fuels for cooking and heating. INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2015 30, 36 (2015).

191 IEA Executive Director Maria Van der Hoeven in IEA news release, "Universal access to energy would herald enormous economic and social benefits" (14 June 2012)

192 The World Bank, EA+EE: Enhancing the World Bank's Energy Access Investments Through Energy Efficiency, 4 (January 2015)

193 Lighting alone consumes about 20% of electricity globally. Collaborative Labelling and Appliance Standard Program (CLASP), Energy Policy Toolkit for Energy Efficiency in Appliances, Lighting, and Equipment 1 (2013) ("CLASP S&L Toolkit)

air conditioners, office equipment, and heating consume huge amounts of electricity.[194] Across the world, "appliance energy use is growing very rapidly and has overtaken water heating as second most important household energy demand."[195] Although energy growth varies considerably among nations[196] and economic sectors, every nation can improve the energy efficiency of its new stock of electric appliances and commercial equipment, which generally can be done at a cost far lower than building new generation facilities, before incurring the large capital expense and adverse environmental consequences of increased generation capacity.

Great savings[197] and reduced environmental impact[198] from generation can be achieved if all appliances are the most efficient available, and old appliances are replaced with new, more efficient ones. Use of energy efficient appliances continues to expand in the United States with the combination of reinforcing existing policies and encouraging the use of energy efficient appliances, through incentives, such as tax credits.[199] These savings are not unique to highly developed countries, but are ubiquitous.

For example, in the 1980s and 1990s, Ghana's electricity supply capacity could not keep up with Ghana's strong economic growth and increased electricity demand. From 1998 to 2000 Ghana's regular rolling blackouts and its economy suffered. Policy makers turned to appliance standards and labelling to help solve this national crisis and in 2000, Ghana developed the first standards and labelling program in sub-Saharan Africa—first for room air conditioners, and then for compact fluorescent lights (CFLs) and residential refrigerators, saving over USD $840 million that would otherwise have been invested in new power plants.[200]

194 Amanda Lowenberger, et al, The Efficiency Boom: Cashing In on the Savings from Appliance Standards (American Council for an Energy-Efficient Economy and Appliance Standards Awareness Project Report ASAP8/ACEEE-A123 March 2012) http://www.appliance-standards.org/sites/default/files/The%20Efficiency%20Boom.pdf , "Taking into account products sold from the inception of each national standard through 2035, existing standards will net [United States] consumers and businesses more than $1.1 trillion in savings cumulatively. By 2035, cumulative energy savings will reach more than 200 quads, an amount equal to about two years of total U.S. energy consumption….Standards have had a particularly large effect on electricity use. On an annual basis, products meeting existing standards reduced U.S. electricity use in 2010 by about 280 terawatt-hours (TWh), a 7% reduction. The electricity savings will grow to about 680 TWh in 2025 and 720 TWh in 2035, reducing U.S. electricity consumption by about 14% in each of those years." The paper analyses the potential U.S. savings from new or updated standards for 34 different types of equipment, and finds that these new standards have the potential to increase energy savings by nearly 50% in 2035, including reduced peak demand of 67 GW and reduced electricity consumption in 2035 of 306 TWh. See Table ES-1.

195 IEA, Worldwide Trends in Energy Use and Efficiency: Key Insights from IEA Indicator Analysis, 43 (2008).

196 Wherever "nation" is used in this chapter, it applies as well to states and municipalities within nations since in many countries states, cities and other municipalities have adopted their own energy efficiency labelling and standards programs.

197 "In 2010, existing standards saved 3.4 quads of energy, which is equivalent to about 3.5% of total U.S. annual energy consumption. Existing standards will save more than 200 quads of energy cumulatively through 2035, which is equivalent to about two years of total U.S. energy consumption. The NPV of existing standards is about $1.1 trillion. … Net savings from existing standards were about $27 billion in 2010 and will increase to about $61 billion in 2025 and $67 billion in 2035 (in 2010$)" Amanda Lowenberger, et al, The Efficiency Boom: Cashing In on the Savings from Appliance Standards at 3-4.
The potential cost savings in the United States from potential new standards through 2035 is estimated to be another $167 billion (2010 $) See Table ES-2

198 "The CO2 savings from existing [U.S] standards in2010 were 203 million metric tons, an amount equal to the CO2 emitted by 51 coal-fired power plants. By 2025, the CO2 savings grow to 448 million metric tons, an amount equal to the emissions of 112 average-sized coal-fired power plants. By 2035, savings increase to 472 million metric tons, the equivalent of 118 coal plant's CO2 output. CO2 savings can also be compared to the emissions of typical passenger vehicles: 2025 savings will be equal to the emissions of 88 million vehicles and2035 savings equal to that of 93 million vehicles. Standards have also reduced emissions of other power sector pollutants including nitrogen oxides," Amanda Lowenberger, et al, The Efficiency Boom: Cashing In on the Savings from Appliance Standards at 3 - 6 sulphur dioxide, and mercury,

199 International Energy Agency, World Energy Outlook, 45 (2015).

200 CLASP, S&L Toolkit 3

The IEA attributes the continued use of inefficient large appliance use across the world to the lack of implementation of policies and lack of minimum energy performance standards, in addition to, improper labelling and lack of industry wide agreements.[201] Appliance efficiency labels that accurately inform consumers of anticipated energy use the appliance will require, and appliance efficiency standards that set minimum efficiency requirements for appliances in the marketplace are among the most inexpensive and effective means of improving the efficiency of residential and commercial electricity use.[202] Under either approach, government policy makers, at relatively low cost, can establish appliance efficiency performance standards and consumer information requirements (labels), and can monitor compliance and enforce violations. Private manufacturers will innovate and compete within the bounds of government to set ground rules.

Governments also can provide incentives to industry to improve appliance efficiency beyond minimum standards. As greater product efficiency is realized, governments can ratchet up the standards to the higher level achieved by the innovation. This iterative process can transform the market to one that drives substantial efficiency improvements.[203]

Globally, both labels and standards have been adopted as valuable tools for setting and implementing national energy efficiency policy. Over 80 nations now have adopted some kind of efficiency and/or labelling requirement, and 55 different product types are now covered by a mandatory standard, with over 3600 different policy measures such as performance standards, and various forms of labelling.[204] Seventy-five nations have refrigerator measures, 73 nations regulate air conditioning, 67 countries have lighting measures, and 47 countries have measures for television efficiency.[205] These measures have in the long term reduced energy use and costs 3-4% per year everywhere they have been introduced, with much more dramatic savings achieved in nations that had no previous efficiency standards or programs.[206] Globally, the national benefits from these programs have exceeded their costs by an average of 3 to 1, a large net savings to society.[207] These programs also present a "least cost pathway" for CO_2 emission reductions. Moreover, in many places appliance prices have fallen as products became more efficient, and predictions of price increases associated with appliance efficiency standards have been shown to be off by a factor of 10, which has led the IEA to conclude that because "long-term appliance purchase prices are generally declining in real terms while products are also becoming more efficient," more ambitious standards are economically justified [208]

201 IEA, supra.

202 Benefits from existing U.S. standards are more than 2,500 times greater than the program costs and represent an overall societal cost-benefit ratio (after the appliances are purchased) of 3 to 1. Standards that were about to take effect in 2001 were estimated to generate benefits worth about 2000 times the program costs. Savings from updating current U.S. standards to reflect efficiency improvement will have an overall cost-benefit ratio nearly as good as the original standards: 2.8 to 1. Energy savings from potential standards in new product categories would enjoy an overall benefit-to-cost ratio of 5 to 1 – far better than the 3 to 1 ratio for existing standards and 2.8 to 1 for updated existing standards. From a government resources perspective, the new standards' benefits would probably be 1,000 times greater than the government's costs.

203 Steven Nadel, Jennifer Thorne, Harvey Sachs, Bill Prindle, and R. Neal Elliot, Market Transformation: Substantial Progress from a Decade of Work (American Council for an Energy-Efficient Economy April 2003), at http://aceee.org.

204 Harrington, L., J. Brown, and M. Caithness, Energy efficient standards and labelling programs throughout the world in 2013 (May 2014, Energy Efficient Strategies) vi. (This report includes a detailed analysis by nation of every measure adopted or proposed).

205 Id.at vii.

206 IEA, Achievements of appliance energy efficiency standards and labelling programs: a global assessment (2015) 3

207 Id. at 4-5 (Mandatory programs in the U.S. had a 3 to 1 ratio, UK a 3.8 to 1, and a program in Fiji 3.5 to 1. Voluntary programs such as the U.S. Energy Star program produced a $4.50 saving for every dollar of incremental cost.)

208 Id. at 6-7.

Globally, these standards and programs have produced a wide-range of benefits at the individual, sectoral, national and international level. At the individual, household and enterprise level co-benefits include improved health and well-being, poverty alleviation, improved energy affordability and access, and increased disposable income. At the sectoral (industrial, transport, residential, commercial) level, co-benefits include increased industrial productivity and competitiveness, improved energy and other infrastructure benefits, and increased profits and asset values. Nationally, co-benefits include job creation, reduced energy-related public expenditures, energy security, and valuable macroeconomic effects. Internationally, appliance efficiency has resulted in moderating energy prices, reducing natural resource pressure, and promoting the achievement of development goals.[209]

Examples are plentiful. China's energy efficiency standards and labelling program will eliminate the need for 28 gigawatts of generating capacity by 2020, which will reduce annual emissions of SO_2 by 6.8 million tonnes, NO_X by 4.8 million tonnes, and particulates by 29 million tonnes.[210] This a remarkable turnaround from China's policy in 1980, when China decided to distribute refrigerators throughout the capital city of Beijing. It did so with resounding success, supplying refrigerators to over 60% of Beijing households by 1990, where only 6% had them in 1980. The reconditioned refrigerators from Japanese factories were thought to be cheap. They were not cheap, however, when the costs of the electric power supply necessary to run these very inefficient machines became apparent. In fact, the purchase and supply of inefficient equipment cost more than three times what would have been the cost of supplying the most efficient refrigerators on the world market [in 1991].[211]

After its first year, the Philippines' mandatory standards and labelling program resulted in a 25% increase in average efficiency of all air conditioners, which translates into an energy savings of 6 MW in demand and 17GWh in consumption. Korea, three years into its mandatory standards and labels programs enjoyed an 11% decrease in refrigerator energy consumption and a 24% decrease in air-conditioner energy consumption. Thailand, which instituted a voluntary program, recorded a 14% decrease in refrigerator energy consumption (after 3 years) and a 65 MW decrease in energy demand and a 643 Gwh drop in consumption.[212]

Despite this progress, there is still much work to be done. Of the 33 Latin American and Caribbean countries, only 13 countries have energy efficiency standards for refrigerators, 12 for air conditioners and 3 for fans.[213] If the region implemented standards for refrigerators, air conditioners and fans, it could annually save 138 TWh in energy and about $20 billion in electricity bills, would help the nations reduce energy subsidies, and would avoid annual emissions of approximately 44 million tonnes of CO2."[214]

This chapter will offer an overview of the process and issues involved in drafting appliance efficiency and labelling laws, examples of typical legislative language, and references to powerful resources with detailed information, analytical templates and supporting databases for drafting a nation's legislation and regulations.

209 Id. at 10.
210 Id. at 10
211 Richard L. *Ottinger, Energy and Environmental Challenges for Developed and Developing Countries,* 9 PACE ENVTL. L. REV. 55, 59-60 (1991).
212 CLASP Success Stories, http://clasp.ngo/OurPrograms
213 CLASP, Energy Efficient Cooling Products in Latin America and the Caribbean: An Opportunity to Cool Down the Planet and Accelerate the Regional Economy (2015) 8
214 Id. at 8-10.

II. HELPFUL RESOURCE -- CLASP

Substantial expertise and resources are available to developing countries seeking to engage in this process. Funding is available from national foreign assistance programs, multilateral development banks, regional U.N. Economic Commissions, the Global Environmental Facility, and various private foundations. Most of the expertise and funding is coordinated through the Collaborative Labelling and Appliance Standards Program (CLASP).[215] CLASP, established in 1999, as an impartial and independent not-for-profit organization dedicated to mitigating energy demand from appliances, lighting, and equipment, is the best resource for any nation considering adopting or revising appliance efficiency standards or labelling laws. CLASP's mission is stated to be as follows: [to develop and share]:

> "[P]ractical and transformative policy and market solutions in collaboration with global experts and local stakeholders. We are the leading international resource and voice for energy efficiency standards and labels (S&L) for appliances, lighting, and equipment. Since 1999, CLASP has worked in over 50 countries on 6 continents pursuing every aspect of appliance energy efficiency, from helping structure new policies to evaluating existing programs."[216]

CLASP supports the design, drafting and implementation of efficiency standards and labels in developing and transitional countries through partnerships with agencies, stakeholders and relevant institutions in those countries. CLASP works directly "with policy makers, governments, technical experts, industry, funding organizations, consumers and consumer groups, and others to improve the environmental and energy performance of appliances and related systems we use every day, lessening their impacts on people and the world around us. CLASP convenes stakeholders, conducts analyses, identifies best practices, builds capacity, shares knowledge, guides decision-makers and transforms markets."[217]

CLASP currently works with over 320 partners in over 60 nations and the EU through a variety of programs. Some are nation based, such as in India, China, the EU and the United States. Other programs are subject-based, such as its Global Best Practices and Clean Energy Access programs, as well as its overarching work of providing direct support and technical assistance to all nations seeking the assistance in developing or improving its appliance efficiency. In this regard, CLASP provides "Getting Started" tools for data collection and surveys, an extensive global standards and labelling laws and policies electronic library of all countries. CLASP helps its partners develop monitoring, verification and enforcement programs, and provides a Monitoring, Verification and Enforcement (MVE) Guidebook and electronic library. CLASP also maintains a web-based "Ask the Expert" tool for additional support.[218]

CLASP's "Getting Started" tools are designed to help countries assemble and analyse the data necessary to develop a program. Quality data regarding equipment ownership and use patterns are the technical foundation of the assessment and development of any energy efficiency policy. In particular, standards and labelling programs for residential and commercial products depend on accurate and locally-relevant information at the level of an individual household or commercial enterprise. Residential and commercial survey datasets provide an indication of ownership rates, common product classes, and use patterns for

215 http://clasp.ngo/WhoWeAre/AboutUs
216 Id.
217 All of these resources are available at CLASP.ngo.
218 Id.

a variety of products. In addition, they yield market information such as brand, model type and prices paid for common equipment. Recognizing the value of facilitating the collection of quality data for use in standards and labelling programs, CLASP, with the support of the United Nations Foundation, has developed a publicly available set of tools as a resource to program managers and analysts.

There are two survey types provided – residential (RECS) and small business (SBECS). In many countries around the world, small shops, restaurants, offices and other businesses use equipment that is similar to that used in residences for lighting, refrigeration, heating and cooling, and heating water. Therefore, the two surveys have many common elements. Large and specialized commercial equipment are not covered.

The tools provided are (1) a standard printable survey form (2) data entry and collection software and (3) an instruction guide for survey management and implementation. Elements (1) and (2) are combined into a single Microsoft Excel spreadsheet for each survey type. The files are designed such that a printout can be made, constituting an exact hardcopy survey form for use in the field by interviewers. Once data is collected, the same files are used to transfer the collected data efficiently and accurately into a datasheet, which can then be used for analysis. User Instructions are given in Microsoft Word files and provide details of how to use the spreadsheet tools and describe each type of information to be collected. In addition, the User Instructions provide guidance towards the effective implementation of a survey program, including training requirements.

Once this data is collected, "decision makers – including policy makers, funding agencies, and other stakeholders – need to know the potential environmental and financial impacts of any standards and labelling policy under consideration."[219] CLASP helps by providing a Policy Analysis Modelling System (PAMS) for estimating the energy savings and monetary costs of implementing local minimum efficiency performance standards. This tool was developed through a decade's long collaboration with the U. S. Department of Energy's Lawrence Berkeley National Laboratory. CLASP describes PAMS as "an easy-to-use software tool … that can be used "out of the box" to estimate costs and benefits of different standards and labelling policies for over 150 countries." It helps policy makers select strategies that maximize benefits for both consumers and governments. CLASP views PAMS as "an ideal tool for countries with few technical or financial resources." It also can help more advanced users improve the accuracy of estimates by customizing the tool with any country-specific data that are available.[220]

The CLASP website and CLASP support can enable any nation to engage in energy efficiency law reform. The CLASP website describes a law development process that is comprehensive, expert, and straight forward.

CLASP works at the national level to build the skills and institutional capacity necessary to develop, enforce, and maintain standards and labels. National successes help build a critical mass of knowledge, skills, and infrastructure in each region. Participation by multiple countries in the same region begins to have an effect at the regional and international levels through effects on cross border trade flows. To achieve this outcome, CLASP devotes about 70% of its resources to national assistance, about 20% to regional alignment/harmonization projects, and about 10% to building

219 Id.
220 http://clasp.ngo/Tools/Tools/PolicyAnalysisModelingSystem

partnerships and creating tools such as its web site to facilitate the national and regional projects.

CLASP projects build upon existing initiatives in any country to promote the cost-effective adoption and implementation of energy efficiency standards and labels. CLASP's objective is to transform the manufacture and sale of energy consuming products to higher levels of energy efficiency, thereby presenting an opportunity for all countries in the region to grow in a more environmentally sustainable and economically efficient manner. CLASP projects often focus on regional markets. Due to its overwhelming success, CLASP now works together with "policy makers, governments, technical experts, industry, funding organizations, consumers and consumer groups" to promote energy efficiency through laws and initiatives.[221]

CLASP provides assistance in any or all of the following seven process-oriented steps in standard-setting or labelling program implementation, including: 1) deciding whether and how to implement energy efficiency standards and labels (appropriate products, priorities, timing); 2) developing a testing capability; 3) designing and implementing a labelling program, encompassing consumer, manufacturer, and retailer outreach; 4) analysing and setting standards; 5) involving all stakeholders at a country and regional level, including industry, NGOs and consumers; 6) maintaining and enforcing compliance, and 7) evaluating the labelling and standards-setting program to demonstrate overall effectiveness and to determine opportunities for upgrade and improvement.

CLASP designs its projects to facilitate exchanges among governments, industry, inter-governmental organizations, and technical support groups based on the concept of linking assistance providers and assistance recipients in partnerships with shared responsibilities. It facilitates the participation of stakeholders with global and national expertise in energy efficiency standard-setting and labelling and builds upon previous successful experiences worldwide to implement any S&L program. CLASP's basic approach is to assist project stakeholders in defining and performing their appropriate roles, rather than performing any basic functions on their behalf. Fundamentally, all the activities can be classified as capacity building.

Experience suggests that inefficient appliance and equipment technology often becomes available to developing countries (low entry costs, little copyright protection) from new-entrant local suppliers no longer able to sell inefficient products in developed countries.

CLASP projects seek to strike the most appropriate balance among the sometimes competing objectives of:

- providing and stimulating the use of highly efficient products;
- supporting local manufacturers; and
- ensuring that consumers have the capacity within the context of the local industrial, economic and energy infrastructure to afford efficient technology.

221 http://clasp.ngo/WhoWeAre/What%20We%20Do

III. STANDARDS AND LABELLING DRAFTING CONSIDERATIONS

A. How Does One Decide Whether to Adopt Standards and/or Labelling Programs?

Appliance energy efficiency and labelling programs generally use two different techniques, energy efficiency labels and energy efficiency standards, either separately or combined.[222]

Label designs can take varying approaches, such as endorsements, certifications, product comparisons, and product energy usage. No matter the form, all labels are designed to inform consumer choice at the time of purchase. The labels do not mandate how efficient a product must be. Instead, label programs seek to provide consumers with energy efficiency and lifecycle cost information to encourage market choices to purchase energy efficient appliances. To the extent accurate energy efficiency and lifecycle cost information is conveyed by labels to the purchaser, consumer choice will be tilted towards more efficient products and manufacturers will be induced to make and market more efficient appliances.

In contrast to labels, energy efficiency standards set specific, minimum energy performance requirements for products and classes of products. Whichever approach, or combination of approaches used, the government must decide whether to make them mandatory or voluntary.

The first step in the decision process is for the government to decide whether it should use labels or standards, or both, and if so, which approaches would be best for the country. The policy maker must also decide whether the program will be mandatory or voluntary. This first step is critical to the success of any program. It is analytically challenging and requires the availability of a broad range of valid, reliable data. The policy maker must assess the nation's institutional, economic, legal, and cultural capacity to develop and implement a program, must determine if there is adequate political support for the effort, must quantify the economic and environmental costs and benefits of an appliance efficiency program, and must estimate the effect of a program on consumer preference.

Example of a statutory energy efficiency policy statement:

To begin, the policy maker must assemble the data on and evaluate: a) the current and potential efficiency of different appliances that are or will be available in the market, b) whether the products are or could be domestically produced or must be imported, and c) the kinds of standards other countries have adopted. CLASP is an important resource for this step. This information must be combined with the evaluation of the nation's needs and institutional capacity to determine what range of products should be covered by the efficiency program (e.g., refrigerators, lighting, air conditioning, freezers, computers, etc.), what kind of regulation (label or standard) would work best for each covered product category, and the anticipated costs and benefits of each approach in order to determine the kind, scope and stringency of policy that should be adopted. The end

222 The overview that follows in this and later sections of the chapter are, unless otherwise specifically noted, taken from STEPHEN WEIL & JAMES E. MCMAHON, EDS., ENERGY-EFFICIENCY LABELS AND STANDARDS: A GUIDEBOOK FOR APPLIANCES, EQUIPMENT AND LIGHTING, 2ED. (CLASP February 2005), the CLASP web site, http://clasp.ngo/Resources/Resources/PublicationLibrary/2000-and-earlier/Supporting-network-for-EESL-in-developing-countries ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC, ENERGY EFFICIENCY: COMPENDIUM OF ENERGY CONSERVATION LEGISLATION IN COUNTRIES OF THE ASIA AND PACIFIC REGION (UNITED NATIONS 1999), AND INTERNATIONAL ENERGY AGENCY , ENERGY STANDARDS AND LABELS (OECD/IEA 2000), http://www.unescap.org/publications

JAPAN: The Rational Use of Energy Law

Chapter 1, Objectives, Article 1.

This law's purpose is to contribute to the sound development of the national economy through implementing necessary measures for the rational use of energy in factories, buildings, and machinery and equipment, and other necessary measures to promote comprehensively the rational use of energy in order to ensure the effective use of fuel resources that would meet the economic and social environment of energy at home and abroad.

Chapter 1-2. Fundamental Policies, etc., Article 3.

1.The Minister of Economy, Trade and Industry shall determine and make public Fundamental Policies … for the purpose of promoting comprehensively the rational use of energy at a factory, business premise,..

2.The Fundamental Policies shall, in order to rationalize the use of energy, define… measures to be implemented by energy users, policies to promote the rational use of energy…in consideration of a long-term outlook of energy supply and demand, technical level for the rational use of energy or other circumstances.

Full text at http://www.asiaeec-col.eccj.or.jp/index.htmlAdditional useful information and data on energy efficiency in Japan is available from Japan's Agency for Natural Resources and Energy, www.enecho.meti.go.jp.

product of this analytical process will be the decision whether to adopt a program, and if so, the kind, scope and stringency of the policy that should be adopted.

B. What Testing Capability is Needed for a Standards and/or Labelling Program?

The next critical requirement is that the nation be able to determine whether a product complies with the proposed standard and whether the label's claims are accurate. Thus, it is essential that the country establish or obtain access to a qualified testing centre for evaluating the energy efficiency of products and label claims. Both standards and label requirements must be supported by protocols for product energy efficiency testing in order to standardize measurement of a product's energy use and efficiency and to standardize the efficiency information on labels. The nation could set up its own centre, join with other nations to run a regional centre, or contract with an existing facility for the services. This testing capability is essential for program legitimacy and effectiveness, both when establishing the regulatory requirements and in insuring compliance. Also, the testing protocols and protocols for product certification by industry must be publicly promulgated, so both industry and the testing centre can reliably and comparably evaluate product performance and market compliance. Additionally, manufacturers relying on private testing for certification, must establish that testing procedures are accredited and valid.

An example from Canada of legal authority for product testing and data reporting follows:

EXAMPLE OF LEGAL AUTHORITY FOR PRODUCT TESTING AND DATA REPORTING

Canada: Energy Efficiency Act - 1992, c. 36

Requirements to supply test products

(1) The Minister may require any dealer who ships or imports energy-using products as described in subsection 4(1) to make available, at such place as the Minister may specify, such number of those products as the Minister considers to be reasonably necessary for examination and testing under this section, and the dealer shall forthwith comply with the request.

Testing

(2) The Minister may dismantle and examine any energy-using product made available pursuant to subsection (1) and may conduct such tests on it as the Minister considers to be reasonably necessary to determine the product's energy efficiency.

Outside testing

(3) The Minister may enter into an agreement or other arrangement with any person for the examination and testing of energy-using products under this section.

Source: http://laws-lois.justice.gc.ca/eng/acts/e-6.4/page-1.html#h-6

Statistics- Regulations –

22. The Governor in Council may make regulations requiring prescribed persons to file with the Minister, in the prescribed form and manner, at the prescribed time and for each prescribed reporting period, a report setting out prescribed statistics and information respecting

(a) the value, quantity, type and use of energy, including alternative energy, purchased, consumed or sold by that person;

(b) the expenditures of that person on the research, development, acquisition and operation of energy-using equipment and related technology; and

(c) the sales of prescribed energy-using products or classes of energy-using products by that person, including the revenue from, and geographic distribution of, the sales.

Source: http://laws-lois.justice.gc.ca/eng/acts/e-6.4/

Availability of technical expertise and testing capability is also essential in designing standards and labels. In choosing a testing standard, the nation must decide what kind of data is most valuable to assess energy efficiency. It could include a range of measures, such as how much energy does the product use overall, and in performing different aspects of its tasks. The analysis must also consider how much variability in energy consumption and efficiency will be acceptable for a product to meet applicable standards or labelling requirements, how much variability in the test method itself is acceptable, and how much all this testing will cost.

An example from Egypt follows:

Egypt. - The Ministry of Electricity and Energy is setting up an energy efficient equipment laboratory as part of its Energy Efficiency Improvement project; the laboratory is funded jointly by the Egyptian Government, UNDP and Global Environment Facility. The laboratory will be an important tool in Egypt's efforts to reduce energy consumption, and will provide "teeth" to Egypt's recently adopted energy efficiency standards for refrigerators, washing machines and air conditioners. The laboratory will enable Egypt to verify energy consumption levels of imported and locally made electrical appliances, and to monitor compliance with energy efficiency standards.

Source: www.clasp.ngo/OLD%20ITEMS/PastProgramLocations/Egypt; http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/MandE/TER/FY2010/UNDP/267/267_452_TE_CCM_Egypt.pdf; https://info.undp.org/docs/pdc/Documents/EGY/00060162_Final%20Draft%20-%20Project%20Document.pdf; www.un.org/esa/sustdev/sdissues/energy/etb_newsletter/etbnewsletter_dec01.pdf

C. What factors must be considered in designing standards and labelling efficiency programs?

Once a nation has decided to adopt a standards or label program it must establish adequate legal authority for and then set about to design a specific label and set particular product efficiency standards.[223]

Examples of relevant Canadian statutory and regulatory language follows:

223 CLASP maintains an extensive, searchable label design library with 326 different labels. The site displays each label, which can be sorted by country, label type, or product; it also maintains links to each program. It is located at www.clasp.ngo/en/Tools/Tools/SL/Search_and www.clasp.ngo/Tools/Tools/EconomyFinder . Another extensive database and important resource is maintained by the Asia-Pacific Economic Cooperation (APEC) Energy Standards and Labelling Program. The APEC Energy Standards Information System (ESIS) is a new APEC-funded initiative to develop a comprehensive web site on testing standards, MEPS, and labelling requirements for countries in the Asia-Pacific region. Information can be found at www.apec-esis.org/

CANADIAN EXCERPS FROM THE LEGAL AUTHORITY FOR A STANDARDS AND DESIGN PROGRAM

Canada, Energy Efficiency Act - 1992, c. 36

Trade in Energy-Using Products Interprovincial trade and importation

4. (1) No dealer shall, for the purpose of sale or lease, ship an energy-using product from …, or import an energy-using product into Canada, unless

(a) the product complies with the energy efficiency standard; and
(b) the product or its package is labelled in the prescribed form…

Tampering with label

No person shall, before an energy-using product is sold to the first retail purchaser or leased to the first lessee, remove, deface, obscure or alter any label put on the product or its package in accordance with the regulations.

Regulations

20. (1) The Governor in Council may make regulations

(a) prescribing as an energy-using product any manufactured product designed to operate using electricity, oil, natural gas or any other form or source of energy or to be used as a door system or window system;
(b) prescribing energy efficiency standards for energy-using products or prescribed classes of energy-using products;
(c) prescribing the form and manner of labelling energy-using products or their packages or prescribed classes of energy-using products or their packages with respect to the products' energy efficiency;
(d) providing for the testing of energy-using products to determine their energy efficiency; …

Source: www.laws-lois.justice.gc.ca/eng/acts/e-6.4/FullText.html

D. What are the Label Design Considerations?

A label can simply provide an endorsement or seal of approval from a certified program, either public or private. The U.S. EPA and Department of Energy ENERGY STAR® label is an excellent example of an endorsement label.[224] Other nations that use endorsement labels include Australia, Brazil, China, European Union (some EU countries, such as Germany, Great Britain, The Netherlands, Austria, Spain and Poland, also have their own endorsement label), India, Japan, Korea, Mexico, New Zealand, Singapore, Switzerland, and Thailand.[225] Endorsement labels generally display a

224 For detailed information see www.energystar.gov (United States), and, www.eu-energystar.org / (European Union Energy Star),

225 Compiled from data reported by Lloyd Harrington of Energy Efficient Strategies in the 1990s and the 2013 report prepared by Jack Brown of Energy Efficient Strategies and Marg Caithness of Maia Consulting ENERGY LABELLING AND STANDARDS PROGRAMS THROUGHOUT THE WORLD IN 2013, supra note 25, and by the CLASP label design library, supra note 32.

seal of approval that provides no specific energy use data to the consumer, but instead represents the endorser's assurance that the product meets some level (hopefully high) of performance, either in absolute terms or in relative terms, such as identifying products that perform at the top 10% of all products of that type on the market.

The value of the endorsement label is directly related to the credibility of the endorser to the purchaser. Hence, the U.S. and International Energy Star label, all of which are government issued, has been very effective. However, as the variety of endorsements and endorsers expands, and endorsements compete with each other, seals of approval labels become confusing to consumers and lose their power to influence consumer choice. On the other hand, one of the major strengths of endorsement labels is that they are easy for the consumer to read because they contain little or no statistical information. An example follows:

EXAMPLE OF LAW ESTABLISHING A LABELING PROGRAM

European Union: Energy labelling of household appliances, (EC) reg. No. 2422/2001

The Directive applies to refrigerators, freezers and their combinations; washing machines, dryers and their combinations; dishwashers; ovens; water heaters and hot-water storage appliances; lighting sources; and air-conditioning appliances…

Household appliances offered for sale, hire or hire-purchase must be accompanied by a fiche and a label providing information relating to their consumption of energy (electrical or other) or of other essential resources. Where appliances are offered for sale, hire or hire-purchase by catalogue or by other means whereby the potential customer is unable to see the appliance displayed, the essential information contained in the label or fiche must be provided to the potential customer before purchase.

The supplier must establish, and make available, technical documentation sufficient to enable the accuracy of the information contained in the label and the fiche to be assessed. This documentation must include: a general description of the product; the results of design calculations, where necessary; test reports; and where values are derived from those obtained for similar models, the same information for these models…

Suppliers must provide:

- a free label, to be attached to the appliance by the dealer in the appropriate position and in the appropriate language version;
- a product fiche, contained in all the brochures relating to the product or, where these are not provided, in all other literature provided with the appliance…

Member States must take the necessary measures to:

- ensure that all suppliers and dealers established in their territory fulfil their obligations under this Directive;
- prohibit the display of labels, marks, symbols or inscriptions relating to energy consumption which do not comply with the requirements of this Directive and which are likely to cause confusion, with the exception of Community or national environmental labels;…

The Directives adopted in implementation of the present Directive must specify:

- the exact definition of the type of appliances to be included;

- the measurement standards and methods to be used in obtaining the information relating to energy consumption;
- details of the technical documentation required;
- the design and content of the label;
- the location where the label shall be fixed to the appliance;
- the content and where appropriate the format of the fiche, on which must be included the information appearing on the label;
- the information details to be provided in the case of mail-order offers for sale.

Source: http://laws-lois.justice.gc.ca/eng/acts/e-6.4/

The label can provide a qualitative rating, specific performance data, or comparative information for consumers. Comparison labels contain various types of energy information, qualitative or quantitative, that can be used to compare products in a category. Examples of comprehensive product comparison label are those mandated in the European Community, Argentina, Australia, Brazil, China, Colombia, Hong Kong (China), Hungary, India, Indonesia, Iran, Israel, Malaysia, Mexico, Sri Lanka, Switzerland, Thailand, and United States. [226]

Comparison labels provide more consumer information than endorsements, but are less easily readable. Countries such as Canada, the U.S., Israel, Jamaica, Japan, Malaysia, Mexico, Indonesia, Russia, Singapore, and Sri Lanka use a label that rates appliances on a continuous scale.[227] Information only labels provide a high level of information but sacrifice readability and ease of product comparison. Information only labels are used in Costa Rica, Mexico, Indonesia and Philippines.[228] These provide energy consumption, efficiency ratings and operating costs for the product only, leaving it up to the consumer to gather and compare data on other products on the market.

Label design can vary within a country from product category to category; countries may make labels mandatory for one product category but leave them voluntary in another category. The particular approach and actual design of labels should be the one that best suits the nation's economic, social, and cultural factors, and should also consider the need to harmonize the label with that required by other nations in the region and with the requirements of the countries where the products are manufactured.

226 Id.
227 Id.
228 Id.

EXAMPLE OF LAW ESTABLISHING A LABELING PROGRAM

European Union: Energy labelling of household appliances, (EC) reg. No. 2422/2001

The Directive applies to refrigerators, freezers and their combinations; washing machines, dryers and their combinations; dishwashers; ovens; water heaters and hot-water storage appliances; lighting sources; and air-conditioning appliances…

Household appliances offered for sale, hire or hire-purchase must be accompanied by a fiche and a label providing information relating to their consumption of energy (electrical or other) or of other essential resources. Where appliances are offered for sale, hire or hire-purchase by catalogue or by other means whereby the potential customer is unable to see the appliance displayed, the essential information contained in the label or fiche must be provided to the potential customer before purchase.

The supplier must establish, and make available, technical documentation sufficient to enable the accuracy of the information contained in the label and the fiche to be assessed. This documentation must include: a general description of the product; the results of design calculations, where necessary; test reports; and where values are derived from those obtained for similar models, the same information for these models…

Suppliers must provide:

- a free label, to be attached to the appliance by the dealer in the appropriate position and in the appropriate language version;
- a product fiche, contained in all the brochures relating to the product or, where these are not provided, in all other literature provided with the appliance…

Member States must take the necessary measures to:

- ensure that all suppliers and dealers established in their territory fulfil their obligations under this Directive;
- prohibit the display of labels, marks, symbols or inscriptions relating to energy consumption which do not comply with the requirements of this Directive and which are likely to cause confusion, with the exception of Community or national environmental labels;…

The Directives adopted in implementation of the present Directive must specify:

- the exact definition of the type of appliances to be included;
- the measurement standards and methods to be used in obtaining the information relating to energy consumption;
- details of the technical documentation required;
- the design and content of the label;
- the location where the label shall be fixed to the appliance;
- the content and where appropriate the format of the fiche, on which must be included the information appearing on the label;
- the information details to be provided in the case of mail-order offers for sale.

Source: http://laws-lois.justice.gc.ca/eng/acts/e-6.4/

E. What are Considerations for Drafting Design Standards?

Standards set product performance criteria that manufacturers must achieve. Standards can be designed to eliminate the least efficient products from the market, eliminate all but the most efficient products from the market, to harmonize with other nations' standards, or to encourage local manufacturers to make, or local importers to import and sell, products more efficient than those that merely meet the minimum standards. In making these decisions, policy makers need to make an engineering analysis, a national impact analysis, a consumer analysis, and a manufacturing analysis.[229]

- The engineering analysis evaluates the energy efficiency of products sold in the country and determines both the technical feasibility and cost of improving the products' efficiency, and also considers how the efficiency improvements will affect the products' overall performance.
- The national impact analysis examines the specific proposed standard's potential social costs and benefits, the impact reduced energy consumption would have on local utilities, and the environmental benefits and possible adverse effects the standard's reduced energy consumption might cause.
- The consumer analysis evaluates the standards' economic impact on a consumer's purchase decision.
- Finally, the manufacturing analysis evaluates the effect of the standard on domestic and international manufacturers, suppliers, importers, employers, and retailers.

In considering this information, whether for label design or standard setting, it is important that all stakeholders be involved, both to establish political credibility, legitimacy, and support for the proposed standard, and to insure that the data and analysis do not ignore key factors, or reflect analytical mistakes. Stakeholders should include community leaders, government officials, legislators, manufacturers, importers, retailers, consumers, energy suppliers, and environmental interests.

The result of this public deliberative process should be substantial consensus on measures that best meet the social, economic, political, and environmental needs of the communities and nation, and fit their scientific and technical capability. Policy makers must also consider what the communities and nation must do to develop adequate institutional capability for the program, what legal authority will be necessary, how and what kind of monitoring capacity they have and will need, how they will inform those regulated of the new mandates, and their capacity to assist those regulated to achieve compliance. Lessons from other nations can be extremely valuable in this endeavour. Finally, the policy makers must evaluate how to develop the capacity to assess the program's actual impacts, its successes and failures, to learn from these lessons, and to use this learning to fix and improve the program. Some examples follow:

229 Weil and McMahon, CLASP GUIDEBOOK, 23, sapra note 29

Examples of Standards Programs in Developing Countries

Ghana. Ghana's Electrical Appliance Labelling and Standards Programme (GEALSP) has set a mandatory minimum standard for air conditioners; it is test standard GS362 (2001) which uses as a reference standard ISO 5151. The implementing entity for this standard is the Ghana Energy Foundation. The Ghana Energy Foundation is a non-profit, public-private partnership institution devoted to the promotion of energy efficiency and renewable energy as a key strategy to Ghana's growing energy needs in a sustainable manner. It was established in November 1997, by the Private Enterprise Foundation in collaboration with the Government of Ghana, energy sector stakeholders and private sector energy consumer.

Egypt. In 2003, the Egyptian Organization for Standardization approved Energy Efficiency Standards Specifications for refrigerators, washing machines and air conditioners. A Ministerial decree requires that manufacturers and importers comply with this standard and label electrical appliances with energy consumption data about the appliance.

Source: www.clasp.ngo

IV. WHAT ASSISTANCE CAN THE CLASP GUIDEBOOK AND OTHER RESOURCES PROVIDE?

The process described above reflects an overview of the general procedures for establishing energy efficiency labelling and standards requirements. It has been taken largely from the CLASP Guidebook that elaborates on each step, with special consideration given to the special challenges facing developing countries. Written by experts from around the world who have extensive experience in helping developing nations develop energy efficiency and label programs, it is an invaluable resource for the process. It details, chapter by chapter, every aspect of the steps described above. It is, in the authors' words, "a manual for government officials and others around the world for designing, implementing, enforcing, monitoring and maintaining labelling and standard-setting programs. It discusses the pros and cons of adapting energy-efficiency labels and standards and describes the data, facilities, and institutional and human resources needed for these programs. It provides guidance on the design, development, implementation, maintenance, and evaluation of the programs and on the design of the labels and standards themselves." It is available free from CLASP at www.clasp.ngo/en/Resources/Resources/StandardsLabelsGuidebook .

Another valuable resource for those interested in developing a label or standards program is the Energy Efficiency: Compendium of Energy Conservation Legislation in Countries of the Asia and Pacific Region (United Nations 1999) by the Economic and Social Commission for Asia and the Pacific. .It contains articles that discuss general considerations for a label or standards program, and that describe the regulatory programs in Australia, Japan, Korea, the Philippines and Thailand. Additionally, it contains examples of energy labels and extensive portions of the relevant laws in Australia, China, Japan, Republic of Korea, the Russian Federation, Thailand, the U.S., and Uzbekistan.

Extensive resources are available on the internet. Among the most useful web sites are:

- Collaborative Labelling and Appliance Standards Program (CLASP), *www.clasp.ngo*.
- APEC Energy Standards Information Systems *www.apec-esis.org.*
- AFREPREN/FWD Energy, Environment and Development Network for Africa.www.afrepren.org/.
- Alliance to Save Energy - www.ase.org/.
- American Council for an Energy-Efficient Economy (ACEEE), *www.aceee.org.*
- Appliance Standards Awareness Project www.appliance-standards.org.
- Energy Efficient Strategies, Australia, *www.energyefficient.com.au* and *www.energyrating.gov.au.*
- Energy Star, U.S, *www.energystar.gov.*
- ECOWAS Observatory for Renewable Energy and Energy Efficiency, *www.ecowrex.orgwww*
- Global Lighting and Energy Access Partnership (Global LEAP) *http://www.cleanenergyministerial.org/Our-Work/Initiatives/Energy-Access.*
- International Energy Agency, *www.iea.org.*
- International Energy Agency 4E Energy Efficient End Use Equipment Program http://www.iea-4e.org/about-4e.
- International Institute for Energy Conservation, *www.iiec.org/.*
- U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy *www.eere.energy.gov.*
- Berkley Lab Energy Technologies Area, *http://eetd.lbl.gov.*
- Capacity Building Project in Energy Efficiency and Renewable Energy (CaBEERE) (a joint project of South Africa and Denmark) - *http://www.energy.gov.za/EEE/Projects/Appliance%20Labelling/Information%20Campaign%202005/ANNEX%20D%20CaBEERE%20Backgrounder.pdf.*
- India Bureau of Energy Efficiency, *www.beeindia.gov.in.*
- Natural Resources Canada Office of Energy Efficiency (OEE), *http://www.nrcan.gc.ca/energy/offices-labs/office-energy-efficiency.*
- Renewable Energy and Energy Efficiency Partnership ,*www.reeep.org.*
- Observatory for Renewable Energy in Latin America and the Caribbean, *http://www.renenergyobservatory.org.*
- Brasil Secretaria de Estado do Meio Ambiente, www.ambiente.sp.gov.br.

VI. CONCLUSION

Appliance energy efficiency standards and label programs are among the most cost effective, durable, and rapidly accessible means to achieve efficient use of electricity. Every KWh of electricity saved by a more efficient appliance is a KWh that is available for other uses, or is a KWh that need not be generated. These savings reduce the need to invest in additional generating capacity, and allow available electricity to be used more effectively.

With enormous capital needs in all sectors, such savings are invaluable. Moreover, in the developing world, where someone and a half billion people still lack access to electricity, it is imperative that every KWh of electricity be used as efficiently as possible, so it can benefit as many people as possible. Particularly as applied to new investment in electricity-using products, efficiency standards and labels can realize substantial energy savings at remarkably low cost. The savings from standards and label programs can also reduce the burning of polluting fuels, saving both fuel costs and the health and environmental costs of the otherwise unnecessary electricity generation.

At initial glance, the notion of developing and implementing a standards or labelling program might seem daunting. However, that is not the case. Rather, because these programs are so cost effective, an impressive array of organizations have combined efforts to make the process of program development and implementation relatively easy and inexpensive.

This chapter has outlined the range of issues that must be addressed in establishing an energy efficiency standards or label program, has pointed to some of the many examples of successful effort, and has provided reference to the extensive resources that are available to support any program. In particular, CLASP and APEC-ISIS provide access to expertise and support to any developing nation that wishes to adopt a program.

CHAPTER 4D
BUILDINGS EFFICIENCY

David B. Goldstein *

1. INTRODUCTION

Although the industrial sector typically dominates the energy consumption patterns in developing countries, in the most prosperous countries, buildings account for about 40% of energy use; considering the energy needed to construct the buildings, this total is even larger. Moreover, the pattern of energy consumption in buildings, focusing on the use of electricity and predominantly at the time of the electric peak load, means that buildings are even more important in terms of energy costs to consumers and to the utility system than the 40% energy consumption number would indicate.

As countries develop, the general pattern tends to be an increasing percentage of energy and peak power are being used in the building sector. This growth can result in serious strains on the energy infrastructure of a country. For example, in 2004, a large number of regions in China began to experience serious problems of imbalance between electricity supply and demand driven by explosive growth in new construction and a low level of energy efficiency in these new buildings.

Energy efficiency can contribute immensely to the solution of these problems, even in the relatively short term. But they cannot be expected to occur "automatically" as a result of market forces, or even in response to market reforms that price energy at its true market value. Instead, experience throughout the world shows that there are numerous, powerful market barriers to rational investment in energy efficiency. These barriers can be overcome by government policies, which are discussed in this chapter.

A. Energy Efficiency in Buildings

Energy efficiency is defined as the ability to provide the same (or higher) level of energy services, such as thermal comfort, high-quality lighting, etc. at lower energy consumption and cost. Energy efficiency is increased by investing in improvements in the design and the technology used in buildings. Typically (but not always) an energy efficient building costs more to construct but it always costs less to operate. The ratio of the value of energy savings to the additional first cost can be considered a return on investment (ROI) on energy efficiency. Typically, the returns on investment greatly exceed what can be obtained in financial marketplaces. In the United States, for

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example, returns on investment for efficiency in commercial buildings typically range from 25% to 50% annually and higher. In examples for other countries, the ROI is even higher.[230]

From a societal perspective, investments in energy efficiency in a building can be compared with the cost of capital investments necessary on the supply side of the energy system to produce a similar amount of peak capacity or annual energy production. Usually, the capital costs of efficiency are lower, and often far lower, than comparable investments in increased supply. The additional operating costs of efficiency are usually zero or negative,[231] compared to substantial operating costs for supply-side options. In addition, energy efficiency investments generally have much shorter lead times than energy supply investments, a particularly important consideration in countries where the demand for energy services is growing rapidly.

For new construction, energy efficiency in buildings is particularly important because the costs of retrofits are almost always much higher than the costs of energy efficient new construction. New construction is a "lost opportunity" resource for energy efficiency, because any efficiency investments not made during construction will be much more expensive to achieve as retrofits.

Energy efficient buildings generally provide not merely the same level of energy service, but a higher level of energy services than conventional buildings. Energy efficient buildings have higher levels of thermal comfort, greater ability to operate useably in the face of energy supply disruptions, and encourage greater productivity of their occupants. These benefits may be substantially larger than (and in addition to) the benefits of direct energy savings.

The most effective programs are designed not only to ensure that a particular target level of energy efficiency improvement is realized but also to assure that the market is prepared continually to introduce better and better technologies for energy efficiency. This process of continuous improvement in energy efficiency should be anticipated in the developmental process for energy efficiency codes by requiring that the codes be reviewed periodically – such as every three or four years – and updated to include requirements for the use of newer technologies that are cost-effective and feasible.

B. What Are The Policy Tools To Encourage And Require Energy Efficiency In New And Existing Buildings?

A number of jurisdictions throughout the world have had great success at overcoming market barriers and producing dramatically higher levels of energy efficiency than would otherwise have occurred. For example, California has held electricity consumption per capita steady for the past 40 years, while the rest of the United States experienced a 50% growth in electricity consumption (and slower

230 When the city of Moscow in the Russian Federation adopted and enforced its most recent energy standard, the incremental cost of energy efficiency turned out to be negative after manufacturers found, after making adjustments to meet the new standard, that the more highly insulated standard-compliant wall panels could be manufactured more cheaply than the old panels because they use less (relatively expensive) concrete and more (relatively cheap). polystyrene insulation. With a negative first cost of efficiency, returns on investment are no longer even a valid metric: the ROI for a negative cost measure is better than infinite. Negative operating costs occur when the energy efficiency measure results in non-energy related operating cost savings for the building. For example, replacing incandescent lights with fluorescent lights reduced the maintenance cost of lamp replacement, which can be expressed as negative building maintenance cost for the efficiency measure

231 Negative operating costs occur when the energy efficiency measure results in non-energy related operating cost savings for the building. For example, replacing incandescent lights with fluorescent lights reduced the maintenance cost of lamp replacement, which can be expressed as negative building maintenance cost for the efficiency measure.

economic growth than in California). This remarkable success was achieved through implementing the key components of a suite of policy initiatives, mostly governmental but some of them based on private sector and NGO initiatives. Other jurisdictions around the world are now also achieving comparable success, using similar policies, but there has been little systematic attempt to compare best practices worldwide.

11. A TAXONOMY OF POLICIES

This section discusses a suite of policies that can apply to the entire economy that will promote energy efficiency through market-based mechanisms. The discussion focuses on those initiatives most relevant to the commercial building sector but the framework generally applies to energy efficiency in other sectors as well. These policies mutually reinforce one another, reducing costs through market forces and generating continual improvement in building technologies and design principles. The economy-wide policies fall into three generic categories:

- General economy-wide policies;
- Policies to accelerate market adoption of new technologies;
- Economic reforms focused on lending and valuing efficiency investments and on utility regulation.

These are discussed in order.

A. General Economy-Wide Policies

The most important policy is to set a mandatory declining greenhouse gas emissions cap. A cap is important not primarily for the fact that it puts a price on carbon, but because it sets a goal that businesses, governments, non-profit organizations, and individuals will shape their actions.

The importance of setting goals—in the absence of placing price pressure on consumers–should not be underestimated. Businesses commonly set goals for product introductions, sales, cost reduction, revenue growth, etc., and these goals guide organizational behaviour in powerful ways. Economic models assume that businesses maximize profits, but actual business operation is based on setting goals that are not directly connected to profit maximization, particularly in the minds and job assignments of the people that are changed with meeting them, even when they tend to lead to that outcome.

1. Policies to Accelerate Market Adoption of New Technologies

Along the entire chain of market adoption from R&D to universal acceptance, different policies are effective at different parts along this chain. Perhaps a better metaphor than "chain" is a pyramid, as illustrated in Figure 1. This figure exemplifies the principle of continual improvement. Each level of the pyramid should be associated with a Key Performance Indicator or Indicators that allow for measurement of the energy efficiency. Test protocols for each level need to be designed and regularly updated over time.

The pyramid structure is chosen because the lower levels of the pyramid represent broader applicability – those with greater "market share" in a sense but with lower levels of energy efficiency

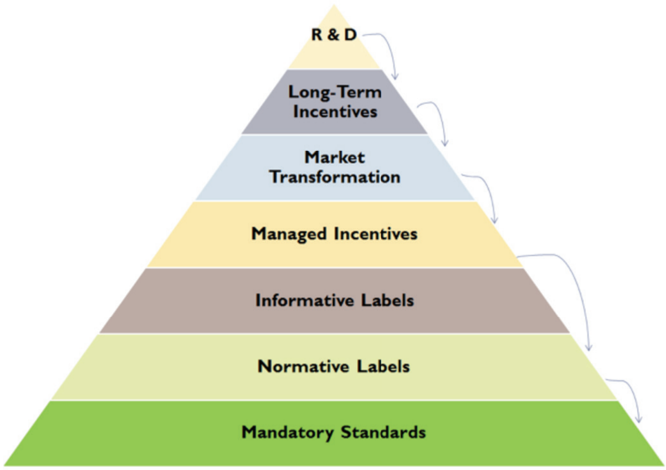

Figure 1: Accelerating Market Adoption through Continual Improvement

improvement. Sitting higher on the pyramid, are building technologies and designs that result in larger energy savings, but declining market share.

a. Mandatory Standards

Mandatory standards such as Minimum Energy Performance Standards, or MEPS, sit at the bottom of the pyramid because they can have essentially 100% compliance, particularly if they are implemented effectively. Part of the paradigm of continual improvement implicit in the pyramid is that mandatory standards are periodically revised to require higher levels of efficiency.

b. Normative Labels

Labels, such as the U.S. Energy Star, or LEED, and the star or letter-grade system, provide a simple way of providing information that encourages consumers to select buildings (or products) with a higher level of energy efficiency than that required by mandatory standards. They can either provide one target level, as most Energy Star programs do, or multiple levels, as LEED and virtually all normative labels in Europe, China, Australia, and other places do.

c. Informative Labels

These labels provide information on the energy consumption of a building or a component thereof without specifying any recommended level. They often encourage even higher levels of efficiency than those required of normative labels.

d Managed Incentives

Managed incentives are programs such as those run by utilities (in most cases), or non-profit organizations or energy agencies (in other cases). They are managed in the sense that the

Administrator has a fixed budget for energy efficiency measures, which is divided into line items for particular end uses or energy-using devices. The incentives are managed to that budget level, thus, if market uptake of a given technology exceeds expectations, the incentive may be terminated or reduced; conversely, an incentive that is not achieving its goals might be increased or changed (or simply dropped as being an assumed failure).

e. Market Transformation

Market transformation programs have the objective to incentivize the next level of energy efficiency: levels that are theoretically available in the sense that products with a superior energy efficiency may be available in the market but are costly and difficult to obtain. These programs often provide targets for manufacturers that assure some level of harmonization so that they can design for these levels of efficiency.

f. Long-Term Incentives

Market transformation has to be premised on the existence of technologies that can meet a given specification. Long term incentive programs aim to overcome the problem that engineering analysis may show a certain energy efficiency is feasible, but no product on the market meets that level. A long-term incentive program assures equipment manufacturers that new, efficient products will receive an incentive for, say, the first three to five years of production from a new line. This guarantee allows the manufacturer to invest in the engineering design, retooling of production lines, and other fixed costs that without the guarantee of the incentive might be too risky.

g. Research and Development for New Technologies and Design Principles

R&D can have two different types of focus: basic research that is often further from the market that is often undertaken with government support or performed by governments themselves, and more market-oriented research and development that may be supported by governments or private companies.

B. General Economic Reforms Focused On Lending And Valuing Investments

1. Reform underwriting to account for energy and transportation costs

Owners of Energy Star homes in the United States have a 32% lower mortgage default rate than owners of conventional homes, and the likelihood of default is linearly related to the energy efficiency rating of a home. Thus, including energy efficiency costs in mortgage underwriting increases the security of home mortgages as well as qualifies buyers to invest more heavily in energy efficiency. At current mortgage rates, a 20-year payback in energy efficiency is cost effective on a cash-flow basis and will qualify the owner for enough additional money to pay for all such efficiency improvements. This kind of reform benefits all parties: the buyer, the national goal for greater energy efficiency, the lender, the investor seeking greater security for income investments, and the government and private infrastructure that responds to defaults.

In many countries it is even more important to count transportation costs in mortgage underwriting because they are so large. As an example, the median price of a home in the U.S. is the low $200,000's, but the cost of transportation to and from the home (assuming it is built in a suburban area, where most new housing has been built for the last half-century) exceeds $300,000 over 30 years. This figure is four times the cost of electricity and natural gas purchased from utilities and about twice the size of the median mortgage loan!

2. Reform appraisals and pro-formas for evaluating buildings

Most commercial buildings are appraised based on the net operating income (NOI) method, where NOI is multiplied by a capitalization rate to derive the value of a building and determine how much money an owner can borrow based upon that appraisal.

But even though energy costs are some 20% of NOI on average, differences in energy costs are not accounted for in the appraisal. This market failure means that while the rest of the building's characteristics are evaluated on the basis of capital investments, energy is considered a cash flow. If building energy ratings were incorporated into capital valuation, energy efficiency measures would be compared with other investments. This would complement the effect of the other policies.

3. Reform utility regulation to align profit motives for utilities with those of their customers

The discussion of managed incentives takes for granted that utilities will be amenable to their own or others' operation of programs to encourage customer energy efficiency. This is not the case in many jurisdictions. Utilities whose revenues are tied to volumetric sales will find that a reduction in sales reduces revenues and profitability, particularly between rate cases. Reformed utility regulation can correct for this factor and also provide financial incentives for successful efficiency (and renewable energy) programs. This adjustment enables utility support of all the rest of the levels of the pyramid.

C. Develop Markets for Whole Building Retrofits for Both Homes and Commercial Buildings

While some experts have suggested a dichotomy between mandatory measures or "sticks" and voluntary or market-based "carrots", the analysis presented here points out the synergies and complementarities between different policies. Each of these policies alone, and the suite of them together, relies on and enhances market forces in an area—building energy efficiency—where the evidence from around the world shows widespread and persistent failures of the market.

Performance-based mandatory codes and standards allow market competition among vendors to meet the energy goals at the lowest cost and to develop and sell innovative technologies. Information on energy efficiency, especially when combined with economic incentives for cutting-edge designs and technologies, encourages risk-taking and its consequent innovation, while allowing the few failures that result to affect only a small fraction of the market.

The combination of these policies drives continual improvement in efficiency and in the level of energy service provided. Examples of laws, regulations, and voluntary approaches for all of these approaches are provided below, with the exception of research and development.

II LAWS AND REGULATIONS OVER THE PAST DECADE

A Codes and Standards

Building energy codes have been the single most effective legal approach to increasing the efficiency of buildings. Energy savings depend in large part on a workable system of code enforcement. This dependence can create difficulties in achieving success, since the inspection infrastructure is usually at the local level while code adoption occurs at the provincial/state level or national level. This means the agency responsible for setting codes with the purpose of achieving energy savings is not the same agency responsible for inspections. Some of this mismatch can be remedied if the adopting agency provides training and other forms of interaction on a regular basis with the enforcing agencies, describing not only how to implement the code but also why it is important to do so.

Efficiency standards for equipment used by building occupants, such as lighting systems, refrigerators, fans, IT equipment, and room air conditioners are also important for achieving high levels of energy savings in buildings. In jurisdictions that have been successful in using codes to achieve energy efficiency in the building shell and mechanical systems, more than half of the energy consumption in buildings comes from devices and end uses other than heating, cooling, ventilation, and water heating.

Energy efficiency technologies and design principles improve over time when policies encourage efficiency. Many countries have regular plans of schedules for updating their energy codes. (*http://ipeec.org/publications/download/id/1962.html - Delivering Energy Savings in Building 3 - Report*) In particular, this applies to Member States of the EU, as well as to model codes used in the United States and Canada.

Energy codes increasingly specify a performance path rather than make prescriptive requirements. Implementation can be coordinated with the informative rating scheme, and depends on developing very detailed and specific rules on how building energy simulation must be done. These rules are usually implemented in large part by software that automates many of the calculations and restricts inputs to parameters that can be inspected and measured.

Successful performance paths generally are based on a comparison between the proposed design and a reference design. In some cases, the reference design is a building identical to the proposed design but which employs the prescriptive approach's values for performance of components such as windows, wall systems, air conditioners and their components, etc. However in some cases, the reference building is based on a less-efficient model and the code requires a percentage savings compared to the reference.

An example of a standard on how energy compliance/energy modelling software should perform is COMNET's Commercial Buildings Energy Modeling Guidelines & Procedures (*http://www.comnet.org/mgp/?purpose=0*), which are based on several globally used international standards such as ASHRAE 90.1.

Jurisdictions that employ a compliance path that compares the proposed design to a reference building and requires compliance software to perform this comparison have enjoyed great success

measured by the percentage of permit applications that adhere to the performance path. They also lead to higher user satisfaction because they give owners the flexibility to trade off some efficiency measures against others. Recently, these tradeoffs have also included credits for on-site renewable energy use, although the size of renewables tradeoffs is often limited.

Many jurisdictions have improved their energy codes substantially over the past decade.

California has updated its energy code three times in the past decade, saving an estimated 15% to 25% or more of pre-existing energy use each time. Most other U.S. states and a few other jurisdictions rely on model codes such as the International Energy Conservation Code (primarily for residential buildings) and ASHRAE Standard 90.1 (exclusively for non-residential buildings and residential high rise buildings), both of which were updated three times with roughly 10% or higher energy savings with each update.

In both forums, the rate of improvement since about 2005 has been much faster than in previous decades. These savings are complemented by appliance and equipment efficiency standards described earlier. The U.S. Congress adopted many significant standards by direct legislation in the latter part of the previous decade, and as a consequence the U.S. Department of Energy issued more standards since 2008 than in the entire period since standards were authorized by Congress in 1978.

With rapid economic growth and urbanization, India has adopted energy efficiency as one of the key pillars of low carbon development. India enacted the Energy Conservation Act in 2001, and the first decade of this millennium saw an enormous interest building efficiency and scaling up of green building space in India. Certified green building space has catapulted phenomenally from under 20,000 square feet in 2005 to over 1.35 billion square feet by 2013[232].

However, there is still an enormous potential given that India is expected to add another 215 billion square feet of building floor area by 2030[233]. The Energy Conservation Building Code (ECBC), the national model code for commercial buildings, was issued in 2007 and since then eight states have adopted it, and over 300 new commercial buildings have become compliant[234]. Two southern states of Andhra Pradesh and Telangana have adapted the ECBC to local conditions and have made it mandatory. Total electricity use doubled from 15% to 30% from 1971 to 2005, but has stayed about the same since then[235].

The California code and ASHRAE 90.1, and to some extent India, have used approaches that harmonize with the COMNET guideline, that establishes a baseline at a level of efficiency lower than provided in the standard itself, and then requires a percentage savings from a table in order to demonstrate compliance. The International Energy Conservation Code adopted a similar approach in 2015, closely harmonizing with the ANSI/RESNET Standard 301.

232 The Hindu: http://www.thehindu.com/features/homes-and-gardens/design/green-money/article4884332.ece
233 Business Standard: http://www.business-standard.com/article/specials/how-india-can-drop-at-least-120-future-power-plants-115122200142_1.html
234 India's INDC submitted to UNFCCC: http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf
235 http://www.business-standard.com/article/specials/how-india-can-drop-at-least-120-future-power-plants-115122200142_1.html

In both cases, the reference standard was developed by a nonprofit organization rather than by a government agency, a fact that recognizes the potential for collaborative relationships between government-established regulations or laws and private-sector standards or policies.

Many jurisdictions adopt and revise energy codes by administrative process, rather than relying on legislative action for each revision cycle. One example of this authorization is the Republic of Korea, which recently adopted legislation on Building Energy related Laws and Regulations, which is summarized in Annex A.

In the past, energy codes regulated energy efficiency only, but recent codes also consider on-site renewable energy. For example, the concept of Zero Net Energy buildings – structures that produce as much on-site renewable energy over the course of a year as they consume – has begun to attract interest among policy-makers and in the real estate industry.

Some codes are beginning to consider requirements on renewables. For example the Republic of Korea has a policy described in Annex B to require new renewable energy in some cases as a step toward the goal of Zero Net by 2015. California has established a policy goal of Zero Net for 2020 in residential buildings and 2030 for commercial buildings, although not all of this savings will be achieved by energy codes. In the United States, the model International Energy Conservation Code for 2015 adopted a performance path based on an Energy Rating Index. The only system currently in compliance with the requirements for this index credits renewable energy production on site on an equal basis to energy saved through efficiency.

An energy code is only as effective as its enforcement. Studies of the energy consequences of real world enforcement are rare. In the United States, the Department of Energy released studies in 2015 that showed that the average new home uses less energy than would be expected by full exact compliance, even in states that do not have complementary incentives or other policies, notwithstanding that a significant number of houses were out of compliance on some features or in terms of total energy use.

The U.S. model code for residential buildings three stories or less, the IECC for 2015, established a new compliance path based on third-party ratings. Since the nonprofit agency that regulates rates, RESNET, has a quality control/quality assurance programs, this path is likely to produce better compliance.

The Republic of Korea's Green Building Development Support Act requires that for new buildings above a certain size an energy conservation plan be submitted along with the application for a building permit. The plan covers mandatory pre-adoption of renewable, passive, and active efficiency options. Through compliance with mandated building energy conservation requirements, and by gradually raising the design criteria year by year, South Korea will achieve a 2025-year goal of all new zero-energy buildings.

B. Normative Labels

Over the past decade, considerable progress has been made on the widespread use of normative standards. Some of the most widely used labels are based on systems administered by NGOs...

The LEED standard, which looks at energy among other environmental aspects of a building, was developed by the U.S. Green Buildings Council, and other similar standards have been developed by green building councils in other countries. This has led the U.S. and global markets to widespread adoption and use of the LEED standard. Its primary intended application is as a rigorous but flexible, market-driven, leadership label that helps entities ranging from real estate players to higher education designers seeking to differentiate their assets as greener and higher performing.

The LEED label is attractive to private sector players because, in many markets, it commands a premium price for real estate sale or lease while also typically realizing savings through systems optimized for more efficient use of energy, water, and materials. Also, it provides more comfortable and appropriately ventilated spaces that can help boost occupant health and performance. This is an example of private businesses providing *de facto* enforcement of a standard that is not legally binding.

LEED is perhaps the widest known green building certification, but green building labels around the world have varying characteristics. For example, some systems are developed by government, while others involve collaboration of private and public sector experts. Some rating systems offer scores, but without a minimum threshold (thus, a building could be rated but not attain a designated performance level). Other differences are more subtle, such as whether the building is compared to the total points in the system, or the points available at that location or for the building type.

While LEED is intended by the USGBC as a voluntary specification or standard, a number of public agencies have adopted LEED criteria as mandatory for public buildings that they own or manage, and a few jurisdictions have adopted LEED criteria into their building codes.

India's Green Rating Integrated for Integrated Habitat Assessment (GRIHA) is another example of a normative rating system that addresses other aspects of environmental quality beyond just energy. See *http://grihaindia.org/. GRIHA has been used to* certify over 250 million square feet of building space in the country.

South Korea legislated the Building Energy Efficiency Certification under the Green Building Development Support Act in November 2015. This certification was effectuated by the Minister of Land and Minister of Energy in February 2016. Also a Building Energy Management system (BEMS) Standard was developed as *KS F 1800-1 Part 1- Specification and Data Mining Procedures* in August 2014.

The U.S. Energy Star[236] specification for new homes typically has been based on incrementally better energy efficiency than the energy code—the stronger of the model national code or the adopted state code in each state. It has achieved a significant market share, and has increased steadily in stringency over the years. It appears to have facilitated the acceptance by builders of new technologies and practices that later were adopted by the model energy codes. Energy Star specifications generally have only one level of achievement that is recognized.

The Energy Star standard for commercial buildings is unlike other standards in that it is based on operational ratings rather than asset ratings. This approach therefore focuses primarily on existing buildings, since one cannot generate an operational rating for a building that has not yet been

236 7See also, Infra, note 4.

occupied. The normative label approach has experienced large and growing market acceptance, and its methods have been used in mandatory energy labelling in several U.S. cities.

The Australian Commercial Buildings Directive (CBD)[237] labels employ a hybrid of both operational and asset ratings, and has multiple levels of rating from no star to six stars generally in half-star increments[238]. The star rating used by the CBD program can be considered a normative label, but the program also is an informative labelling program. A distinctive feature of the CBD program is that it attempts to distinguish overall building energy use that is controlled by the landlord or manager from energy use in tenant spaces that are under tenant control.

The European Energy Performance of Buildings Directive has resulted in letter-grade normative labels. These include either or both asset ratings and operational ratings, depending on which EU Member State is implementing the policy.

Note that operational ratings include the effects not only of efficiency, but of behaviour—both the level of energy services provided and the quality of operations and maintenance. South Korea's recent laws established requirements for normative labelling and rating and on indoor temperature and on energy management system hardware to promote conservation:

C. Informative Labels

Informative labels can be asset ratings or operational ratings. Both have their advantages and disadvantages. Asset ratings measure energy efficiency and operational ratings are broader measures of energy performance but are not necessarily related to efficiency.[239] Asset rating labels are already required and in use in Russia, Kazakhstan, Uzbekistan, Kyrgyzstan, in the Republic of Korea, many member states of the European Union, and in a growing number of North American cities, including New York. Russia was one of the first jurisdictions to require informative labels; both asset ratings and operational ratings are required. However, an effective enforcement mechanism for the operational rating has been lacking. In Europe the EPBD[240]also includes informative labels.

In the U.S. market the Residential Energy Services Network (RESNET) label[241]for new home efficiency has grown to about a 38% market share of all single family homes sold in 2015 – despite a lack of mandates or even financial incentives in most cases. The average rated home used about 10% less energy than the most stringent model code, which was only enforced in a handful of jurisdictions. Not only is the level of performance higher than that of the most advanced model codes, it is also generally higher than the Energy Star normative level.

RESNET tracks the distribution function of ratings by state and over time. This data can be used to inform future energy code changes. The RESNET standard credits on-site generation, both from combined heat and power (CHP) and solar. However, these are only minimally used features of the

237 Overview of the Program, COMMERCIAL BUILDING DISCLOSURE: A NATIONAL ENERGY EFFICIENCY PROGRAM, AUSTRALIAN GOVERNMENT, http://cbd.gov.au/overview-of-the-program (last visited Mar. 8, 2016).

238 P. Bannister, NABERS: Lessons from 12 Years of Performance Based Ratings in Australia, Twelfth Int. Conference for Enhanced Building Operations, Manchester, UK, Oct. 2012, https://oaktrust.library.tamu.edu/bitstream/handle/1969.1/148920/ESL-IC-12-10-28.pdf?sequence=1&isAllowed=y.

239 Goldstein & Eley, supra...

240 See: http://www.epbd-ca.eu/.

241 See: http://www.resnet.us/energy-rating.

system. As of 2012-2015: only 1.4% of rated homes used solar, and virtually none used CHP. This evidence supports the value of informative labels as enhancing efficiency even in the absence of other policies. But labels will be even more effective as part of a suite of policies.

D. Managed Incentives

Managed incentives are a large and growing part of the efficiency program options in North America, and collectively have a budget approaching US$10 billion. The ability of utilities to recover revenues for such programs and to maintain shareholder satisfaction as they reduce electricity and gas sales depend on regulatory approval of tariffs and investor incentives policies in the case of investor-owned utilities. These legal regulatory decisions are made at the state or provincial level in North America but nationally in many countries. For the case of government-owned utilities the agency itself can decide to promote efficiency and self-regulate in an analogous fashion.

E. Market Transformation

North American program administrators banded together some 20 years ago to form the Consortium for Energy Efficiency, which establishes competitively fair specifications for advanced levels of energy efficiency that voluntarily can be adopted by program administrators throughout North America.

In South Korea, the government has promoted transformation of the energy efficiency building market by forming a consortium of several energy related agencies, institutions, universities, and industries. Note that these programs involve government as a partner rather than a regulator.

F. Long-Term Incentives

U.S. examples of long-term incentives include tax incentives provided to owners of efficient new homes and commercial buildings. The new homes tax incentives adopted by the U.S. Congress in the Energy Policy Act of 2005 were set at a level that had not been achieved by more than a couple of hundred homes nationwide. The commercial incentives were set at levels that represented less than 0.5% of new buildings in California, which had much more activity in all of the programs described above than other U.S. states. Over the next four years, the level of market share of compliant homes rose steadily to the level of 10% of the market, proving the validity of the approach. In South Korea, there is an incentive of BEMS installation costs 3-10% tax deduction (Restriction of Special Taxation Act Amendments Article 25 (2), '14 .3)

III. GENERAL ECONOMIC REFORMS FOCUSED ON LENDING AND VALUING INVESTMENTS

A. Reform Underwriting to Account for Energy and Transportation Costs

These reforms are very simple in principle. One of the key factors considered by lenders in determining mortgage qualification is the ratio of income to monthly loan service, insurance, and tax payments. It would be straightforward to adjust the payment total downward by the difference between that home's annual costs for utilities and transportation relative to a reference home. In the case of

energy, the applicant's bills would be calculated from an asset rating, which already predicts costs, and a typical, or worst-5 percentile, reference building of the same size. For transportation the U.S. Department of Housing and Urban Development maintains a website that, with a few simple rules, could establish both the applicant's expected costs and those of a reference house.

Notwithstanding the benefits of such a reform—lower loan defaults, encouragement of more new construction in locations that the newer generation of buyers and renters prefer (more walkable, transit-served neighbourhoods), reduced costs to consumers, reduced pollution, encouragement of home ownership, limitations on the disruptions caused by gentrification by allowing people of more modest means to own their dwellings, virtually no progress has been made on this issue anywhere in the world.

B. Reform Appraisals and Pro-Formas for Evaluating Buildings

A number of nonprofit organizations in the United States are working towards these goals, with some progress to date. Appraisals now may contain a so-called "green addendum" that looks at energy efficiency. But the incorporation of energy performance data into the financing and appraisal processes is still incomplete and rare in practice.

Although it is not hard to map out a theory of how to promote energy efficiency building retrofits, both in terms of savings potential and the measures most likely to achieve the potential at low cost and in terms of the policies and incentive mechanisms proposed, it is hard to find fully successful programs that operate on a mass scale. The Global Building Performance Network has developed a tool to compare retrofit programs across leading jurisdictions in the EU and the US that is based on rankings in terms of a number of criteria. None of the programs scored near the top grade in any criterion, much less in all. (See:http://www.gbpn.org/databases-tools/purpose-renovation-policy-tool#)

Notwithstanding this paucity of large-scale successes, there are two examples of small-community-scale projects that have succeeded in achieving 85% market share of all residential buildings over a three-year period. Both were run by U.S. utilities, and both required 100% payment by the utility to achieve this high share. The utility did all the work as well as providing all the funding; they hired the auditors and the contractors, and inspected the work after completion.

So it seems safe to conclude that *deep retrofits (~30-50% savings or more) are possible quickly with universal acceptance*, but (to date) only at the cost of 100% subsidy. The challenge is to create a more equitable cost share.[242]

242 Additional References: International Energy Agency. Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings. Jens LAUSTEN. March 2008
Northwest Energy Efficiency Alliance and New Buildings Institute. A Search for Deep Energy Savings. Cathy Higgins. August 2011. http://newbuildings.org/meta-report-search-deep-energy-savings.

ANNEX A :BUILDING EFFICIENCY LAWS IN SOUTH KOREA

Framework Act on Low Carbon, Green Growth (2010.01; Modified in 2013.10)

South Korea developed Framework to promote the development of the national economy by laying down the foundation necessary for low carbon, green growth and by utilizing green technology and green industries as new engines for growth, so as to pursue the harmonized development of the economy and environment and to contribute to the improvement of the quality of life of every citizen and the take-off to a mature, top-class, advanced country that shall fulfil its responsibility in international society through the realization of a low-carbon society.

Korea: Framework Act on Low Carbon, Green Growth

Article 8 (Relationship with other Acts)

1) This Act shall take **precedence over other Acts** in application to low carbon, green growth. (2).....

Article 54 (Expansion of Green Buildings)

The Government shall establish and implement policies, such as a grading system for green buildings and other systems, in order to expand buildings with high efficiency in the use of energy, a high ratio of new and renewable energy, and minimum emission of greenhouse gases (hereinafter referred to as "green buildings"). (2) The Government shall **set and manage medium and long-term and periodic goals for buildings that meet or excel the standards prescribed by Presidential Decree in order to reduce the consumption of energy and the emission of greenhouse gases in buildings.** (3) The Government shall prepare and implement measures and standards for each stage of design, construction, maintenance, dismantling, etc., such as enhancing design standards and the procedures for permits and reviews, in order to minimize consumption of energy and resources and reduce emission of greenhouse gases in the entire process of design, construction, maintenance dismantling, etc. of buildings. (4) The Government shall implement **energy inspections**, energy saving programs under **Article 25 of the Energy Use Rationalization Act,** and activities for reducing greenhouse gases through such programs so that existing buildings can be converted into green buildings. (5) The Government may require the installation and management of intelligent meters for controlling and reducing consumption of energy such as power consumption, etc. in newly constructed or renovated buildings. (6) The Government shall apply the measures under paragraphs (1) through (5) to buildings of central administrative agencies, local governments, public institutions, educational institutions, etc. specified by Presidential Decree so that they can play the role of leaders toward green buildings and shall inspect and control their implementation. (7) The Government shall

endeavour to increase or supply green buildings when developing a new city or re-developing cities on a scale not smaller than that prescribed by Presidential Decree. (8) The Government may, if necessary for expanding green buildings, provide support, such as **financial support, tax abatement or exemption,** and other measures as prescribed by Presidential Decree.

Additional information of Framework Act and Enforcement of Decree are available at Ministry of Government Legislation, http://www.moleg.go.kr/english/.

NOTE: The laws and regulations are in order of the Framework Act, the Enforcement Decree, and the Enforcement rule in South Korea.

Korea: Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy.

This Act is aim to the promotion of technological development, use and distribution of new energy and renewable energy, and the activation of the new energy industry and the renewable energy industry, and by promoting the stable supply of energy, environment-friendly conversion of the energy structure, and the reduction of greenhouse gas emissions.

Article 12 (Investment Recommendation and Mandatory Use, etc. of New and Renewable Energy)

…(2) Where the Minister of Knowledge Economy deems it necessary to facilitate the use or distribution of new and renewable energy, he/she may require any of the following persons to mandatorily install new and renewable energy facilities in a building newly built, expanded or remodelled by such person in a certain percentage of the total project cost, as prescribed by Presidential Decree

Article 2 (Definitions)

1) The term "new energy and renewable energy" (hereinafter referred to as "new and renewable energy") means energy converted from existing fossil fuels, or renewable energy, including sunlight, water, geothermal, precipitation, bio organisms, etc., which falls under any of the following items: (a) Solar energy; (b) Bio energy converted from biological resources which fall within the criteria and scope prescribed by Presidential Decree; (c) Wind power; (d) Water power; (e) Fuel cells; (f) Energy from liquefied or gasified coal, and from gasified heavy residual oil which falls within the criteria and scope prescribed by Presidential Decree; (g) Marine energy; (h) Energy from waste which falls within the criteria and scope prescribed by Presidential Decree; (i) Geothermal energy; (j) Hydrogen energy; (k) Energy prescribed by Presidential Decree, other than petroleum, coal, nuclear power or natural gas.

Additional information of Framework Act and Enforcement of Decree are available at Ministry of Government Legislation, http://www.moleg.go.kr/english/.

Green Building Development Support Act (2012.02; Modified in 2014.05)

The Act introduces the requirement that owners and lessors of certain buildings attach a copy of the building's energy efficiency rating report to any agreement for the sale or lease of such building as set forth in the Table below. There is an administrative fine of up to KRW 20 million if failure to do so. In addition, a copy of such report is required to be attached to the Real Estate Transaction Report, which must be filed prior to the closing of the sale of any building.

Korea: Framework Act on Low Carbon, Green Growth

Article 8 (Relationship with other Acts)

(1) This Act shall take precedence over other Acts in application to low carbon, green growth. (2).....

Article 54 (Expansion of Green Buildings)

(1) The Government shall establish and implement policies, such as a grading system for green buildings and other systems, in order to expand buildings with high efficiency in the use of energy, a high ratio of new and renewable energy, and minimum emission of greenhouse gases (hereinafter referred to as "green buildings"). (2) The Government shall set and manage medium and long-term and periodic goals for buildings that meet or excel the standards prescribed by Presidential Decree in order to reduce the consumption of energy and the emission of greenhouse gases in buildings. (3) The Government shall prepare and implement measures and standards for each stage of design, construction, maintenance, dismantling, etc., such as enhancing design standards and the procedures for permits and reviews, in order to minimize consumption of energy and resources and reduce emission of greenhouse gases in the entire process of design, construction, maintenance dismantling, etc. of buildings. (4) The Government shall implement energy inspections, energy saving programs under Article 25 of the Energy Use Rationalization Act, and activities for reducing greenhouse gases through such programs so that existing buildings can be converted into green buildings. (5) The Government may require the installation and management of intelligent meters for controlling and reducing consumption of energy such as power consumption, etc. in newly constructed or renovated buildings. (6) The Government shall apply the measures under paragraphs (1) through (5) to buildings of central administrative agencies, local governments, public institutions, educational institutions, etc. specified by Presidential Decree so that they can play the role of leaders toward green buildings and shall inspect and control their implementation. (7) The Government shall endeavor to increase or supply green buildings when developing a new city or re-developing cities on a scale not smaller than that prescribed by Presidential Decree. (8) The Government may, if necessary for expanding green buildings, provide support, such as financial support, tax abatement or exemption, and other measures as prescribed by Presidential Decree.

Additional information of Framework Act and Enforcement of Decree are available at Ministry of Government Legislation, http://www.moleg.go.kr/english/.

The related act, enforcement decree, and enforcement rule are available at *http://www.law.go.kr/main.html* in Korean only.

Energy Use Rationalization Act (1996.12; Modified 2015.01)

The purpose of this Act is to contribute to the sound development of the national economy, the promotion of the national welfare, and the international efforts to minimize the global warming by realizing the stability of the demand and supply of energy, increasing the rational and efficient

utilization of energy, and reducing the environmental damage caused by the consumption of energy.

There is a modification in March of 2013 for designation of Heating and cooling temperature restriction, etc. as in the box.

Korea: Energy Use Rationalization Act

Article 36-2 (Designation of Heating and Cooling Temperature Restriction Buildings)

Article 36-3 (Measures for the Maintenance and Management of Heating and Cooling Temperature Restriction Buildings)

Additional information of Framework Act and Enforcement of Decree are available at Ministry of Government Legislation, *http://www.moleg.go.kr/english/*.

CHAPTER 4E
ROAD TRANSPORTATION EFFICIENCY

Adrian J Bradbrook**

1. INTRODUCTION

Road transport causes vast environmental, planning and sociological problems in modern society. The increasing dominance of motor vehicles in recent decades as a means of transport has caused poor air quality in urban areas, deteriorating quality of life in inner city areas as a result of traffic congestion and the decline of public transport, reliance on insecure oil supplies, enormous expenditures to protect oil production and transport and transportation's major contribution to the hazards of climate change. In the developed countries, perhaps the greatest effect of motor vehicle usage has been on the design of major towns and cities.

The general availability of cars has resulted in the creation of sprawling outer suburbs, poorly serviced by other forms of transport and services, where life is effectively impossible without motor vehicles. Many large cities in developing countries suffer the same fate and the problems will proliferate unless remedial action is taken. As developing country economies grow, they are rapidly building and acquiring more motor vehicles, thus incrementally increasing the world demand for petrol.

Road transport represents one of the greatest areas of challenge for energy efficiency. Approximately 50 per cent of the world's oil production is consumed by road vehicles. In other sectors of the economy, oil has been partially or totally been replaced by other fuels in recent years. Oil is declining today as a source of home or office heating, and has been largely phased out in most of its commercial and industrial uses, including power generation. Transport is the one sector where oil has not yet been effectively substituted.

Various forms of fuel substitutes for oil have been developed, such as ethanol, liquefied petroleum gas (LPG) or compressed natural gas (CNG), but each of these options appears to suffer from various disadvantages or inconveniences. In the long term, hydrogen may prove to be a viable substitute vehicle fuel, but even ardent proponents of a hydrogen economy concede that this will not occur in the near future. The manufacture of hydrogen from fossil fuel, the usual source today, removes most of the environmental advantages of hydrogen. In addition, the expense of the equipment needed to extract the hydrogen, make it available to vehicles in containers of manageable size and security from explosions in traffic accidents, and create a national supply system is simply prohibitive.

Electric vehicles are newly in ascendance. They significantly decrease vehicle pollution and climate change problems, much more so as electricity is produced from renewable energy rather than fossil fuels. As their costs decrease and batteries improve allowing greater distances to be driven between battery recharging, they may become the vehicles of the future.

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In the context of enhancing energy efficiency in the transport sector, national laws exist in some countries regulating the motor vehicle industry and providing fiscal incentives. The various possibilities will be examined under each of these headings.

II. THE OPTIONS FOR REGULATING THE MOTOR VEHICLE INDUSTRY

A. Fuel Economy Standards for Vehicle Manufacturers

This proposal relates to the introduction of fuel economy standards for all domestically sold passenger cars, four-wheel drive vehicles and light commercial vehicles. This could be achieved by voluntary agreement between the government and vehicle manufacturers, but if such negotiations fail to achieve acceptable targets, a regulatory mechanism can be developed and introduced by national legislation.

Laws requiring vehicle manufacturers to ensure that their vehicle fleet conforms in any given year with government-prescribed maximum fuel consumption figures are in operation in the United States, Canada, Japan, India and China.

1. Canada

The Canadian legislation, which was similar to that in the United States, was not initially promulgated into effect in light of a voluntary code of practice between government and industry (Motor Vehicle Fuel Consumption Standards Act (MVFCSA), R.S. 1985, c M-9; available at **http://laws-lois.justice.gc.ca/eng/acts/M-9/)**. In November 2007, however, Canada's voluntary code of practice was converted into mandatory fuel economy standards through the implementation of the MVFCSA. This fuel consumption program was later replaced with targets aimed at limiting total greenhouse gas emissions (GHGs) from passenger automobiles and light trucks in 2010. These standards are progressive. The most recent standards can be found here: *http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-201/*.

Explanatory links: **http://www.transportpolicy.net/index.php?title=Canada:_Light-duty:_Fuel_Consumption_and_GHG**, **https://www.unece.org/fileadmin/DAM/trans/doc/2011/wp29/WP29-153-13e.pdf**

2. United States

The United States' standards are contained in the Corporate Average Fuel Economy (CAFÉ) standards, enacted in 1975 pursuant to the Energy Policy and Energy Conservation Act. The legislation has since been consolidated with other legislation affecting motor vehicles and forms Title V of the Motor Vehicle Information and Cost Savings Act. It is located in Title 49 of the US Code (available at **https://www.law.cornell.edu/uscode/text/49/subtitle-VI/part-C/chapter-329**).

In outline, the CAFÉ system involves the establishment by the government of a precise average fuel economy standard or standards that each vehicle manufacturer must attain each year in respect of all vehicles produced during that year. The CAFÉ figure for each manufacturer takes into account the fuel economy of each class of vehicle produced and is weighted to take account of the number

of vehicles produced in each class in each year. Two separate standards were initially introduced, one for passenger vehicles and one for light trucks.

These two CAFÉ standards have recently split both 'passenger vehicles' and 'light trucks' into further categories based on a vehicle's 'footprint,' calculated based on a vehicle's wheelbase and average track width. In 2016, the agreed standard for passenger vehicles with a footprint of less than 41 square feet (3.8m) was 41 miles per gallon, and for those with a footprint of less than 55 square feet, 31 miles per gallon. For light trucks with a footprint of less than 41 square feet the standard is 34 miles per gallon, and for those with a footprint of less than 75 square feet it is 24.5 miles per gallon. The standards become more stringent each year, and have been agreed upon up to the year 2025 (see Energy Independence and Security Act 2007, s 102).

Links:www.nhtsa.gov/staticfiles/rulemaking/pdf/2017-2025_CAFE-GHG_Supplemental_NOI07292011.pdf (for table of standards);

(explanatory): https://en.wikipedia.org/wiki/Corporate_Average_Fuel_Economy

A major loophole in the CAFÉ standards was created when the US government decided to classify large sport utility vehicles (SUVs) and light trucks as passenger vehicles. This action largely nullified the very strong petrol savings from the CAFÉ standards.

The most significant feature, of the statute, United States CAFÉ system, Title V of the Motor Vehicle Information and Cost Savings Act, 49 U.S.C. § 32904, full text at *http://www4.law.cornell.edu/uscode/49/32901*, is:

The determination of each manufacturer's CAFÉ figure is stipulated in 49 USC 32904(a)(1) as follows:

The CAFÉ system is commonly referred to as one of "harmonic averaging". The averaging is the reciprocal of the average of the gallons per mile used by each vehicle in the fleet. The effect of this is that the system is more onerous on manufacturers than might appear at first glance. To put it simply, the CAFÉ figure for two vehicles, one rated at 20 miles per gallon and the other at 40 miles per gallon will not be 30 miles per gallon, as might be expected, but 26.7 miles per gallon. The use

(1) The Administrator of the Environmental Protection Agency shall calculate the average fuel economy of a manufacturer subject to –:

(A) section 32902 (a) of this title in a way prescribed by the Administrator; and

(B) section 32902 (b)&(d) of this title by dividing –

(i) the number of passenger automobiles manufactured by the manufacturer in a model year; by

(ii) the sum of the fractions obtained by dividing the number of passenger automobiles of each model manufactured by the manufacturer in that model year by the fuel economy measured for that model

Full text at *https://www.law.cornell.edu/uscode/text/49/32904*

of this system provides the most accurate measure of the fuel consumption of the fleet. Thus, in the above illustration, if the two cars were each driven 10,000 miles, they would jointly consume 750 gallons of petrol, thereby achieving an aggregate fuel consumption figure of 26.7 miles per gallon.

Pursuant to 49 USC 32904(b), there is a two-fleet rule. This means that there are in effect two CAFÉ figures in operation, one for cars manufactured locally in the US and one for cars produced overseas. A vehicle is classed as an overseas produced vehicle if it fails to meet the 75% of local content requirement. The two-fleet rule was added at the insistence of trade unions that feared that CAFÉ standards would lead to US car manufacturers producing all their cars overseas. An exemption from the normal CAFÉ requirements (contained in s 32902(d)) may be provided by the Secretary of Transport on application by a manufacturer who manufactured (whether in the US or not) fewer than 10,000 vehicles per year in the model year two years before application, if that manufacturer manufactured (whether in the US or not) fewer than 10,000 models in that model year (www.law.cornell.edu/uscode/text/49/32902).

A system of carry-forward credits enables manufacturers to comply with CAFÉ regulations at a level less than their prescribed fuel efficiency standard for any given year. By 49 USC 32903(a), manufacturers may earn a credit by exceeding the standard set in any year. This credit can then be applied against the standard for any of the three consecutive years before the model year for which the credits are earned, or any of the five consecutive years after the model year. (s 49 32903(a); https://www.law.cornell.edu/uscode/text/49/32903).

3. Japan

The Japanese system of fuel efficiency dates from a 1992 report of the Study Group on Automobile Fuel Efficiency Improvement, established by the Ministry of Transport and the Ministry of Trade and Industry.[243]

The Law Concerning the Rational Use of Energy (available at *http://spider.iea.org/pubs/newslett/eneff/jp.pdf*) was passed in 1979. The Act authorises regulatory fuel efficiency standards for passenger vehicles, among other measures aimed at improving energy efficiency across different sectors and industries.

To date, the Act has been amended six times. In 1998, amendments to Chapter 6 of the Act introduced the 'Top Runner Program' for automobiles and other energy-consuming machinery. The program sets efficiency standards for such products using the energy efficiency achieved by the best, or 'top' model of that product available on the market, also taking into account prospects of technological development in that period. Manufacturers comply if the weighted average fuel efficiency of all products sold in that year achieve the enforcement of the program is achieved through a system of rewards for compliance in the form of product labelling, which is achieved through a system of rewards generally considered to be a competitive advantage in sales, and the blaming and shaming of manufacturers who do not comply. The program has since expanded to cover a wider range of electrical appliances, for example microwave ovens and DVD recorders.

243 See Ministry of Transport (Japan), M.O.T. News, No 54 (March 23, 1993).

When determining fuel efficiency standards for automobiles, vehicles are divided into categories based on vehicle weight, rather than vehicle footprints in the US system. The 2020 targets divide vehicles into 15 weight classes, ranging from 740kg and below to 2271kg and above. The 2015 standards required that manufacturers meet the efficiency standard for individual weight classes. However, the 2020 targets are for the average fuel economy of a manufacturer's entire fleet.

References:

http://www.iea.org/policiesandmeasures/pams/japan/name-24362-en.php

http://www.climatepolicy.jp/thesis/pdf/09035dp.pdf

http://www.eccj.or.jp/top_runner/pdf/tr_passenger&freight_vehicles_gasoline&diesel_mar2007.pdf (2015 standards)

http://www.eccj.or.jp/top_runner/pdf/tr_passenger_vehicles_dec2011.pdf (2020 standards)

4. India

Section 14 of the Energy Conservation Act 2001 states:

14. The Central Government may, by notification, in consultation with the Bureau, —

(a) specify the norms for processes and energy consumption standards for any equipment, appliances which consumes, generates, transmits or supplies energy;

(b) specify equipment or appliance or class of equipment or appliances, as the case maybe, for the purposes of this Act;

Full text at *https://www.law.cornell.edu/uscode/text/49/32904*

Section 18 goes on to state:

18. The Central Government or the State Government may, in the exercise of its powers and performance of its functions under this Act and for efficient use of energy and its conservation, issue such directions in writing as it deems fit for the purposes of this Act to any person, officer, authority or any designated consumer and such person, officer or authority or any designated consumer shall be bound to comply with such directions.

Explanation – For the avoidance of doubts, it is hereby declared that the power to issue directions under this section includes the power to direct –

(a) regulation of norms for process and energy consumption standards in any industry or building or building complex; or

(b) regulation of the energy consumption standards for equipment and appliances.

Using this power, on January 30 2014 the Indian Government passed regulation D. L.-33004/99, which creates fuel efficiency standards for light-duty motor vehicles which come into effect in April 2016. The standards apply to vehicles under 3,500kg with fewer than nine seats and will operate between 2016 and 2021.

Manufacturers must comply with a weight-based corporate average system. Although the standard is ultimately a CO2 emissions standard, it is calculated using the 'average fuel consumption standard' for a manufacturer. The exact formula can be found at: http://www.egazette.nic.in/WriteReadData/2014/158019.pdf

References:

Energy Conservation Act 2001: *http://powermin.nic.in/upload/pdf/ecact2001.pdf*

Regulation: *http://www.egazette.nic.in/WriteReadData/2014/158019.pdf*

http://transportpolicy.net/index.php?title=India:_Light-duty:_Fuel_Consumption

http://www.theicct.org/sites/default/files/info-tools/pvstds/India_PVstds-facts_dec2014.pdf

5. China

The first Chinese fuel consumption standards were introduced by 'Limits of Fuel Consumption for Passenger Cars' (National Standard GB 19578-2004), which established the first two phases of the Chinese program. The National Standards prescribe standards of fuel consumption, rather than fuel efficiency. Phases I (2005-6) and II (2008-9) differ from other described national standards in that instead of allowing manufacturers to meet an average standard across an entire fleet, individual vehicles must meet fuel consumption standards for its weight class. There are 16 weight classes, which are further divided into separate standards for automatic and manual transmissions. Phase II increased the stringency of fuel consumption standards imposed by Phase I.

Phase III came into effect in 2012 with the creation of National Standard GB 27999-2011, which both tightened the fuel consumption standards of Phase II and created a corporate-average fuel consumption target. The CAFC target, currently set at 6.9L/100km[244], must be complied with by manufacturers separately and in addition to individual vehicle standards. Phase IV, contained in National Standard GB GB19578-2014, further tightened fuel consumption standards for individual vehicles and set a flexible target of 5L/100km for average fuel consumption over manufacturers' fleets by 2020.

References:

Main: http://transportpolicy.net/index.php?title=China:_Light-duty:_Fuel_Consumption

http://www.un.org/esa/dsd/resources/res_pdfs/csd-19/Background-paper3-transport.pdf

244 http://www.gov.cn/zwgk/2012-07/09/content_2179032.htm

B. Fuel Consumption Labelling

The majority of countries with legislation on consumer protection have legislated in recent years to provide a compulsory system of labelling for commonly-used domestic electric appliances, such as refrigerators, heaters, air conditioners, washing machines, dishwashing machines and clothes dryers. The use of labelling for fuel consumption statistics of new motor vehicles is found less commonly. The major illustrations of such legislation are in the United States, Europe and Australia.

The US legislation is contained in Title 49 section 32908 of the US Code (*https://www.law.cornell.edu/uscode/text/49/32908*). The European Parliament has adopted a mandatory Directive (1999/94/EC) relating to the availability of consumer information on fuel economy and CO2 emissions in respect to the marketing of new passenger cars (**http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31999L0094).** The Australian fuel labelling law is contained in Australian Design Rule (ADR) 81/01

(https://www.comlaw.gov.au/Series/F2005L04084). As from March 2011, the Australian Design Rule also applies to pure electric and hybrid vehicles.

Labelling for fuel consumption assists in promoting consumer confidence in motor vehicles. It enables customers to make an informed choice between various competing products, provides an incentive to manufacturers to design more energy efficient vehicles, and labelling promotes energy conservation generally.

The proposal to introduce a mandatory system of fuel consumption labelling has been criticised on the basis that the fuel consumption figures achieved under test conditions could never be achieved under road conditions, and that this would lead to a rash of complaints against the manufacturers. While it is true that road conditions significantly increase fuel consumption over test conditions, the figure or figures displayed on the label could be modified to take account of this fact. This occurs in the United States where, under the current legislation (cited above); two fuel consumption figures are displayed, one for fuel consumption in city conditions, and one for fuel consumption in highway conditions. New labels prominently feature a combined fuel economy rating (as well as separate city and highway ratings), as well as a fuel consumption rating. *http://www3.epa.gov/carlabel/documents/420f11017a.pdf.*

These figures are calculated by discounting the figure for city driving by 10 per cent from the figure obtained during test conditions, and by discounting the figure for highway driving by 22 per cent. Any overall fuel consumption figure displayed must be calculated using the discounted figures above and on the assumption that the vehicle will be driven 55 per cent under city conditions and 45 per cent under highway conditions.

Labelling legislation usually prescribes the exact form of the label, preferably in the regulations attached to the enabling statute. As the labelling system is designed as a consumer protection and information measure, it is essential that the label be carefully designed so as to disclose the relevant amount of information in a manner that is easy to understand. Thus a six-star system, currently used in many countries in labelling for appliance energy efficiency, including Australia, is arguably too vague as more exact information is required. Conversely, the label currently used in the United States may be considered to be too difficult to comprehend in that the same label also gives information on

the price of the standard vehicle and all optional equipment, together with a mass of miscellaneous information including the vehicle identification number, the dealer number, the final assembly point, the method of transportation, and the vehicle description. It is quite likely that the fuel consumption figures can be overlooked by consumers in the overall mass of information.

An effective form of label would consist simply of fuel consumption information and, like the US label, would give separate figures for city and highway fuel consumption, appropriately discounted from the figures obtained from standard test conditions. For comparative purposes the label could indicate the range of fuel consumption figures obtained by passenger vehicles and light trucks generally. It is further suggested that a global figure for the estimated annual fuel cost for the vehicle or the amount of money saved, which forms part of the US label, not be included in any new label. The estimated fuel cost is considered by the writer to be too vague and misleading, from a consumer perspective, as the figure will depend very largely on the number of kilometres driven in a given year. This will be unknown in each case and will vary greatly between consumers and as petrol prices fluctuate.

As an alternative to introducing a system of compulsory fuel consumption labelling for motor vehicles, it would be possible to legislate for other point-of-sale material such as a system of display charts and placards indicating fuel consumption statistics of various types of vehicles on the walls of dealers' showrooms. This has been proposed in Australia by vehicle manufacturers. While such a proposal would represent an improvement on the present position, from the perspective of consumer information and protection it would seem to be a less satisfactory alternative.

1. Brazil

Since 2009 Brazil has employed a voluntary system of fuel efficiency labelling. Vehicles are divided into eight categories according to either vehicle footprint size or vehicle type: pick-up, off road, sports, large, medium, and compact or subcompact. The label features a ranking which informs consumers of the vehicle's comparative fuel efficiency against other models in the same category, starting from 'A', being the most fuel efficient, and 'E', being the least efficient.

2. Singapore

In 2013 Singapore's Land Transport Authority introduced fuel economy labels which feature both the fuel and CO2 consumption of the vehicle. The label also contains a sliding scale used to compare a particular vehicle's fuel economy to others on the market.

3. China

Chinese fuel consumption labels have been mandatory since 2010 and feature three separate rates of fuel consumption, for urban driving conditions, suburban conditions, and 'integrated operating conditions' (featured most prominently).

4. India

The Indian Bureau of Energy Efficiency runs a voluntary program of fuel consumption labelling. Labels feature a vehicle's combined fuel consumption and the vehicle's star ranking, on a scale of one to five stars. Featured less prominently is the vehicle's ranking on a comparative scale.

For general information on this subject, see

*http://transportpolicy.net/index.php?title=Global_Comparison:_Fuel_Efficiency*_Labeling, which includes a comparison of different countries' labelling systems.

C. Fuel Consumption in Model-Specific Vehicle Advertising

This idea originated in Australia, where the Ecologically Sustainable Development Transport Working Group proposed that all advertising in relation to the sale of new vehicles make specific reference to each vehicle's fuel consumption statistics.[245] This proposal was justified in four ways: first, it would raise the public awareness of fuel consumption as a factor in the purchase decision; secondly, it would put fuel consumption information before the prospective buyer at an early stage in the purchasing process; third, sufficient fuel consumption data exists, so that the need for additional testing costs is avoided; and fourthly, it ranks fuel efficiency alongside other attributes in the overall image of desirability of ownership delivered by the advertisement.

The Australian government has to date not adopted this legislative proposal. However, a similar measure has been introduced in the Republic of Korea.

The Rational Energy Utilization Act 1995, article 15(4), states:

"If a manufacturer, importer or distributor of the efficiency indicated machinery and materials, makes any advertisement of the efficiency indicated machinery and materials using such advertisement media as prescribed by the Ordinance of the Ministry of Trade, Industry and Energy, he shall include the energy consumption efficiency or quantity consumed, and the method of use in the contents of the advertisement."

Full text available at: *www.unescap.org/esd/energy/publications/compend/ceccpart4chapter8.htm.*

5. Europe

In Europe, EU Directive 1999/94/EC (as amended by 2003/73/EC), available at http://eur-lex.europa.eu/legal-content/CS/TXT/?uri=uriserv:l32034 states that the European Union requires dealers in new passenger cars to provide potential buyers with useful information on these

245 Ecologically Sustainable Development Working Groups, Final Report – Transport, Australian Government Publishing Service, Canberra, 1991.

vehicles' fuel consumption and CO2 emissions. This information must be displayed on the car's label, on posters and other promotional material, and in specific guides. The UK incorporated these requirements into the Passenger Car (Fuel Consumption and CO2 Emissions Information) Regulations 2001.

Analogies can be drawn with legislation controlling advertising in other industries in support of the type of law reform under consideration. Perhaps the closest analogy is with tobacco advertising, which is subject to many and varied controls. The controls in some cases expressly prohibit corporations from publishing in a print medium an advertisement for smoking or for the use of tobacco products. Interestingly, in some jurisdictions, tobacco advertisements are allowed, but are subject to the inclusion of a health warning in prescribed terms (see, for example, Canada: Tobacco Products Labelling Regulations (Cigarettes and Little Cigars, 2011-177/page-3.html#h-4) s 12; http://laws-lois.justice.gc.ca/eng/regulations/SOR-; New Zealand: Smoke-Free Environments Act 1990, s 29AA; www.legislation.govt.nz). Food advertising legislation is also relevant by analogy. Under legislation in many jurisdictions, it is an offence to publish, or to be a party to the publication of, an advertisement that falsely describes any food that is likely to mislead as to the nature, substance or quality of the food (see, for example, Victoria, Australia: Food Act 1984, s 13; www.austlii.edu.au/au/legis/vic/consol_act/fa198457/)

II. FINANCIAL MECHANISMS USED TO IMPROVE MOTOR VEHICLE FUEL EFFICIENCY

Various economic measures might be introduced to encourage vehicle manufacturers to manufacture more fuel-efficient vehicles and to encourage the public to purchase such vehicles. Such stimulatory measures might be introduced as an alternative, or in addition to various forms of regulation. A combination of regulatory and stimulatory measures (together with voluntary agreements negotiated between government and the motor vehicle industry to promote fuel efficiency) may well be the most effective approach to take. The regulatory measures would require manufacturers to adopt a minimum standard of compliance, while the stimulatory measures would encourage and reward them to go as far as possible beyond the specified minimum.

The financial strategies that governments may pursue to improve motor vehicle fuel efficiency include the following:

A. Differential Sales, Value-Added, or Goods and Services Tax

The present sales tax, value-added tax, or goods and services tax legislation in existence in nearly all countries could be amended to introduce either a skewed sales tax where higher charges are imposed on the purchase of motor vehicles with a high rate of fuel consumption; or a tax increase/rebate programme where higher rates of tax for inefficient vehicles are combined with tax rebates for relatively efficient vehicles.

1. Skewed Sales, Value-Added, or Goods and Services Tax

a) United States

In the United States, a specified supplementary lump sum tax is imposed on manufacturers on the

sale of new passenger motor vehicles that do not meet prescribed standards of energy efficiency. This system has been in operation since 1978. It is commonly referred to as the "gas guzzler tax". The supplementary federal tax is imposed according to the following schedule, set out in US Code, s 4064(a): https://www.law.cornell.edu/uscode/text/26/4064

If the fuel economy of the model type in which the automobile falls is:	The tax is:
At least 22.5 miles per gallon (mpg)	$0
At least 21.5 but less than 22.5 mpg	1,000
At least 20.5 but less than 21.5 mpg	1,300
At least 19.5 but less than 20.5 mpg	1,700
At least 18.5 but less than 19.5 mpg	2,100
At least 17.5 but less than 18.5 mpg	2,600
At least 16.5 but less than 17.5 mpg	3,000
At least 15.5 but less than 16.5 mpg	3,700
At least 14.5 but less than 15.5 mpg	4,500
At least 13.5 but less than 14.5 mpg	5,400
At least 12.5 but less than 13.5 mpg	6,400
Less than 12.5 mpg	7,700

Emergency vehicles such as ambulances and police cars are exempt from the tax. The legislation defines the terms "automobile", "fuel economy", "model type", "model year" and "manufacturer, and also explains how fuel economy is to be measured (ibid).

The imposition of such a system would raise additional tax revenue. The reform could be made revenue-neutral and give additional incentive for the purchase of fuel-efficient vehicles if the schedule were modified and expanded so as to give a lump-sum reduction for the sale of each vehicle that met or exceeded the specified fuel-consumption statistics. The introduction of a sliding scale would result in a significant price reduction for the most fuel-efficient vehicles.[246]

Rather than imposing lump-sum payments, the legislation could impose differential sales, value-added, or goods and services tax rates based on motor vehicle fuel efficiency. Under this proposal the existing tax rates could be modified so as to increase the rate of tax payable in respect of fuel-inefficient vehicles and (possibly) to reduce the rate of tax payable by fuel-efficient vehicles. The differing sales, value-added, or goods and services tax rates approach is more consistent with most current tax regimes, which specify rates rather than lump sums. This approach was favoured in Australia in the report of the federal government's Environmentally Sustainable Development Working Group on Transport.[247]

246 See Adrian Bradbrook and Alexandra Wawryk, "Legislative Implementation of Financial Mechanisms to Improve Motor Vehicle Fuel Efficiency" (1998) 22 Melbourne University Law Review 537 at 543.
247 ESD Working Groups, note 1 above, 138 (Recommendation 4).

b. Japan

Japanese purchasers of automobiles are required to pay an automobile acquisition tax. The taxes themselves are not calculated according to environmental concerns, but for vehicles achieving at least 20% higher than FY2015 fuel efficiency targets (among other environmental targets) qualify for a tax break for the consumer of between 25-50%, depending on the target achieved: see www.iea.org/policiesand measures/pams/japan/name-24924-en.php; www.wri.org/sites/default/files/wri_workingpaper_japan_final_ck_6_11_14.pdf (pg 21).

In October 2015 it was reported that the Japanese government was planning to scale back these tax breaks because so many vehicles entering the market meet the standards, but no decision has yet been made: see www.japantimes.co.jp/news/2015/10/25/business/government-looks-scale-back-tax-break-eco-cars/#.Vt_SK4x941I.

2. A Feebate System

A second option is to levy a lump-sum charge or rebate on customers on the purchase of new vehicles. The actual charge or rebate would vary according to the level of fuel-efficiency of the vehicle. Such a system would specify a sliding scale of charges for vehicles of lower efficiency ("gas guzzlers"), but also incorporate a sliding scale of rebates for vehicles of higher efficiency ("gas sippers"). This option is commonly referred to in North America as "feebates."

A system of this nature, entitled the Tax for Fuel Conservation, was introduced by the Ontario government in 1990 and is still current (Retail Sales Tax Act, c R.31; https://www.ontario.ca/laws/statute/90r31). The additional tax ranges between $75 (for vehicles with fuel consumption ratings below 6 litres per 100 kms) to $7,000 for vehicles with fuel consumption ratings in excess of 18 litres per 100 kms. A $100 tax rebate is given to purchasers of vehicles with fuel consumption ratings below 6 litres per100 kms.

Work has been undertaken in the United States by the American Council for an Energy-Efficient Economy on the development of a model formula for the calculation of feebate charges and rebates designed to best encourage energy efficiency.[248] This study defines a feebate as the product of a feebate rate and the difference between a vehicle's energy factor and some reference level relative to which all vehicles are judged. Thus:

Feebate = (feebate rate) x [(energy factor) - (reference level)].

The energy factor is a measure of the vehicle's energy efficiency. For a fuel-economy based feebate, the energy factor is the vehicle's fuel economy rating in kilometres per litre.[249] The reference level is an average value of the energy factor. For example, for a fuel economy feebate, the reference level could be a fleet-based fuel economy. The feebate rate is the monetary value assigned to each unit difference in the energy factor above or below the reference level.

248 John DeCicco et al, Feebates for Fuel Economy: Market Incentives for Encouraging Production and Sales of Efficient Vehicles (1992).

249 The energy factor may account for other vehicle attributes such as vehicle size, carbon dioxide emissions, vehicle class, "crashworthiness", alternative fuel use, payload weight, power to weight ratio, or the level of domestic (as opposed to imported) content: ibid, at 19.

Another very high leverage option would be directed to inefficient cars presently on the road, often older vehicles that are the most polluting. For example, 65 per cent of the cars in Egypt are over 10 years old, 25 per cent are over 20 years old, and 25 per cent of the buses are over 15 years old. These figures are typical for most developing countries. Feebates have been suggested (although not yet enacted) – charging a fee on inefficient vehicles, which would pay for granting a rebate for the purchase of more efficient models. The older model would be scrapped, and the newer model purchased with the rebate. Amory Lovins of the Rocky Mountain Institute made the following calculation (using US prices):

> "Giving the owner of the average 1990 car (23 mpg) a $4,900 rebate – four times trade-in value – for scrapping it and replacing it with a new $21,000, 48-mpg, 5-seat compact hybrid car would save enough gasoline to repay the rebate of its life at $1.25 a gallon".[250]

Between March 2007 and March 2009 the Canadian federal government ran two separate programs, the 'EcoAuto Rebate Program' and the 'Green Levy' which, operating together, worked as a feebate program. Purchasers of fuel efficient vehicles (cars that achieved a combined fuel economy of 6.5L/100km (36 mpg US) or better and new light trucks that achieved 8.3 L/100km (28 mpg US) or better) could apply for rebates of $1000-$2000, while manufacturers or importers of fuel inefficient vehicles (beginning at between 13 L/100km and 14 L/100km) were made to pay a levy starting at $1000, and increasing in increments of $1000 up to 16L/100km, at which point the levy was capped. This was a regulatory program administered by the Department of Transport (as provided for in s 5 of the Canada Transportation Act) and funded by the federal government, as provided for in the 2007 Canadian budget. These programmes have not been continued.

http://www.unep.org/transport/gfei/autotool/case_studies/northamerica/canada/Canada%20CASE%20STUDY.pdf (page 3)

http://www.budget.gc.ca/2007/pdf/bp2007e.pdf (budget)

https://books.google.com.au/s?id=Cw9xC4yBEa4C&pg=PA33&lpg=PA33&dq=ecoauto+rebate+program+green+levy&source=bl&ots=0vUEujJJaw&sig=QOzDDKWJ5cJXf-r_StG7Qk4ERFE&hl=en&sa=X&ved=0ahUKEwiO-p26ranKAhVWD2qYKHXXDDTYQ6AEIRjAI#v=onepage&q=ecoauto%20rebate%20program%20green%20levy&f=false

B. Skewing Motor Vehicle Registration Charges Towards Higher Charges On Inefficient Vehicles

Another tax policy option is to amend existing national or State motor vehicle registration charges so as to require the owners of cars with a high rate of fuel consumption to pay increased charges. While the laws imposing such charges differ from jurisdiction to jurisdiction, it is common to find that different registration fees are imposed for different vehicles. Commonly, the registration charges are based on a number of factors, such as the type of vehicle to be registered, the weight of the vehicle to be registered, the number of cylinders of the motor vehicle and whether the vehicle is to be used for private or commercial purposes: see for example, New South Wales, Australia: *Motor Vehicles*

250 Amory B Lovins, Energy Security Facts, Rocky Mountain Institute, 2 June 2003.

Taxation Act 1988; http://www5.austlii.edu.au/au/legis/nsw/consol_act/mvta1988268/s5.html; and South Australia, Australia: Motor Vehicle Regulations 1996; http://www.austlii.edu.au/au/legis/sa/consol_reg/mvr2010281/. It would be possible to amend or replace this legislation with a law varying the amount of motor vehicle registration charges according to the fuel consumption statistics of the vehicle. To date this proposal has not been adopted.

C. Increasing Petroleum Excise Taxes

Petroleum excise taxes are levied directly on the consumers of petrol at the point of sale on a cents per litre basis. Such a tax already provides an incentive to consumers to reduce the use of petrol and to purchase fuel-efficient cars. In Australia, a paper commissioned by the Commonwealth Department of Transport and Communications suggested that motor vehicle fuel efficiency could be significantly improved by eliminating or reducing sales or goods and services taxes on cars and raising petroleum excise taxes to compensate for the lost revenue.[251] This reform could be achieved by a simple amendment to the relevant petroleum excise and sales or goods and services tax legislation, but has not yet been enacted in any jurisdiction.

D. Income Tax Incentives

An Income tax is currently imposed in almost all countries by national legislation. It is usually calculated by applying the appropriate tax rate to the taxable income, then subtracting any rebates or credits. Taxable income is determined by subtracting allowable deductions from a taxpayer's assessable income.

Governments could offer income tax rebates or credits on the purchase of motor vehicles that meet specified fuel economy standards. This concept is similar to the various incentive programs in the United States that are designed to stimulate the purchase of alternative-fuel vehicles and the conversion of petrol-based vehicles to alternative fuels.

For example, in 1990 California enacted legislation providing an income tax credit to individuals and businesses that either purchased new alternative fuel vehicles or retrofitted their standard vehicles using an alternative-fuel conversion kit certified by the State's Clean Air Regulatory Board.[252] Under this low emission vehicle (LEV) credit, a taxpayer could receive as a tax credit 55 percent of the incremental cost (that is, the cost above the purchase price of an equivalent standard-fuel vehicle) associated with purchasing a new vehicle that meets specified emission standards or converting an existing vehicle so as to meet the same standards. The maximum credit was $1,000 for vehicles under 5,750 pounds and $3,500 for vehicles over 5,750 pounds.[253] The Californian scheme expired in 1996.

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251 Nelson English, Loxton & Andrews Pty Ltd, Study on Potential to Improve Fuel Economy of Passenger Motor Vehicles (Working Paper, Commonwealth Department of Transport and Communications, Canberra, 1991).

252 Act of 1 January 1991 ch. 1611, 6 Cal Stat (1990). California Legislative Analyst's Office, "An Analysis of the Low-Emission Vehicle Tax Credit Program" (1996): *www.lao.ca.gov/rp62196.html*.

253 California Legislative Analyst's Office, note 13 above. Federal tax incentives for the purchase of, or conversion to, alternative fuel vehicles are established in National Energy Policy Act 1992, 42 USC 13201-556 :*https://www.law.cornell.edu/uscode/text/42/chapter-134*

E. Luxury Car Tax Higher Threshold For Fuel-Efficient Vehicles

In Australia, as of July 2008, a higher threshold was introduced for the payment of the Luxury Car Tax for fuel-efficient vehicles. The LCT rate is currently 33%. Section 25-1(4) of A New Tax System (Luxury Car Tax) Act 1999 states: "If the car has a fuel consumption not exceeding 7 litres per 100 kilometres as a combined rating under vehicle standards in force under section 7 of the Motor Vehicle Standards Act 1989, the luxury car tax threshold is the "fuel-efficient car limit for the year in which the supply of the car occurred or the car was entered for home consumption." For the 2015-16 financial year, the LCT threshold was $75,375 for fuel efficient vehicles and $63,184 for other vehicles: see *https://www.ato.gov.au/Rates/Luxury-car-tax-rate-and-thresholds/*.

F. Employer-Supplied Vehicle Fringe Benefits

A fringe benefits tax (FBT) is currently imposed in some countries, including Australia, where it is located in the Fringe Benefits Tax Assessment Act 1986 www.austlii.edu.au/au/legis/cth/consol_act/ftbaa1986312/ and still operates despite changes in government. FBT is a separate tax paid by employers regardless of the employees' liability for income tax. Liability is assessed on an annual basis, but paid in quarterly instalments. The return is separate from the normal income tax return. The tax is payable on the "tax inclusive" value of benefits, that is, the "grossed up" taxable value of the benefits. The grossed up taxable value of fringe benefits can be calculated by using the formula:

Aggregate FBT amount x 1/(1- FBT rate), where the aggregate FBT amount means the aggregate FBT amount in relation to the employer in relation to the year of tax, and the FBT rate is the rate applicable for the year of tax.

The Australian Fringe Benefits Tax Assessment Act 1986 sets out particular rules for assessing the value of car fringe benefits. As a general rule, liability for FBT will arise where an employee has the private use of an employer's car. The car may be leased or owned by the employer. "Car" is defined in s 136 of the Fringe Benefits Tax Assessment Act 1986. Exemptions from FBT apply to certain types of commercial vehicle where the only private use of the vehicle is for "work-related" travel (s 8).

Governments could seek to encourage the purchase or lease by businesses of more fuel-efficient motor vehicles by providing FBT incentives, in the form of tax deductions or rebates. Such deductions or rebates would reduce the cost to businesses of providing vehicles to employees. Similarly to sales tax, a skewed system could be employed whereby FBT surcharges on the provision of energy-inefficient cars to employees would co-exist with FBT rebates for fuel-efficient vehicles.[254]

G. Grants, Low-Interest Loans or Loan Guarantees to Businesses for the Lease or Purchase of Fuel-Efficient Vehicles

Another option to encourage the use of more fuel-efficient vehicles by businesses is by government subsidy for the purchase or lease of new fuel-efficient vehicles by grants, low-interest loans or loan guarantees.[255]

254 See Note 6 above, at 547-548.
255 See note 6 above, at 548.

In addition, national governments could provide assistance to local or State government agencies to lease or purchase fuel-efficient vehicles. In many countries, local and/or state governments operate a fleet of motor vehicles, comprised of various types of vehicles. Many of these vehicles are large and energy-inefficient. Although fuel efficiency is a factor that local and/or State governments take into account when determining the composition of their vehicle fleet, it is often only one factor out of many. National governments could influence the vehicle mix of local and/or State governments by making the selection of fuel-efficient vehicles more economically attractive. This could be achieved by the providing funding for the purchase and/or the operating costs of fuel-efficient vehicles. This proposal has not yet been adopted in any jurisdiction.

III. THE OPTIONS FOR PLANNING AND DEVELOPMENT LAWS

The UN Commission on Sustainable Development has noted that the rapid pace of urbanisation worldwide means that not only are more people living and working in cities, but also more people and more goods are making more trips in urban areas, often over longer and longer distances (Report E/CN.17/2001/19-E/2001/29; http://www.un.org/documents/ecosoc/docs/2001/e2001-29.pdf.

This development has profound effects on the transport sector. The design of cities can directly influence the amount of consumption of transport fuels. If cities are allowed to spread without adequate controls, the danger exists that public transport to the extended areas will become inadequate, necessitating almost exclusive reliance on motor vehicles. This has already occurred in a number of major cities throughout the world. In addition, of course, the spread of cities without adequate planning controls inevitably means more travel and therefore more fuel consumption. Rapid urbanisation is probably inevitable, but, with political will, the shape and design of such urban areas can be controlled so as to render such cities more efficient in terms of transport usage and fuel consumption. Such planning controls can ensure that development occurs in such a way that public transport can provide an adequate service and that the need for vehicle travel within urban areas is minimised.

In many developing countries planning and development laws are very rudimentary. Even in developed countries the comprehensive planning and development laws seldom take into consideration issues of improving energy efficiency in the transport sector by providing measures for reducing fuel consumption. This is so despite the clear recommendations contained in Agenda 21, paragraphs 7.52 and 9.15 (https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf)

requiring national action to be taken to encourage development patterns which reduce transport demand, promote public transport, and support non-motorised modes of transport and the control of traffic management. This is echoed in clause 20 of the Johannesburg Plan of Implementation: http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD PlanImpl.pdf.

Many of these policies will require implementation by legislation. The following legislative options can be identified:

A. The Introduction of or Changes to Existing Town Planning Laws to Encourage Urban Consolidation

Urban consolidation is designed to use urban land more efficiently in order to improve accessibility to city centres and other important hubs. It can be promoted in a variety of ways, including the following:

- By ensuring that inappropriate regulations and processes preventing urban consolidation be removed from local and national building and town planning laws;
- By government authorities conducting assessments of the capability for redevelopment in each local government area through a study of the infrastructure capacity;
- By creating within town planning laws guidelines or development rules providing clear zoning and priorities as to where and how much development should occur in each city area;
- By ensuring that attention is paid to redevelopment of land around key public transport nodes to include dense housing and some commercial activity so that travel is minimised and public transport facilities are made more attractive;
- By investigating whether taxation laws can be changed so as to encourage high density housing in areas identified for development by government authorities; and
- By encouraging dual or multiple occupancy. This is the right to register and rent a self-contained apartment or unit forming part of an existing or new residence, the right to subdivide existing blocks so as to create additional housing units, and the right to sell large backyards of existing blocks for further development.

All these options are designed to reduce travel demand by allowing more people to live close to established areas where employment and other urban facilities, such as shops and entertainment complexes, exist. They will all require law reform to either introduce new planning and/or building legislation or to amend such existing legislation.

Cities that have taken legislative action in this area include Curitiba (Brazil), Singapore and Canberra (Australia). For the Curitiba local legislation, see www.curitiba.pr.gov.br (in Portuguese), and for a general discussion of the provisions in English, see http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan007067.pdf The Singapore provisions are contained in Planning Act, Part II, §§ 5-11 http://statutes.agc.gov.sg. The Canberra provisions are made under the Planning and Development Act 2007 (ACT):

http://www.austlii.edu.au/au/legis/act/consol_act/pada2007236/ and the Planning and Land Regulation 2008 (ACT): http://www5.austlii.edu.au/au/legis/act/consol_reg/padr2008327/.

B. The Greater Use of Environmental Impact Assessments

National legislation requiring environmental impact assessments for all major development projects has been a cornerstone of environmental law in general, and sustainable development in particular in recent years and is regarded internationally as essential. It has been supported in many international

legal instruments, for example, in clause 97 of the Johannesburg Plan of Implementation: http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf.

Environment impact statements are considered to be one of the most effective means of ensuring that environmental concerns are taken into account in any development and of raising awareness of the importance and impact of the environment both in the public and in government agencies. This option would ensure that past practices of ignoring the environmental impact of proposed developments is not allowed to continue. While the use of such statements is mandated in some countries in certain circumstances, its use is currently limited in developing countries. All town planning changes, that would actually or potentially impact on public or private transport usage or availability, could be made subject to a compulsory environmental impact statement as a precursor to approval.

C. Demand Management Programmes

A variety of demand management programmes have been implemented and proposed for adoption in various countries in order to reduce the need for travel, the amount of travel and the impact on this travel, without restricting access to urban facilities. Such programmes are wide-ranging in their scope and nature. They include the following:

- The use of staggered or flexible working hours and the deregulation of weekend working;
- The encouragement of ride sharing (and consequently the reduction in vehicle and fuel use) by measures such as: high occupancy vehicle lanes; laws requiring employers with more than a specified number of employees to develop increased vehicle occupancy schemes for their employees; the removal of legal prohibitions on payment for ridesharing; "every car a taxi" laws permitting drivers to pick up pedestrians at designated areas;
- Improvement of traffic flow by the use of traffic management measures, such as computer-coordinated traffic signals;
- Regulatory control of access to city centres for private vehicles, by such means as: vehicle permits required to enter city centres; granting access to odd or even number plated-vehicles on alternate days; car free days; bans on certain classes of vehicles; vehicle taxation according to city access privileges; or lotteries to allocate city access rights;
- Increased parking controls, including increased fees and restrictions on the number of parking places available;
- Restricting the number of cars that may be registered;
- Road pricing controls, by imposing fees for vehicle use of certain key roads. This can be achieved electronically by the use of overhead cameras and special computer cards attached to vehicle windscreens, which record when vehicles pass a certain point;
- Encouraging residents to use modes of transport other than private vehicles, by: establishing bicycle lanes; the provision of special parking areas outside inner city areas and encouraging people to walk to work or take buses from these parks; fee reductions and/or timetable improvement for public transport services;
- Modification of taxation laws to discourage companies providing company cars to their senior

Singapore Road Traffic Act, Part I, § 10A

Singapore has restrictions on the number of cars that may be registered. Under this system, in order to register a car, the owner must obtain from the Land Transport Authority a Certificate of Entitlement, for which the price is set through a market system. The law in §10A reads in part:

(1) No vehicle shall be registered or, except as otherwise provided by this Act, continue to be registered under this Act unless there is in force a permit issued by the Registrar authorising the registration of the vehicle.
(2) Except as otherwise provided by this Act, a permit shall be issued upon the payment of a levy.
(3) The Minister may from time to time, by notification in the Gazette, prescribe a limit on the number of permits to be issued by the Registrar under subsection (1) and the Minister may prescribe different limits for vehicles belonging to any category, class or description.
(4) The Minister may make rules for carrying out or giving effect to this section and, in particular, the rules may —
(a) provide for the issue of permits under this section to successful applicants who submitted bids for the permits;
(b) require fees and deposits to be paid for the submission of applications for the issue of permits under this section, and provide for the forfeiture of deposits for non-compliance with any conditions governing the submission of such applications;
(c) prescribe the levy, or the method or manner for determining the amount of the levy, payable for a permit issued under this section;
(d) prescribe the period for which a permit issued under this section is in force and different periods may be prescribed for vehicles belonging to different categories, classes or descriptions;
(e) prescribe the conditions upon which permits are issued under this section;
(f) provide for a rebate on all or any part of the levy payable for the issue of a permit under this section, in such circumstances as may be permitted by the rules;
(g) provide for the cancellation of a permit issued under this section and the refund of all or part of the levy paid for the issue of the permit in such circumstances as may be permitted by the rules;
(h) provide for the transfer of permits under this section at any time prior to the registration of a vehicle authorised by the permit;
(ha) provide for the transfer of permits under this section to facilitate the replacement of defective vehicles;
(i) provide for the issue of permits, whether with or without the payment of a levy, for vehicles which were registered under this Act prior to 2nd April 1990;
(j) provide for the renewal of a permit before or after its expiration and the levy and any other fee to be paid therefore;
(k) exempt any particular vehicle or class of vehicles from the payment of the levy for a permit issued under this section; and
(l) provide for all matters which are required or permitted to be prescribed or which are necessary or convenient to be prescribed for carrying out or giving effect to this section.

Road pricing controls are illustrated by Singapore. This has an electronic road pricing scheme that operates during peak hours. This is administered by the Land Transport Authority, under rules

provided in the Road Traffic Act, Part IA, §§ 34A, 34B, 34C and 34D. This reads in part:

34B(1) The Minister may prescribe road-user charges to be paid in connection with the use of any specified road.

(2) All road-user charges collected under this Part shall be paid into the Consolidated Fund.

34C The Authority may install or cause to be installed on any road in respect of which a road-user charge is levied under this Part such electronic or computerised or other facilities as it thinks fit for the purpose of collecting the road-user charge and may also install or cause to be installed such ancillary facilities as the Authority thinks necessary.

34D (1) The Minister may make rules for the purposes of carrying this Part into effect and, in particular, may make rules —

(a) specifying the roads in respect of which, and the days and hours during which, a road-user charge shall be levied;
(b) prescribing the amount of road-user charge to be levied in respect of any specified road and for this purpose, road-user charges of different amounts may be prescribed in respect of —

(i) different specified roads or parts thereof;
(ii) different hours of the day or different days of the week; and
(iii) different classes, categories or descriptions of vehicles;

(c) prescribing the manner in which road-user charges shall be levied and collected, including the use of electronic or computerised or other facilities therefore, and for this purpose, the rules may —

(i) require all vehicles (whether registered in Singapore or elsewhere) to be installed with such devices and appurtenances and in such manner as may be prescribed before they may be ridden, driven or moved on a specified road during the prescribed hours;
(ii) provide for the issue by the Authority or its agents of stored value cards to be used with any device prescribed under sub-paragraph (i),
regulate the use of such stored value cards and prohibit the issue of such stored value cards by any person not authorised by the Authority to do so;

(iii) prohibit the sale, supply, installation, repair or maintenance of any device or appurtenance prescribed under sub-paragraph (i) by any person not authorised by the Registrar to do so;
(iv) specify the conditions under which any device or appurtenance prescribed under sub-paragraph (i) may be removed from one vehicle and installed in another or transferred from one person to another; and
(d) prescribing the records to be kept by the Registrar in connection with this Part and regulating the disclosure by the Registrar of any information in such records.

Statutes and regulations available at: http://statutes.agc.gov.sg.

employees, and to impose on employees' liability for income tax on the value of company cars; and

- The inclusion of driver education on the need for fuel efficiency driving practices as part of the requirements for passing the driving test necessary to secure a driver's licence.

While some of these measures may be introduced administratively by government agencies, the majority of these reforms will require amendments to, or new national or state legislation affecting, road traffic, labour and taxation legislation.

See, for example, the below Singapore legislation.

Regulation of vehicle access to city centres occurs in Beijing, China and in a number of European cities, including Gotherberg (Sweden) and Copenhagen (Denmark). Payment for entry of vehicles is required in some cities (London, UK). These reforms have been implemented as part of the European Union's Progress Project. The Project is discussed at www.progress-project.org, and the legal aspects of the Project, including the relevant legislation, at www.progress-project.org/Progress/pdf/D4_2.pdf.

Increased parking controls also have been implemented in Singapore. These are regulated by the Land Transport Authority under the Planning Act: http://statutes.agc.gov.sg/aol/search/display/view.w3p;page=0;query=DocId%3A%222343ea5f-5a9f-4a36-ac03-2ce1bc74558b%22%20Status%3Ainforce%20Depth%3A0;rec=0-

The best illustration of encouraging transport by other than motor vehicles is Copenhagen (Denmark). This city particularly encourages bicycle use. This is undertaken under the planning legislation by administrative action. See the City of Copenhagen Policy Document: http://kk.sites.itera.dk/apps/kk_pub2/pdf/823_Bg65v7UH2t.pdf. For basic details, see http://www.un.org/esa/dsd/susdevtopics/sdt_pdfs/shanghaimanual/Chapter%204%20-%20Sustainable%20urban%20transport.pdf (at page 21).

IV. CONCLUSION

As can be seen from the above presentation of options, there are many ways that governments can select to encourage the purchase of more efficient vehicles and to penalize purchase of inefficient ones. Similarly, there are many legal options for encouraging the greater use of efficient vehicles and for taxing the use of inefficient ones. While some jurisdictions have adopted one or more of these options, the potential for greater savings in this area is very substantial.

SECTION FIVE – RENEWABLE ENERGY

CHAPTER A. THE IMPORTANCE OF RENEWABLE ENERGY

Katherine Kennedy*

I. INTRODUCTION

There are many compelling reasons for countries to seek to increase their use of renewable energy to produce electricity. Most sources of renewable energy produce zero or extremely low air and water pollution impacts, although, as is discussed in subsequent chapters, some forms of renewable energy, such as large hydro and some forms of biomass, can have negative environmental consequences. As the world struggles to address global warming, renewable energy presents a crucial zero carbon alternative to carbon-intensive fossil fuel generation, and continuing to scale up renewable energy rapidly has become a paramount strategy to curb carbon emissions, which are a key component of global warming pollution. Renewable energy sources are by definition sustainable and practically unlimited, as they are naturally renewed on very short time cycles and come from sources such as the sun and the wind that are inexhaustible. Most renewable energy sources, such as hydro, solar, geothermal, land-based and offshore wind, tidal and wave power, have zero fuel costs, helping to reduce and hedge against energy price volatility.[256]

The last decade has seen huge growth in global renewable electricity capacity and investments, accompanied by steep reductions in their cost, particularly for wind and solar energy. Historically, despite the many advantages of renewable energy, use of renewable energy (except large hydropower) to produce electricity had been extremely low. So-called "new renewables" (all renewable energy resources except large-scale hydropower and traditional biomass) provided only 2% of global electricity production in 2004. But this figure has bounded upward to 10.3% of global electricity production in 2015.[257]

Despite this impressive rate of growth, there are still a number of significant economic, regulatory, and political barriers that must be addressed to allow renewable energy to continue to scale up quickly, reliably and sustainably, and ultimately, overtake fossil fuels. These barriers include the following:

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* This chapter focuses on renewable electricity sources and policies. However, readers should note that countries around the world have turned increasingly to solar thermal energy for home and water heating. Renewable energy can also be used for transportation, e.g. for electric vehicles powered by solar power and by an increasingly decarbonized electric grid.

256 Janet L. Sawin, Mainstreaming Renewable Energy in the 21st Century, World Watch Paper 169, fig.1-2. (May 2004), http://www.worldwatch.org/system/files/EWP169.pdf.

257 UN Environment Centre/BNEF, Global Trends in Renewable Energy Investment 2016, 30-31 (2016), http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf.

The cost of land-based wind and solar power has steeply declined over the past few decades, and is at, or approaching nominal grid parity in an increasing number of regions. But fossil fuel electricity, by reason of its world-wide heavy subsidization, still generally has a first-cost nominal price advantage. The true cost to the consumer for renewables, however, is considerably lower than for fossil fuels if the externality costs to human health, climate change and other environmental damages from fossil fuel combustion are taken into account.

- While renewable energy has zero or low fuel costs, the initial cost of construction per megawatt is still nominally higher for many forms of renewable energy than for fossil fuel plants, even where life cycle costs are lower for renewables. Unfortunately, it is the nominal first cost price that often is all that is considered. In the meantime, economic policies encouraging renewable energy such as renewable portfolio standards, feed-in tariffs, and tax incentives will continue to be important in scaling up renewable energy, as will the suite of smart renewable energy finance policies discussed in Section Three of this Guide.
- As indicated, many environmental and public health benefits of renewable energy – particularly its value in combating global warming pollution – are currently externalized and not reflected in electricity prices. However, this is beginning to change as international and domestic policies are adopted that increasingly place a price on carbon, and as regulators impose limits on other forms of pollution. In the United States, for instance, the U.S. Environmental Protection Agency's Clean Power Plan is seeking to establish carbon pollution standards for existing and new power plants at the national level for the first time, although implementation is currently delayed by a Supreme Court stay.[258]
- Traditional forms of regulation at both the electric distribution and transmission level still tend to favour continuously supplied, centralized, fossil fuel and nuclear generation over renewable generation that is often more distributed and variable, causing challenges discussed below. This is changing now as some utility regulators begin to innovate by revolutionizing utility regulation to better align utility and shareholder interests with clean energy, as with New York State's acclaimed Reforming Energy Vision proceeding.[259]
- Some electric utilities oppose distributed renewable generation due to concerns that it requires the availability of back-up power, and it may increase administrative costs. Where it is installed on the customer side, it can lead to loss of anticipated utility revenue in jurisdictions where utility revenues are tied to sales. Better rate design can address these concerns.
- As there is increased grid integration of renewable energy technologies across the world, policies that seamlessly integrate renewables and ensure that there is a level playing field for renewables in wholesale electricity markets are increasingly necessary. Electricity transmission planning policies need to be put in place to avoid grid constraints that prevent renewable energy from moving smoothly from its place of origin to population centres.

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258 See 80 Fed. Reg. 64662 (Oct. 23, 2016). For a description of the Clean Power Plan, see Clean Power Plan for Existing Power Plants, https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants. On February 9, 2016, the U.S. Supreme Court stayed the implementation of the Clean Power Plan pending the resolution of various legal challenges. Order, West Virginia v. EPA, No. 15A773 (U.S. Feb. 9, 2016).

259 Eleanor Stein, New York REV shows utilities and regulators how to manage change, UTILITY DIVE (Mar. 3, 2016), http://www.utilitydive.com/news/new-york-rev-shows-utilities-and-regulators-how-to-manage-change/415002/.

- Lastly, the producers of fossil fuels and fossil fuel generated electricity have a strong incentive to oppose increased use of renewable energy in political and regulatory forums and have been doing so vigorously.

Fortunately, there are a number of legislative and regulatory tools that countries, states, and municipalities throughout the world have deployed that can be useful in overcoming these barriers and encouraging the use of renewable energy. These policy tools have been employed successfully by many countries including China, the United States, and Germany, which are the top countries for non-hydro renewable electricity capacity, followed by Italy, Spain, Japan and India.[260] These policy tools have been used by many sub-national states and cities as well.

As proof of the value of these policies, the penetration of renewable energy technologies is growing rapidly on a global basis. Renewable power is the fastest-growing energy source in the world.[261] For example, in 2015, countries globally installed almost 64,000 MW of wind, which was a new record. The total wind capacity of the world has reached 435 GW.[262]

The European Union has set a target of supplying 20% of Europe's total energy needs from renewable sources by 2020.[263] Energy market consultants project China to increase its installed wind capacity to 347.2 GW by 2025;[264] by the end of 2015, China, the world leader on both solar and wind energy, has installed a total capacity 145 GW of wind, more than in all of the European Union.[265] India has set a goal of 99.5 GW of installed solar capacity and 60 GW of installed wind capacity by 2022. South Africa's Integrated Resource Plan for 2010-1030 sets a target of supplying 26.3% of its energy needs (more than 23.5 GW) through hydro, wind, and solar by 2030.[266]

This section of the Guide will explore the legislative and regulatory tools that are available and have been used around the world to promote renewable energy, including citations to full text and some legislative excerpts. Other sections of the Guide present in-depth discussions of hydropower, solar and wind power, biomass and geothermal energy, as well as discussions of rural applications of renewable energy and renewable energy financing.

II. LEGISLATIVE AND REGULATORY STRATEGIES TO ENCOURAGE THE USE OF RENEWABLE ENERGY FOR ELECTRICITY

This chapter will give an overview of the legislative and regulatory measures available to encourage the use of renewable energy for electricity and overcome the barriers to its adoption. The subsequent chapters in this section will provide an in-depth examination of the measures pertaining

260 REN21, Renewables 2015, Global Status Report 21, fig. 4, http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.
261 BP Statistical Review of World Energy 2015 at 1, http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2015/bp-statistical-review-of-world-energy-2015-full-report.pdf.
262 World Wind Energy Association, The World Sets New Wind Energy Record: 63.7 GW of New Capacity in 2015, http://www.wwindea.org/the-world-sets-new-wind-installations-record-637-gw-new-capacity-in-2015/.
263 European Commission, Renewable Energy Directive, ENERGY (Sept. 4, 2016), https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive.
264 GlobalData, China's Wind Power Capacity Will Treble by 2025 as Global Growth Stabilizes, GlobalData says, GLOBALDATA (July 1, 2015), http://energy.globaldata.com/media-center/press-releases/power-and-resources/chinas-wind-power-capacity-will-treble-by-2025-as-global-growth-stabilizes-says-globaldata.
265 Global Wind Energy Council, Global Wind Report: Annual Market Update (2015) at 4.
266 Government of India, Ministry of New and Renewable Energy, Tentative State-wise break up of Renewable Power by 2020, Ujwalbharat.gov.in (2016), http://mnre.gov.in/file-manager/UserFiles/Tentative-State-wise-break-up-of-Renewable-Power-by-2022.pdf.

to hydroelectric, solar, wind, biomass, and geothermal energy.

There are four broad categories of tools that have been widely deployed in jurisdictions around the world, often with considerable success, to promote renewable energy for electricity production.

These are:

- Renewable Portfolio Standards-- renewable energy purchase or set-aside requirements;
- Economic Tools – support programmes including research and development funding, public benefit programmes and tax credits;
- Distributed Generation Measures – programmes designed to support distributed

forms of renewable energy, such as solar panels and small wind systems that can be installed on a customer's premises, which include:

  - net metering programmes that allow customers with on-site renewable resources to offset consumption charges with credits for energy production;
  - streamlined interconnection requirements to allow renewable distributed resources to connect with the utility distribution grid; and
  - the establishment of fair and non-burdensome standby and backup rates for renewable distributed generation.

- Disclosure and Green Marketing Measures.

The strategies discussed in this section can be achieved through the legislative process (statutory enactment by a legislative body), the regulatory process (e.g. regulatory action by utility or energy regulators), or through a combination of these techniques. Whether a legislative or regulatory approach should be used in any jurisdiction will depend on political considerations (whether elected officials or appointed agency officials are more likely to take action quickly and be favourable to renewable energy), and legal issues (for instance, whether regulatory agencies have a broad grant of jurisdiction which enables them to undertake renewable energy policies without specific new statutory authority). In many cases, both statutory and regulatory action will be necessary, with legislation required in the first instance to establish the requirement programme, and regulation then required to fill in the details and implement the legislation.

A. Renewable Portfolio Standards

1. Introduction

A renewable portfolio standard (RPS) is a policy mechanism to increase the amount and/or proportion of renewable energy purchased in a particular jurisdiction, which could be a country, state, province, or city. An RPS typically places a requirement upon covered retail electric suppliers to supply a designated portion of their retail load with eligible sources of renewable energy. The RPS requirement typically increases over time until it reaches a specified level. An RPS also often includes a market-based system of tradeable renewable energy credits as a compliance mechanism.

In the United States, as of March 2016, 29 states and the District of Columbia have adopted an RPS, and eight states have adopted renewable portfolio goals.[267] Federal RPS legislation seeking to adopt a national RPS has been introduced in both chambers of the United States Congress numerous times but has never passed.[268]

As is discussed below, RPS requirements and/or similar renewable energy requirements have been adopted internationally, including in Australia, Austria, Belgium, China, the Czech Republic, Denmark, Finland, France, Hungary, India, Ireland, Italy, Japan, Norway, the Netherlands, Poland, Portugal, Russia, Spain, Sweden, and the United Kingdom.[269] The European Union has likewise adopted union wide renewable energy requirements. [270]

Typically, an RPS is developed by legislation, but not always. In the United States, most state RPS programmes have been enacted by state legislation.[271] However, in Arizona and New York, state-wide RPS programmes have been developed by administrative action by utility regulators. [272] Colorado's RPS was adopted directly by the voters via a ballot initiative.[273] Internationally, most national RPS requirements have been adopted legislatively.

Many cities globally also are undertaking renewable energy initiatives. The city of Malmö, Sweden has committed that by 2030, the city will run on 100% renewable energy, including electricity, heating and transport.[274] The City of Seoul, Korea, has launched a major initiative to scale up solar power and reduce its dependence on nuclear and coal-fired power.[275] In the U.S., in 2014, Mayor Bill de Blasio's administration in New York City announced a ten-year sustainability plan to reduce the city's greenhouse gas emissions by 80% over 2005 levels by 2050. The plan, entitled "One City

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267 U.S. Energy Info. Admin., Most states have Renewable Portfolio Standards, TODAY IN ENERGY (Feb. 3, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=4850. As of October 2015, the following are the 29 states in the United States that have adopted some form of RPS or RPS-like requirement: Arizona, California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania (designated an "alternative energy standard"), Rhode Island, Texas, Vermont, Washington, and Wisconsin. The following seven states have adopted some form of non-binding renewable energy goals: Indiana, Kansas, North Dakota, Oklahoma, South Carolina, South Dakota, Utah, and Virginia. Id. See National Conference of State Legislatures, State Renewable Portfolio Standards and Goals, NCSL (Mar. 23, 2016), http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx.

268 See James Montgomery, Trying Again: Proposing a National U.S. Renewable Energy Standard, RENEWABLE ENERGY WORLD (Nov. 1, 2013), http://www.renewableenergyworld.com/articles/2013/11/trying-again-proposing-a-national-u-s-renewable-energy-standard.html.

269 Chiara Criscuolo and Carlo Menon, Environmental Policies and Risk Finance in the Green Sector, OECD (Mar. 31, 2014), http://www.oecd-ilibrary.org/docserver/download/5jz6wn918j37.pdf?expires=1452687888&id=id&accname=guest &checksum=CC232FE1DB7FB36076B852F5C7E3E81D; Renewable Energy Law of the People's Republic of China (adopted Feb. 28, 2005; amended Dec. 26, 2009), http://english.mofcom.gov.cn/article/policyrelease/Businessregulations/201312/20131200432160.shtml

270 Directive 2001/77/EC of the European Parliament and of the Council (Sept. 27, 2001), http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32001L0077.

271 See DSIRE, Summary Tables, Renewable Portfolio Standards, DSIRE (2016), http://programs.dsireusa.org/system/program /tables.

272 See Case 03-E-0188, Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, Order Regarding Retail Renewable Portfolio Standard, Sept. 24, 2004, http://documents.dps.ny.gov/public/Common/ViewDoc.aspx? DocRefId={B1830060-A43F-426D-8948-F60E6B754734; Ariz. Admin. Code R14-2-1618, http://apps.azsos.gov/ public_services/Title_14/14-02.pdf; see also Case 15-E-0302, Proceeding on Motion of Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard, Order Further Expanding Scope of Proceeding and Seeking Comments, Feb. 24, 2016, http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={CE6519EE-3330-449E-AC0B-E57B3D85928D.

273 See The Renewable Energy Initiative, Colorado passes the first-ever statewide vote on renewable energy, RENEWABLE ENERGY YES (2016), www.renewableenergyyes.com; DSIRE, Renewable Energy Standard, DSIRE (Aug. 5, 2015), http://programs.dsireusa.org/system/program/detail/133.

274 ICLEI: http://www.iclei.org/activities/our-agendas/low-carbon-city/iclei-100re-cities-regions-network.html.

275 C40 Cities: Seoul: Make Seoul a City of Sunlight: http://www.c40.org/profiles/2014-seoul.

Built to Last," aims to reduce emissions by retrofitting the city's public and private buildings, where energy use accounts for nearly three-quarters of city's climate change contribution.[276] In 2015, Mayor de Blasio's administration announced an initiative to supply 100% of the city government's power needs from renewable sources.[277] Also in 2015, the San Diego City Council unanimously passed an ordinance mandating the entire city to receive 100% of its power from renewable sources and reduce its greenhouse gas emissions by 50% by 2035.[278] In April 2016, the City of San Francisco adopted an ordinance requiring all new buildings to install solar panels.[279]

As noted above, in the United States, federal legislation to establish a national RPS has been introduced but has never been enacted. Until and unless a uniform federal standard is established, the U.S. RPS effort will continue on a state-by-state basis. Renewable energy advocates hope that eventually, state and local efforts will create pressure for the U.S. Congress and the Administration to act, but not in such a way as to preclude stronger state action.

Experience with RPSs thus far have demonstrated a high degree of success: about two-thirds of all renewable energy capacity additions in the United States between 1998 and 2012 took place in states that had enacted RPSs.[280] The ability of future RPSs to replicate that success in promoting renewable energy growth and environmental benefits will depend on several factors. These include: 1) How are RPS eligible resources defined? 2) Is the size of the RPS mandate achievable, yet ambitious enough to provide real incentives for renewable energy growth in the jurisdiction? 3) Is the RPS fairly administered and applied? 4) Is the RPS enforceable? and 5) Does the RPS provide flexible mechanisms for compliance such as renewable energy trading credits? Each of these factors presents important drafting issues, which are discussed below.

In the United States, two RPS programmes that have been judged to be particularly successful are those of Texas and California. The Texas RPS, enacted in 1999, provides stringent penalties for non-compliance and uses flexible credit trading mechanisms to lower costs. It set an initial goal of 2000 megawatts (MW) of new renewable energy capacity by 2009, but this was later increased to 5,880 MW by 2015 and 10,000 MW by 2025. Texas met and exceeded its 10,000 MW installed capacity goal by 2010, a full fifteen years ahead of schedule.[281] California's RPS initially mandated energy companies to purchase 20% of their energy from renewable sources; this was later increased to a requirement of 33% by 2020.[282] By 2015, most California energy companies

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276 MAYOR'S OFFICE OF LONG-TERM PLANNING AND SUSTAINABILITY, THE CITY OF NEW YORK, ONE CITY BUILT TO LAST (2014), http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf.

277 City of New York, Press Office, De Blasio Administration Moves to Power 100 Percent of City Government from Renewable Sources of Energy, NYC.GOV (July 1, 2015), http://www1.nyc.gov/office-of-the-mayor/news/478-15/de-blasio-administration-moves-power-100-percent-city-government-renewable-sources-of.

278 Matt Richtel, San Diego Vows to Move Entirely to Renewable Energy in 20 Years, THE NEW YORK TIMES (Dec. 15, 2015), http://www.nytimes.com/2015/12/16/science/san-diego-vows-to-move-entirely-to-renewable-energy-in-20-years.html?_r=0.

279 City of San Francisco Board of Supervisors Green Building, Environment Codes – Better Roof Requirements for Renewable Energy Requirements (April 19, 2016), https://sfgov.legistar.com/View.ashx?M=F&ID=4399794&GUID=FE220DFF-2C3F-4F0B-8C9B-39F1A61039F2; National Public Radio, City of San Francisco Requires New Buildings to Install Solar Panels (April 20, 2016), http://www.npr.org/sections/thetwo-way/2016/04/20/474969107/san-francisco-requires-new-buildings-to-install-solar-panels.

280 Warren Leon, The State of of State Renewable Porfolio Standards 4, http://www.cesa.org/assets/2013-Files/RPS/State-of-State-RPSs-Report-Final-June-2013.pdf (Jun. 2013).

281 Texas Wide Open for Business, The Texas Renewable Energy Industry 8 (2014), http://gov.texas.gov/files/ ecodev/Renewable_Energy.pdf.

282 Kevin de Leon and Mark Leno, S.B. 350: Golden State Standards, CALIFORNIA CLIMATE LEADERSHIP (2015), http://focus.senate.ca.gov/sites/focus.senate.ca.gov/files/climate/505050.html.

had already met the standard five years ahead of schedule, and the California legislature again acted to increase the requirement to 50% by the year 2030.[283] Other state-wide programmes that are often cited with a strong prognosis for success include Arizona, Hawaii, Nevada, and New Jersey. In particular, Hawaii has initiated a transition to a 100% renewable-energy portfolio by 2045.[284]

Maine's RPS programme as it was originally drafted is often cited as an example of what legislative drafters should avoid: although it technically imposed a 30% renewable energy requirement (later increased to 40%),[285] the original RPS failed to lead to the development of any new resources because of over-broad eligibility requirements. The definition of "eligible resources supply" was originally defined so broadly that it included fossil-fuel cogeneration, percentage requirements were non-binding, and there were no provisions to encourage new renewables.[286] Amendments to the RPS in 2006, 2007, and 2011 eventually addressed some of these issues. In 2014, Maine obtained three-fifths of its net electricity generation from renewable sources, mostly hydropower and biomass, with wind contributing 8% of electricity generation.[287]

1. Key RPS Drafting Issues

This paragraph provides a brief overview of some of the most important and complex drafting issues for any RPS legislation or regulation.

a. How broad a set of energy resources will the RPS cover?

The definition of RPS eligible resources is a crucial initial issue, which requires several sets of critical decisions to be made.

Will the RPS provide incentives only to energy resources that meet a strict definition of renewable energy, or will it cover a range of other energy resources? The answer to this question may depend on whether policy makers are seeking to use the RPS primarily as a tool to provide environmental, public health, and global warming benefits, or whether they view it primarily as a fuel diversification tool. As is discussed below, many jurisdictions carefully define RPS eligible resources in order to ensure that only environmentally beneficial renewable resources are included; others frame their RPS legislation as an "alternative" rather than a "renewable" energy standard, suggesting that the latter goal of fuel diversity is more important.

The issue of including electricity produced from municipal solid waste (MSW) incineration plants in an RPS programme has also been hotly debated in the political arena, with varying results. In the United States, at least nine states, including New York, have chosen to exclude MSW incineration from RPS programmes, reflecting either a judgment that MSW is not a renewable resource and/

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283 Id.
284 Governor of the State of Hawaii David Y. Inge, Press Release: Governor Inge Signs Bill Setting 100 Percent Renewable Energy Goal in Power Sector, HAWAII.GOV (Jun. 8, 2015), http://governor.hawaii.gov/newsroom/press-release-governor-ige-signs-bill-setting-100-percent-renewable-energy-goal-in-power-sector/.
285 Leon, op. cit., 4 fig.1.
286 Grace, Wiser, Bolinger, Renewable Portfolio Standards: Background and Analysis for New York State (May 2002) at 6, http://www.dps.ny.gov/rps/rpsbackgroundpaper.pdf, op. cit., 3.
287 U.S. Energy Info. Admin., Maine: State Profile and Energy Estimates, EIA (May 2015), http://www.eia.gov/state/?sid=ME.

or (most frequently) that environmental and public health concerns about air pollution from MSW incineration call for its exclusion.[288] In a comparison of air emission rates from waste-to-energy facilities in New York, the New York Public Service Commission determined that in the year 2000, the average mercury emission rate from the state's waste-to-energy plants was six times higher than the average emission rates for those pollutants from the state's coal burning plants.[289] Other states, including New Jersey, Connecticut, Maine, and Nevada, have included MSW incineration, often as part of a secondary tier in a tiered approach to eligibility.

In Europe, most country-level RPS-type renewable energy standards focus on "new renewables" (e.g. wind, PV, biomass, biogas, and geothermal). Few include municipal solid waste incineration within their programme, and most also exclude large hydro.[290] However, the European Union Renewables Directive is more flexible, allowing for the inclusion of municipal solid waste incineration and large hydro projects.[291]

b. Will all renewable energy resources be eligible for the RPS programme?

Many jurisdictions may wish to limit the eligibility of some renewable energy resources in their RPS programmes.

First, some jurisdictions have chosen to focus RPS programmes on stimulating new renewable resources rather than using the RPS to support existing renewable technologies, which may be mature and not require further support.

Second, some legislators may choose to support particular forms of renewable resources that are indigenous to the jurisdiction. For instance, Arizona and Nevada's RPS programmes focus on solar power in recognition of the dry and sunny climate in these states.[292]

Third, if jurisdictions are primarily motivated by environmental goals, they may choose to either exclude renewable resources that can have adverse environmental impacts from the RPS or define eligibility in a way that minimizes these impacts. For instance, large hydroelectric projects, although traditionally classified as renewable, can cause a range of serious environmental problems, from fish kills to widespread ecosystem destruction through the construction of dams. The Low Impact Hydro Institute is a resource that can be used to provide more environmentally meaningful, site-specific and targeted definitions of "low impact" hydro.[293]

288 Other states that have excluded MSW incineration from their RPS include Arizona (with a single exemption for one MSW facility under a pilot program), California (with an exemption for a single pre-existing MSW facility), Delaware, the District of Columbia, Illinois, Montana, North Carolina, New Hampshire, New Mexico, New York, Rhode Island, Texas, Vermont, and Washington. The states with RPSs in which MSW incineration may be eligible are Colorado, Connecticut, Florida, Hawaii, Iowa, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, New Jersey, Nevada, Ohio, Oregon, Pennsylvania, and Wisconsin. See DSIRE, Programs, Renewable Portfolio, DSIRE (2015), http://programs.dsireusa.org/system/program.

289 New York Public Service Commission, Case 03-E-0188, Order Regarding Retail Renewable Portfolio Standard (Sept. 24, 2004) at 39, http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/85D8CCC6A42D-B86F85256F1900 533518/$File/301.03e0188.RPS.pdf.

290 Haas and Eichammer et al., How to promote renewable energy systems successfully and effectively, ENERGY POLICY 32 (2004) 833-839, Table 2, http://www.sciencedirect.com/science/article/pii/S0301421502003373.

291 European Environment Agency, Renewable Electricity Consumption, EEA (Sep. 4, 2015), http://www.eea.europa.eu/data-and-maps/indicators/renewable-electricity-consumption.

292 ARIZONA ADMIN. CODE Art. 18: Renewable Energy Standard and Tariff, http://apps.azsos.gov/public_services/Title_14/14-02.pdf; NEVADA ADMIN. CODE Chap. 704 § 8831, http://www.leg.state.nv.us/nac/nac%2D704.html#NAC704Sec8831.

293 See Low Impact Hydropower Institute, Welcome to LIHI (2016), http://www.lowimpacthydro.org.

Similarly, biomass projects can have either high or minimal environmental impacts (chiefly air emissions) depending on what type of biomass is used, how it is grown and harvested, and how it is utilized. Some jurisdictions have wisely chosen to limit biomass eligibility in RPS programmes on this basis.

Finally, a focus on environmental goals may sometimes lead to the inclusion of energy resources that are not traditionally classified as renewable. For instance, several states, such as New York, Connecticut, and Maine, include natural-gas powered fuel cells as RPS eligible, both because fuel cells have extremely low air emission rates and because the hydrogen required to produce electricity from fuel cells can be produced from renewable resources as well as from natural gas.

c. *What are the considerations regarding the use of RPS Programme Tiers?*

Another approach that policy makers can consider is to establish resource tiers, sometimes known as "technology bands," for RPS eligibility. Under this approach, policy makers create tiers of preferable and less preferable resources and then allow each tier to meet a certain percentage of the RPS mandate. For instance, New Jersey's RPS created a two-tiered standard with two sets of eligible resources. Class I resources include wind, solar, landfill gas and "sustainable" biogas, geothermal, wave, tidal, and fuel cells. Class II resources include hydropower up to 30 MW and solid waste incineration that meets certain specified environmental standards. One tier is open to both Class I and Class II resources and remains flat at 2.5% of total retail sales. The second tier is open only to Class I resources and begins at 0.5%, with gradual incremental increases following.[294]

A potential benefit of this approach is to provide policy makers with the ability to pursue varying goals simultaneously through individual tiers (e.g. environmental benefits and resource diversity). Potential downsides to this approach include that it: creates an additional level of complexity that may make compliance and enforcement more difficult; provides a temptation to solve political problems by creating a niche for non-renewable energy resources in a policy intended to promote renewable energy; and may create consumer confusion by suggesting that there are "shades of green" within the definition of renewable energy.

Another approach for legislators who wish to emphasize stimulation of a particular form of renewable energy is to provide multiple renewable energy credits (described below) per kilowatt hour. For example, Arizona offers extra credits for in-state manufacture, in-State installation, and early installation of distributed solar technologies. Nevada's RPS grants 2.4 credits for off-grid photovoltaics. New Mexico provides 3 credits for solar technologies installed and operational before January 1, 2012, provided they meet certain criteria.[295]

Other states have adopted specific, distinct policies – in addition to RPS policies – to encourage particular types of renewables that may require additional policy support. For instance, New York has adopted the NY-Sun program, which aims to install 3,000 MW of solar power in New York State over a decade (backed by an investment of U.S. $1 billion), while also implementing policies

294 DSIRE, New Jersey: Renewable Portfolio Standard, DSIRE (May 20, 2015), http://programs.dsireusa.org/system/program/detail/564.

295 DSIRE, New Mexico: Renewable Portfolio Standard, DSIRE (May 29, 2015), http://programs.dsireusa.org/system/program /detail/720.

that will reduce the cost of solar over this time period so that incentives are no longer required. [296] Other states, such as Rhode Island, Maryland, and New Jersey have adopted legislation aimed at incentivizing specific amounts of offshore wind power.[297]

d. What are the considerations regarding imported renewable energy eligibility for RPS's?

Policy makers must determine whether RPS eligibility will be limited to renewable electricity produced within the jurisdiction or whether eligibility will extend to renewable electricity that is imported from outside the jurisdiction. If renewable projects outside the jurisdiction are RPS eligible, and the RPS programme provides for trading of Renewable Energy Credits (REC), discussed below, policy makers also must decide whether a delivery requirement should be imposed for out-of-jurisdiction renewable energy or whether RECs may be freely traded without regard to whether electricity is delivered within the jurisdiction.

Policy trade-offs presented by these questions include the following: Restricting RPS eligibility to renewable projects within a jurisdiction may help ensure that the jobs and other economic benefits of renewables deployment will be realized in-state. It may also help to ensure that renewable electricity will be generated in state and thus displace fossil-fuel generation. On the other hand, regional air quality improvements brought about by allowing out-of-state renewables to be RPS eligible are also likely to benefit in-state air quality. [298]Developing a vigorous regional trading system may also reduce the cost of the RPS programme and ultimately help to support a thriving in-state renewable industry.[299]

In the United States, most state RPS programmes (e.g. Arizona, Connecticut, Nevada, New Jersey, New York, Texas) impose some form of delivery requirement on imported renewable electricity for RPS eligibility.[300] In the United States, the Commerce Clause of the U.S. Constitution[301] likely limits a state's ability to entirely prohibit participation of out-of-state renewable electricity in a state's RPS programme, but delivery requirements are likely to pass constitutional muster.

There are also potential environmental and economic benefits to a broader, more seamless regional renewable energy credits trading programme where RECs are freely traded. A state RPS programme that makes out-of-state RECs eligible from a carefully defined region, ensuring that air quality benefits will inure to the state, also will also likely meet Commerce Clause requirements.

e. What are the factors in defining RPS goals and targets?

Policy makers must also design the end goal and interim targets for an RPS. An RPS typically establishes a required end goal for renewable energy. This can be expressed by establishing a

296 New York State Energy Research and Development Authority, NY-Sun, NYSERDA.NY.GOV, http://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun (2016).
297 National Wildlife Federation, Catching the Wind: State Action Needed to Seize the Golden Opportunity of Atlantic Offshore Wind Power (2014), http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/Offshore-Wind/NWF-2014_CatchingTheWind-7_15.pdf
298 Rader, op. cit., 32-36.
299 Id.
300 Grace, Wiser, Bolinger, op. cit., 24-25.
301 U.S. CONST. Art. I, § 8, Cl. 3, http://www.usconstitution.net/xconst_A1Sec8.html

requirement for the amount (MWh) of renewable electricity that must be provided, a renewable electricity capacity (MW) requirement, or requiring that a percentage of electricity sold in a particular jurisdiction must be renewable. An approach that focuses on the actual amount (MWh) of renewable electricity to be produced will maximize the environmental benefits of RPS legislation. An RPS also typically includes a start date for RPS initial compliance, which is then ramped up through interim targets until the ultimate RPS goal is met. Some RPS programmes "sunset" after a particular date (meaning that they terminate after a specified period of time); others have an infinite duration or are subject to discontinuation after a particular date only if there is a regulatory determination that the requirement is no longer necessary. Finally, some jurisdictions have developed RPS cost caps as a means to limit the cost of RPS programmes.[302]

Policy makers need to ensure that the ultimate goal, as well as the target goals, of the RPS is both technically and economically achievable, given available renewable resources, and is ambitious enough to produce the desired additional renewable energy demand that will drive further commercialization of renewable resources, leading to greater availability and lower prices.

f. *How can responsibility be assigned for meeting RPS goals?*

Policy makers must decide with whom responsibility for meeting RPS goals will lie. Spreading RPS obligations among the broadest group of energy providers makes the most sense from the perspective of fairness and fully capturing opportunities for renewable deployment. In the United States, states thus far have assigned RPS requirements to retail electricity providers, chiefly investor-owned utilities (privately-owned utilities rather than government-owned public power authorities). Public power authorities, which are typically (but not exclusively) wholesale suppliers, have generally not been subject to RPS requirements.

Exempting certain types of load serving entities from the RPS can increase costs for those who are not exempt, make RPS goals harder to meet, and create a politically damaging sense of unfairness. On the other hand, there may be political or jurisdictional problems presented by imposing RPS obligations on entities such as municipal utilities.

g. *How can RPS compliance be achieved?*

Drafters of RPS legislation or regulations should consider which design, implementation, administration and enforcement options will work best to ensure the success of their RPS programmes and achieve compliance with their RPS goals.[303] There is no single approach that will work best in all jurisdictions. Instead, RPS drafters should design the programme that is best suited for the needs of the particular

302 Galen Barbose, Renewables Portfolio Standards in the United States: A Status Update, LAWRENCE BERKELEY NATIONAL LABORATORY (2012), http://www.cesa.org/assets/2012-Files/RPS/RPS-SummitDec2012Barbose.pdf.

303 There are a number of helpful overviews of best practices for state RPS design and implementation. See, e.g. Warren Leon, Clean Energy States Alliance, Designing the Right RPS: A Guide to Selecting Goals and Program Options for a Renewable Portfolio Standard, Prepared for the State-Federal RPS Collaborative and NARUC (March 2012), available at http://www.cesa.org/assets/2012-Files/RPS/CESA-RPS-Goals-and-Program-Design-Report-March-2012.pdf; Ryan Wiser and Galen Barbose, Lawrence Berkeley National Laboratory, 2011 National Summit on RPS, Update on the Implementation of U.S. Renewables Portfolio Standards (Oct. 26, 2011), available at http://cesa.org/assets/Uploads/2011-RPS-Summit-Combined-Presentations-File.pdf; Nancy Rader and Scott Hempling, Nat'l Ass'n of Regulatory Util. Comm'rs, The Renewables Portfolio Standard: A Practical Guide (Feb. 2001) at 56-57; available at http://www.scotthemplinglaw.com/files/pdf/ppr_renewables_portfolio_standard_0201_0.pdf

jurisdiction, taking into account the specific RPS goals that have been identified, the nature of the state's electricity system and regulatory framework, regional markets, natural resources and other factors that may be unique.[304]

The implementation structure of U.S. state RPS programmes varies considerably. The most common approach, particularly in states with restructured utility markets with retail competition, is to allow utilities to meet RPS obligations via the purchase and trading of Renewable Energy Credits (RECs). A REC is a tradable, contractual instrument that represents the full suite of non-power environmental attributes of one megawatt-hour of renewable energy generation on the electricity grid. In some states, however, mostly states that still have regulated electricity markets, utilities meet RPS goals by entering into bundled contracts with renewable energy developers for both electricity and RECs. Utilities enter into these contracts via Request for Proposal solicitations or bilateral negotiations, with regulatory oversight. Hybrid approaches are also possible. In some states, including New York and Illinois, government agencies conduct RPS procurements instead of utilities.[305]

Allowing RPS compliance through tradable REC programmes has a number of benefits, including promoting a competitive renewables market, increasing efficiency, and under some circumstances reducing RPS costs. Under this compliance system, renewable electricity generators receive certification as RPS-eligible generators from the RPS administrator. The administrator then provides the generator with the number of tradable RECs that correspond to the amount of renewable electricity produced by that facility over a given compliance period. The generator thus has two products: "generic" or "null" electricity (meaning "generic" megawatt hours that can be sold to meet electricity needs just like any other form of electricity, with no special renewable attributes) and RECs. The generator can then sell each product separately. Retail electricity sellers are obligated to purchase RECs to meet their RPS compliance obligations. REC prices are determined by the market (although in some instances price caps are imposed). A subsequent retailer can combine RECs with system energy to create a new green power product. Where RECs vary in price, for example, due to the original source type of generation, retailers can engage in REC arbitrage by selling high value RECs from one facility and reconstituting the green power with less expensive RECs from another generator.[306]

Possible disadvantages to a REC trading approach to consider include the potential for REC price volatility caused by unexpected REC shortages and possible consumer confusion about what RECs are and how trading works.[307] In addition, a REC only approach may not provide renewable energy developers with sufficient certainty to allow them to obtain financing. Long-term power contracts for both RECs and electricity may need to be required to ensure that renewable energy projects can obtain financing, and some states are including long-term contract requirements in their RPS programmes.[308]

For instance, Connecticut's RPS programme includes a REC trading component. However, it also gives the state Commissioner of Energy and Environmental Protection the authority to solicit proposals from renewable energy sources and, if found to be in the interest of ratepayers, select

304 Leon, op. cit., 6.
305 Wiser, op. cit., 11.
306 Leon, op. cit., 30-31.
307 Id.
308 Id. at 11, 48-49.

proposals to meet up to 4 percent of state's load distribution. The commissioner can also direct electric distribution companies to enter into Power Purchase Agreements for energy, capacity and environmental attributes for terms less than 20 years. These agreements must be approved by the Public Utilities Regulatory Authority and costs incurred by the distribution companies can be recovered through electric rates for the distributor's customers.[309]

h. What are the considerations for RPS enforcement?

Enforcement provisions are critically important for RPS legislation or regulation, including the ability to assess penalties on RPS covered electricity sellers who fail to meet their RPS responsibilities, as well as on RPS-certified renewable energy generators who violate the applicable rules.[310] U.S. state RPS programmes incorporate a number of enforcement mechanisms, including Alternative Compliance Payments, explicit financial penalties, and penalties at the discretion of the regulator. While penalties for RPS non-compliance have been levied in at least six states, non-compliance is also often excused.[311]

i. What are the options for RPS administration?

Drafters of RPS legislation or regulation will need to clearly assign implementation of the RPS to a regulatory agency. Typically, the agency with central RPS implementation responsibility will be a public utility commission or a state energy office. An independent third-party administrator could also be selected. Selection of the most appropriate agency to oversee and implement the RPS implementation will depend on which agency has the most expertise, interest in, and broadest jurisdiction over, renewable energy. More than one agency may also be designated to implement the RPS jointly. The implementing agency (or agencies) needs authority to undertake the following RPS implementation tasks: certification of RPS eligible generators; verification of renewable generation by certified facilities; provision of public information; enforcement of the RPS, and possible establishment and management of a "cost cap".[312]

III. ECONOMIC TOOLS TO PROMOTE RENEWABLE ENERGY

There are a number of economic support and incentive mechanisms that policy makers can deploy to support renewable energy. These are described below in three categories: 1) government support and investment policies that have been used worldwide to promote renewable energy, such as the policies commonly called "feed-in tariffs" and research and development support; 2) public benefit programmes, used in many parts of the United States, under which electricity users typically pay a small "systems benefit charge" per kilowatt hour of electricity used that is collected by utilities and goes into a public benefit fund to support renewable energy, energy efficiency, and low-income energy efficiency programmes; and 3) tax mechanisms that can be used to support renewable energy both by imposing tax on fossil fuel tax technologies and by providing tax credits to renewable energy manufacturers and/or customers. In addition, Section Three of this Guide addresses renewable energy project finance policies, which are also crucially important for renewable energy development.

309 Conn. Gen. State. Ann. § 16a-3f.
310 Rader, op. cit., 72-78.
311 Wiser, op. cit., 30.
312 Id. at 79-82.

It is also important to remove fossil fuel subsidies in order to create a level playing field for renewable energy to compete with traditional baseload electricity generation technologies. Global subsidies for fossil fuel and nuclear power technologies remain high, with estimates of total subsidies globally ranging from $550 billion to $5.6 trillion. [313] Such subsidies artificially reduce the cost of fossil fuel and nuclear energy, making it more difficult for renewable energy technologies to compete and scale up. In 2014, almost thirty countries, including Egypt, India and Indonesia moved forward with fossil fuel subsidy reform. [314] Further progress on removing fossil fuel subsidies globally will be important in creating a future dominated by renewable energy.

A. Renewable Energy Incentives and Feed-In Tariffs

Many countries, most prominently Germany, Spain, and Denmark, have implemented "feed-in" tariffs to provide government economic support for renewable energy. Austria, Italy, the United Kingdom, Thailand, Malaysia, and Ukraine, among others, have also established these tariffs.[315] A feed-in tariff is a provision that allows all eligible generators to receive a fixed and known price for their renewable electricity sales.[316] The costs of these tariffs are covered by increased electric rates that sometimes take the form of regional or national surcharges (similar to those established for public benefit programmes, see below); sometimes they are simply embedded in rates. In some sense, this approach combines the legal mandate approach of the RPS (described above), with the public benefit fund approach discussed below. Note, however, that the feed-in tariff approach used alone differs in important ways from the RPS approach: under a feed-in tariff, utilities are required to pay a specified price for electricity generated by renewable energy technologies, but the quantity is decided by the market; under an RPS approach, the quantity (or percentage) of renewable energy is set and the price is decided by the market.[317]

In 2000, Germany enacted the Renewable Energy Act (Erneuerbare-Energien-Gesetz). The Act has been amended multiple times, most recently in 2014. Under the Act, grid operators pay a feed-in tariff, which is charged as part of electricity rates. Energy companies are legally required to purchase renewable energy resources and there is a fixed price scheme, with specific per-kilowatt hour payments for each renewable energy technology based on the real costs of generation.[318] Through its feed-in tariffs, initially adopted in 1990 as part of the German *Energiewende* – clean energy transition – Germany has transformed itself from a country with sparse renewable energy generation into one of the world's top five leaders in renewable energy.[319] German wind capacity

313 REN. 21, op. cit., 24.
314 Nordic Council of Ministers, Fossil-Fuel Subsidies and Climate Change: Options for Policy-makers within Their Nationally Determined Contributions (2015) at 18.
315 See PV Magazine, Photovoltaic Feed-In Tariffs, MARKETS AND TECHNOLOGY (2016), http://www.pv-magazine.com/services/feed-in-tariffs/feed-in-tariffs-for-various-countries/; Craig Morris, Austria adopts new feed-in tariffs, Renewables International (Sept. 2012), http://www.renewablesinternational.net/austria-adopts-new-feed-in-tariffs/150/537/56767/.
316 RYAN WISER ET AL., INTERNATIONAL EXPERIENCE WITH PUBLIC BENEFIT FUNDS: A FOCUS ON RENEWABLE ENERGY AND ENERGY EFFICIENCY (October 2003), http://resource-solutions.org/document/international-experience-with-public- benefits-funds-a-focus-on-renewable-energy-and-energy-efficiency/.
317 Haas, Eichhammer et al, op. cit., 2.
318 Act on the Development of Renewable Energy Sources (RES Act 2014), http://www.bmwi.de/English/Redaktion /Pdf/renewable-energy-sources-act-eeg-2014,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf; National Renewable Energy Laboratory, German Renewable Energy Sources Act (EEG) 2009, NREL Renewable Energy Project Finance (Jan. 2008), http://www.feed-in-cooperation.org/wDefault_7/wDefault_7/download-files/documents/National-documents/Germany/renewable-energy-sources-act_2009-en.pdf; Overview Renewable Energy Sources Act, GERMAN ENERGY BLOG (2012), http://www.germanenergyblog.de/?page_id=283; see also WISER ET AL., op. cit., 14, 65.
319 Renewables 2015, op. cit., 20.

has increased from 56 MW in 1990, to more than 14,600 MW in 2003, to 45,000 MW by the end of 2015.[320] In the first half of 2015, wind power met almost 13% of German's total electricity demand.[321] Similarly, as of year-end 2015, Germany led the world in solar PV capacity, with nominal capacity of about 40 GW, greater than any other type of power plant in the entire country.[322]

Likewise, Spain's Royal Decree 2818 of 1998 guarantees the purchase of renewable energy sources at a fixed price or at a fixed premium on top of the market price, resulting in total payments in the range of 80% to 90% of the average electricity price.[323] This programme has demonstrated remarkable staying power, and the decree itself has been modified and reissued multiple times, most recently in 2014[324] Spain generated more than 20% of its electricity by wind in 2014. [325] However, Spain has recently put in place new policies that will make increased growth of solar PV more difficult.[326]

An early pioneer in land-based wind and offshore wind, Denmark has strongly encouraged renewable energy for decades. Originally, power companies were required to pay 85% of the retail electricity price for wind energy purchased from privately-owned wind turbines, with a deduction for administrative costs. Feed-in tariffs were subsequently phased out in Denmark, but support for wind power has continued with the introduction of an RPS-like green certificate market in 2001. In recent years, the Danish government implemented an environmental premium to be paid by purchasers of electricity to wind energy producers. For Denmark, the 2009 European Renewable Energy Directive specifies that the share of renewable energy in the country's final energy demand is to rise from 17% in 2005 to 30% in 2020. The government has set a target of 50% wind energy in electricity energy demand by 2020 as part of its long-term strategy to achieve a 100% renewable energy mix in the electricity and heat sector by 2035, and in all sectors by 2050.[327] Remarkably, Denmark now has so much installed wind generation capacity that during times of peak output, it can supply well more than 100% of the *entire country's* demand for electricity while exporting a large surplus to Germany and Norway.[328]

Feed-in tariffs have not been without controversy. The high costs associated with these programmes have led to pushback in many countries, particularly in Western Europe. In many cases the premium

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320 Id. at 29; EUROPEAN WIND ENERGY ASSOC., WIND IN POWER: 2014 EUROPEAN STATISTICS (Feb. 2015), http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA-Annual-Statistics-2014.pdf; Global Wind Energy Council, op. cit., 9.

321 Phys.org, German wind power output tops 2014 total, PHYS.ORG (Oct. 1, 2015), http://phys.org/news/2015-10-german-power-output-tops-total.html.

322 HARRY WIRTH, RECENT FACTS ABOUT PHOTOVOLTAICS IN GERMANY 5 (Oct. 16, 2015), https://www.ise.fraunhofer.de/en/publications/veroeffentlichungen-pdf-dateien-en/studien-und-konzeptpapiere/recent-facts-about-photovoltaics-in-germany.pdf.

323 Spain Royal Decree 2818/1998: "Special Regine," EIA.org (2013), http://www.iea.org/policiesandmeasures/pams/spain/name-21692-en.php; http://www.appa.es/dch/spanish_market.htm.

324 Spain Royal Decree 413/2014, LSE (2014), http://www.lse.ac.uk/GranthamInstitute/law/royal-decree-4132014-regulating-the-production-of-electricity-generation-from-renewable-energy-cogeneration-and-waste/.

325 Asociación Empresarial Eólica, Wind Energy in Spain (2015), http://www.aeeolica.org/en/about-wind-energy/wind-energy-in-spain/.

326 Ilias Tsagas, Spain Approves "Sun Tax," Discriminates Against Solar PV, RENEWABLE ENERGY WORLD (Oct. 23, 2015), http://www.renewableenergyworld.com/articles/2015/10/spain-approves-sun-tax-discriminates-against-solar-pv.html.

327 International Renewable Energy Agency, 30 Years of Policies for Wind Energy: Lessons from 12 Wind Energy Markets 54-59 (2012), https://www.irena.org/DocumentDownloads/Publications/IRENA_GWEC_WindReport_Denmark. pdf.

328 Arthur Nelson, Wind power generates 140% of Denmark's electricity demand, THE GUARDIAN (Jul. 10, 2015), http://www.theguardian.com/environment/2015/jul/10/denmark-wind-windfarm-power-exceed-electricity-demand.

National Renewable Energy Act, 2015

40. Procurement of Renewable Electricity and payment guarantee

(1) Regulated Obligated Entities shall within one year of the establishment of the RPO trajectory, develop five-year Renewable Electricity Procurement Plans towards meeting RE targets

(2) Over a period of time, such RPO shall be net at least cost to the consumers and submit them for approval to the respective State Electricity Regulatory Commissions

(3) The Central Electricity Authority shall review all Regulated Obligated Entities' Renewable Electricity Procurement Plans in order to identify and report to respective SERCs opportunities for cost reductions through coordination and cooperation among all Regulated Obligated Entities across the country.

(4) The Ministry shall, within one year of notification of the Act, establish clear guidelines for procurement mechanisms including but not limited to competitive bidding processes

(5) Provided that the risks of the procurement mechanisms are identified and mitigation strategies are developed

(6) Until such guidelines are adopted, the price of Renewable Electricity shall be established as per the approval of the Appropriate Commission

(7) The open access consumers procuring electricity from renewable energy sources not to pay the surcharge for open access. <EA amendment: Section 42>

41. Timely Payments for RE Procurement:

(1) Regulated Obligated Entities shall within one year of the notification of the Act, create adequate and sufficient payment security mechanisms that ensure timely payments for RE power procured

(2) SERCs shall ensure that the tariff for renewable energy shall be paid by obligated entities / procurers, in a timely manner. The payment for procured RE shall get same priority as payment for other procured power, from any source whatsoever. The SERCs shall be responsible to ensure equitable treatment to renewable energy payments.

42. Access to Grid and Forecasting

(1) Grid connectivity:

i. Notwithstanding anything contained in this Act or any other enactment, the operators of the transmission and / or the distribution system, as the case may be, shall be obliged to connect the renewable energy generator to the system. . .

Source: **http://mnre.gov.in/file-manager/UserFiles/draft-rea-2015.pdf**

paid was locked in at a high rate while renewable technology costs dropped rapidly, and many jurisdictions have since adjusted their feed-in-tariff rates. The United Kingdom, for example, recently announced cuts to its feed-in-tariffs. [329]Some countries, such as the Netherlands, have

329 BusinessGreen, Feed-in Tariff cuts: the reaction, businessGreen (Aug. 27, 2015), http://www.businessgreen.com/bg/analysis/2423671/feed-in-tariff-cuts-twitter-reacts.

implemented feed-in-tariffs but subsequently repealed them or allowed them to sunset (or expire) upon reaching a statutory expiration date.[330] Opponents of feed-in tariffs believe that they distort energy markets and lead to price increases; proponents view feed-in tariffs as one of the most effective ways to scale-up renewable energy.

Many countries provide other types of incentives to promote renewable energy. For example, China's newly adopted Renewable Energy Law allocates government funding for renewable energy research and development. Article 12 of the law's "Industry Guidance and Technology Support" section lists scientific and technical research in the development and utilization of renewable energy, in addition to industrialized development of renewable energy, as the preferential area for high-tech development and high-tech industrial development in the national programme. It allocates funding for: scientific and technical research; and application, demonstration, and industrialization, to promote technical advancement in the development and utilization of renewable energy, reduce the production cost of renewable energy products, and improve the quality of those products.[331]

India has proposed a draft renewable energy law (see below) that similarly will lay the groundwork for providing economic incentives that will encourage renewable energy development.[332]

As the market for energy becomes increasingly globalized, some countries have looked to create supranational organizations and incentives to promote the development of renewable energy. Most recently, India's Prime Minister Narendra Modi jointly announced with France its new "International Agency for Solar Technologies and Applications" at the COP21 meetings in Paris. The agency would provide funding for the deployment of solar energy technologies in developing countries (many of which lie in the tropics where solar energy is plentiful) and, crucially, to promote the dissemination of information and the sharing of technologies between technologically advanced countries and less wealthy nations.[333]

B. Public Benefit Funds

Policy makers may also choose to create public benefit or system benefit charge ("SBC") programmes to support renewable energy. Under these policies, which have been established by legislation or by regulation in different jurisdictions, electricity customers typically pay a small systems benefit charge per kilowatt hour of electricity consumed that is collected by utilities and goes into a Public Benefit Fund (PBF) to support public or system benefits. Although the majority of PBF funds in the United States go to support energy efficiency, a substantial portion is also directed to renewable energy. As of December 2015, twenty U.S. states and the District of Columbia have established

330 See, e.g., International Energy Agency, MEP: Environmental Quality of Electricity Production, IEA (2014), http://www.iea.org/policiesandmeasures/pams/netherlands/name-21635-en.php.

331 Renewable Energy Law of the People's Republic of China, Chapter 3, Art. 12, op. cit. The bill is set to be placed before Parliament sometime in 2016, according to Shreya Jai, National Renewable Energy Act to Change Landscape of RE, BUSINESS STANDARD (Jul. 20, 2015), http://www.business-standard.com/article/economy-policy/national-renewable-energy-act-to-change-landscape-of-re-115072001013_1.html.

332 The bill is set to be placed before Parliament sometime in 2016, according to Shreya Jai, National Renewable Energy Act to Change Landscape of RE, BUSINESS STANDARD (Jul. 20, 2015), http://www.business-standard.com/article/economy-policy/national-renewable-energy-act-to-change-landscape-of-re-115072001013_1.html.

333 Arthur Neslen, India unveils global solar alliance of 120 countries at Paris climate summit, THE GUARDIAN (Nov. 30, 2015), http://www.theguardian.com/environment/2015/nov/30/india-set-to-unveil-global-solar-alliance-of-120-countries-at-paris-climate-summit; United Nations Framework Convention on Climate Change, Announcement, India and France Launch International Solar Energy Alliance at COP21, UNFCC (Nov. 2015). http://newsroom.unfccc.int/clean-energy/international-solar-energy-alliance-launched-at-cop21/.

public benefit fund programmes that provide economic support for renewable energy.[334]

Outside of the United States, public benefit fund programmes of this type are used in Ireland and Brazil, and to some extent, in Germany and the Netherlands.[335] The United Kingdom also had a successful public benefit fund programme in place from 1990-1998, known as the Non-Fossil Fuel Obligation (NFFO).[336] Under the Non-Fossil Fuel Obligation, renewable generators were able to bid for above-market power purchase agreements in auctions. Electric utilities were mandated to accept power under these contracts, but were reimbursed for their above-market costs through a levy, or wires charge, on electricity rates.[337] The UK's Non-Fossil Fuel Obligation programme was replaced effective April 1, 2002 with a Renewable Obligations programme that utilizes tradable Renewable Obligations Certificates. Power producers who fail to meet their obligation can buy out the obligation at a price of 30 British pounds/MWh (approximately $.048/kWh), with the proceeds distributed to companies that have met their obligations.[338] The United Kingdom is currently reviewing the programme and contemplating some major revisions, however, including ending the programme for land-based wind power as of April 2016.[339] As of March 2016, legislation to effectuate this change is pending in Parliament but has not yet been enacted.[340]

Some EU states, including Germany, already rely at least in part on public benefit fund programmes—though they most often are part of a hybrid system used to support the feed-in tariff systems discussed above.[341]

In establishing a public benefit fund programme to support renewable energy, policy makers must address several key issues, including:

1. What Will Be The Funding Level of the PBF Programme?

In the United States, public benefit funds are sometimes set by state administrative agencies on a case-by-case basis for each utility service area. In other states, a particular charge is assessed per kWh supplied, as, for example, in Connecticut ($0.003/kWh).[342] Other states set a charge based on projected annual total utility revenue, as in Hawaii (2%) and Wisconsin (1.2%).[343] Several public benefit fund programmes outside of the U.S. have typically been larger: the UK Non-Fossil

334 See DSIRE, Programs: Public Benefit, DSIRE (2016), http://programs.dsireusa.org/system/program; DSIRE, Voluntary Solar Resource Development Fund, DSIRE (Nov. 2014), http://programs.dsireusa.org/system/program/detail/4876 (Note, however, that Virginia's program is entirely voluntary and relies primarily upon elective donations from retail consumers).
335 WISER ET AL., op. cit., 17.
336 The National Archives, Non-Fossil Fuel Obligation (NFFO), DTI.GOV (Feb. 2003), http://webarchive.nationalarchives.gov. .uk/20070603164510/http://www.dti.gov.uk/energy/renewables/policy/nffo_obligation.shtml.
337 WISER ET AL., op. cit., 16.
338 See Ofgem, Renewables Obligation Certificates (ROCs), Ofgem (2016), https://www.ofgem.gov.uk/environmental-programmes/renewables-obligation-ro; http://www.renewable-energy-policy.info/relec/unitedkingdom/policy/greencertificate.html.
339 Dep't of Energy & Climate Change, Changes to onshore wind subsidies protect investment and get the best deal for bill payers, GOV.UK (Jun. 18, 2015), https://www.gov.uk/government/news/changes-to-onshore-wind-subsidies-protect-investment-and-get-the-best-deal-for-bill-payers.
340 CMS Cameron McKenna, The Energy Bill Completes Third Reading in the House of Commons, Lexology (Mar. 23, 2016), http://www.lexology.com/library/detail.aspx?g=08919378-03c6-42c0-9362-ed85fecaced2.
341 WISER ET AL., op.cit.
342 DSIRE, Connecticut Energy Efficiency Fund, DSIRE (Jan. 2015), http://programs.dsireusa.org/system/program/detail/2313.
343 DSIRE, Hawaii Energy, DSIRE (Sept. 2014), http://programs.dsireusa.org/system/program/detail/3686; DSIRE, Wisconsin Focus on Energy Program, DSIRE (Jan. 2016), http://programs.dsireusa.org/system/program/detail/2085.

Fuel Obligation was funded at up to 0.9% of retail electricity sales; the surcharge in Italy in 2013 totalled about 6% of retail sales; and the surcharge in the Netherlands totalled 4% of retail sales.[344]

2. How long will the PBF programme remain in place?

Some programmes are established on a permanent basis. Others last five to ten years, and some have the possibility of renewal (e.g. New York's System Benefits Charge was initially established for three years, and it has been extended three times in five-year increments).[345] If too limited in duration, or if there is too much uncertainty about duration, public benefit fund programmes will not succeed in promoting renewable energy. The German Public Benefit Fund was expressly instituted to extend beyond a single legislative period and has been expanded since its introduction in 1999.[346] The surcharge has since endured, increasing every year through 2014.[347]

3. What Kind of Renewable Energy Programmes will the PBF Programme Support?

There are an almost limitless variety of programmes and incentives for renewable energy that public benefit funds can support. The text of public benefit fund legislation or regulation needs to be broad enough to allow the programme administrator sufficient discretion to determine which incentives will be best suited for the jurisdiction and are likely to be the most successful. Historically, in regards to renewables, public benefit fund-type programmes have concentrated on capital grants to renewable energy projects, including rebates, research, development, and demonstration programmes.[348] Other more recent and innovative types of programmes include fixed production incentives, low-cost consumer loans, favourable financing terms for renewable energy projects, and grants to help commercialize and build the market infrastructure for renewable energy.[349]

Over the period from 1992 to 2002, Japan successfully used a PV rebate programme, combined with net metering laws, low-interest loan programmes, and education programmes, to lead to the installation of more than 144,000 residential systems. Installed PV capacity in Japan now totals 144 GW as of 2015.[350]

4. Who will administer the PBF programme?

There are basically three options for programme administration: 1) utility administration; 2) administration by a government agency; and 3) administration by an independent, non-utility

344 Wiser et al, op. cit., 29. See THE CENTER FOR RESOURCE SOLUTIONS, INTERNATIONAL EXPERIENCE WITH PUBLIC BENEFIT FUNDS: A FOCUS ON RENEWABLE ENERGY AND ENERGY EFFICIENCY 16 (2013), www.raponline.org/docs/CRS_PBFInternational Experience.pdf.

345 New York State Dep't of Public Service, System Benefits Charge, NYDPS (2014), http://www3.dps.ny.gov/W/PSCWeb.nsf/ All/58290EDB9AE5A89085257687006F38D1?OpenDocument.

346 FEDERAL MINISTRY FOR THE ENVIRONMENT, NATURE CONSERVATION, AND NUCLEAR SAFETY, THE ECOLOGICAL TAX REFORM: INTRODUCTION, CONTINUATION, AND DEVELOPMENT INTO AN ECOLOGICAL FISCAL REFORMS ("The Ecological Tax Reform") 3, 5, 9 (Feb. 2004), http://www.bmu.de/files/oekost_en.pdf.

347 Craig Morris, A first: German renewable energy surcharge shrinks, ENERGY TRANSITION (Oct. 15, 2014), http://energytransition.de/2014/10/a-first-german-renewable-energy-surcharge-shrinks/. In 2015, the surcharge had a moderate decrease for the first time in its history. Id.

348 WISER ET AL., op. cit., 37.

349 Id. at 37-38.

350 Jason Deign, Japan's PV market outlook: settled after major growth, Solar Plaza (Sept. 16, 2015), http://www.solarplaza.com/channels/markets/11418/japans-pv-market-outlook-settled-after-major-growth/.

non-governmental entity. In the United States, most renewable energy public benefit funds are administered by government agencies, with a few by electric utilities and non-profits

C. Tax Approaches

Tax approaches can be used in several ways to encourage the use of renewable energy.

Both the production and use of renewable energy can be directly encouraged by providing tax credits or deductions (tax credits are reductions from payable taxes, thus of greatest benefit to low income taxpayers; tax deductions are reductions from the amount of income subject to taxation, thus the greater the income, the larger the deduction).

In the United States, the most successful federal tax programme has been the Renewable Energy Production Tax Credit, which provides eligible renewable project owners with cash payments based on renewable electricity production on a dollars per kilowatt-hour basis. Qualifying facilities are eligible for annual incentive payments of 1.5 cents per kilowatt-hour (1993 dollars and indexed for inflation) for the first ten-year period of their operation, subject to the availability of annual appropriations in each federal fiscal year of operation. Qualifying facilities must use solar, wind, geothermal (with certain restrictions as contained in the rulemaking), or biomass (except for municipal solid waste combustion) generation technologies. Fuel cells using hydrogen derived from eligible biomass facilities also are considered an eligible technology. Congress extended the U.S. production tax credit several times, and it was recently renewed again for five years in December 2015, retroactive to January 1, 2015, with a phasedown and ultimately a phase-out of this tax credit at the end of this five-year period.[351]

Similarly, Congress also extended the solar Investment Tax Credit until 2022, with a phase down in the size of the credit.[352] These extensions marked significant progress for the U.S. renewables industry. In the past, the short periods of time for which Congress had authorized these tax credits had brought uncertainty to the renewable energy industry, and had created "boom and bust" cycles of investment rather than building steady increases.

Many U.S. states also offer tax incentives. Among these are: state production incentives; corporate tax incentives, which promote renewable energy equipment by allowing corporations to receive credits or deductions against the cost of equipment or installation; personal income tax credits or deductions to cover the expense of purchasing and installing renewable energy equipment; property tax provisions that exclude the added value of renewable energy systems in the valuation of property for taxation purposes; and exemptions from sales tax for renewable energy equipment. A table of state tax incentives for renewable energy can be found on the website of Database for State Incentives for Renewable Energy. See: http://www.dsireusa.org/summarytables/financial.cfm?&CurrentPageID=7.

India has used a combination of investment tax credits, financing assistance, and accelerated depreciation to spur a boom in renewable energy. India is now the world's fourth-largest producer

351 U.S. Department of Energy, Renewable Energy Production Tax Credit (PTC), ENERGY.GOV (2015), http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc.

352 U.S. Department of Energy, Business Energy Investment Tax Credit (ITC), ENERGY.GOV (2015), http://energy.gov/savings/business-energy-investment-tax-credit-itc.

of wind power.[353]

China's Renewable Energy Law creates incentives through tax benefits as follows:

Conversely polluting forms of electricity generation can be taxed in order to make the polluters accountable for the externality costs of the damage to human health and the environment from their pollution. By raising the price of highly polluting forms of electric generation, pollution taxes

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Article 26—The state shall adopt a tax preferential policy for projects that are listed in the regenerable energy industry development guidance catalogue.

Source: http://english.mofcom.gov.cn/article/policyrelease/Businessregulations/201312/20131200432160

allow market forces to encourage the adoption of renewable resources. Pollution taxes (including carbon emission taxes) exist in France, Belgium, Spain, Austria, Germany, Greece, Italy, the United Kingdom, Finland, Ireland, Luxembourg, Denmark, the Netherlands, Brazil, Latvia, and Lithuania[354]. In the United Kingdom, for example, the sales of electricity, coal, natural gas, and liquefied petroleum gas are taxed; renewable energy was exempt up until August 2015.[355]

In Germany, electricity, motor fuels, and heating fuels are taxed, with the goal of supporting social security to boost the economy and lower unemployment while reducing energy consumption.[356] Under the German programme, the level of taxation varies by energy source—for example, in 2003, electricity was taxed at 2.05% while diesel fuel and petrol were taxed at 15.34%.[357] Of all the revenue generated by the German ecological tax, approximately 1% goes directly to fund the development of renewable energy.[358]

353 Global Wind Energy Council, op. cit. at 9; http://www.wwindea.org/the-world-sets-new-wind-installations-record-637-gw-new-capacity-in-2015.
354 Tax Policy Center, Key Elements of the U.S. Tax System, Briefing Book (2016), http://www.taxpolicycenter.org/briefing-book/key-elements/environment/europe.cfm; Eduardo Damião Gonçalves et al., Environmental Law and Practice in Brazil: overview, PRACTICAL LAW (Oct. 2012), http://us.practicallaw.com/2-508-8459#a652802; European Environment Agency, Air Pollution – National Responses (Latvia), EEA (2015), http://www.eea.europa.eu/soer/countries/lv/air-pollution-national-responses-latvia.
355 Gov. UK, Environmental taxes, reliefs and schemes for businesses, Gov.UK (Apr. 2016), https://www.gov.uk/green-taxes-and-reliefs/climate-change-levy.
356 European Environment Agency, Fuel prices, EEA (2015), http://www.eea.europa.eu/data-and-maps/indicators/fuel-prices-and-taxes/assessment-5; Ellen Thalman, What German households pay for power, CLEAN ENERGY WIRE (Jan. 2016), https://www.cleanenergywire.org/factsheets/what-german-households-pay-power
357 OECD, OECD ENVIRONMENTAL PERFORMANCE REVIEWS 119 table 5.1 (2012); Thalman, op. cit.
358 FAN GANG ET AL., THE ECONOMICS OF CLIMATE CHANGE IN CHINA: TOWARDS A LOW-CARBON ECONOMY 37 box 0.9 (2013).

In 1992, the European Commission's proposal for a European Union-wide energy tax failed, largely due to international trade concerns over the lack of any such tax in the United States.[359] However, after ten years of negotiations, EU environmental ministers approved a directive to harmonize energy taxation that became effective in January 2004.[360] The directive applies to all accession countries, with transition periods.[361] As a result, many EU countries have implemented new or higher energy taxes. Beginning in 2011, there have been repeated attempts to amend the directive to reflect the EU's new, more ambitious greenhouse gas reduction goals and to provide for separate treatment of taxes based on greenhouse gas emissions and those based on total energy consumed (regardless of pollution effects).[362]

IV. RENEWABLE DISTRIBUTED ENERGY GENERATION

Particular attention is needed on the question of how to promote renewable generation sited within the distribution system or on-site generation located in a specified community or at the customer home or business, often referred to as "distributed generation." Distributed renewable generation has many benefits: it can be deployed in urban areas, where air pollution problems are often severe and where larger renewable energy projects may be difficult to site; it can be installed on a customer's premises and used to reduce customers' electricity bills through net metering mechanisms, as is discussed below; and it can be deployed in rural communities to delay or avoid expensive enhancements to utility transmission and distribution systems.

Outlined below are three tools that policy makers can use to promote renewable distributed energy: 1) net metering policies that allow customers who install renewable energy projects on-site to pay utility bills only for the net electricity used on their premises; 2) policies to ensure a swift and straightforward process for interconnecting renewable energy projects to the utility electric grid where one exists, or to a minigrid where no grid connection is possible; and 3) policies to ensure that the backup rates charged by utilities to customers with on-site renewable distributed generation in grid–served areas are fair and appropriate.

A major barrier to the adoption of renewable distributed generation is the issue of utility regulatory financial incentives. In many states, utilities' revenues are determined by the amount of electricity that they sell. Furthermore, some distributed generation resources are designed to reduce their owner's need for energy from the grid during times of peak usage, thus reducing the amount of capacity required by that customer. Depending on the billing structure, this may reduce demand charges collectable by the utility.[363] Hence, customer investments in energy efficiency and distributed generation may cause utility revenues to drop. This important source of utility resistance to distributed generation can be solved by adopting electric revenue adjustment mechanisms, which make utilities indifferent to the amount of electricity that they sell. One effective adjustment mechanism is a policy

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359 Benjamin J. Richardson and Kiri L. Chanwai, The UK's Climate Change Levy: Is it Working?15 J. ENVTL L. 39, 40 (2003), http://jel.oupjournals.org/cgi/reprint/15/1/39.
360 See FEDERAL MINISTRY FOR THE ENVIRONMENT, NATURE CONSERVATION, AND NUCLEAR SAFETY, op. cit., 4.
361 Id.
362 Dörte Fouquetand and Jana Viktoria Nysten, The Legal Helpdesk: Energy Taxation in the EU 2-3, http://www.keepon-track.eu/contents/virtualhelpdeskdocuments/energy-taxation_1718.pdf.
363 See Solar Energy Industries Assoc., Net Metering, SEIA (2016), http://www.seia.org/policy/distributed-solar/net-metering.

known as "revenue decoupling," under which regulatory commissions determine the appropriate revenue needs of the utility and assure recovery of fixed costs without regard to the volume of electricity sales or deliveries.[364]

A. Net Metering

Net metering allows consumers who have on-site renewable generation to be paid by their electric utility for the electricity they provide to it in excess of the electricity they use from their home generation renewable resources. Net metering typically allows for the flow of electricity both to and from the customer through a single meter that moves backward when the on-site system is producing electricity. In effect, the customers are using the generation from their on-site systems to offset the cost of the electricity that they would otherwise have purchased from the utility at the utility's retail electricity rate.[365]

In the United States, as of February 2016, forty-one states, the District of Columbia and four U.S. territories have mandatory net metering programmes. [366]Worldwide, some 48 countries have adopted net metering policies. The most recent additions to this list (added in 2014) include Columbia, Costa Rica, and Honduras. [367] In Europe, laws providing for net metering or similar schemes have been adopted in Belgium, Denmark, Germany, Greece, Italy, the Netherlands, Spain, Turkey, and the United Kingdom. [368]Switzerland had a net metering programme, but it has been terminated and its new feed-in tariff requires the installation of a second meter. [369] In Asia, *Japan, the Philippines, Singapore, South Korea, Thailand, Malaysia, India, Pakistan, and Sri Lanka* have adopted net metering laws.[370]

While use of net metering policies is widespread, legislators and regulators should be aware that getting the details right is very important to ensure that net metering legislation is successful in promoting renewable energy. Net metering legislation continues to meet with strong opposition from utilities, who fear that the growth of distributed generation will lead to loss of sales and revenues (for those utilities whose revenues are tied to sales).

As an example of the debates that have arisen around net metering, in 2015, after an application from Nevada utilities, the Nevada Public Utility Commission (PUC) amended net metering rates and significantly boosted charges on renewable energy consumers within the state. The Nevada PUC failed to "grandfather in" or exempt existing net metering customers, causing huge controversy.

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364 In California, for instance, the legislature enacted Assembly Bill 29x in 2001, which established Public Utility Code Section 739.10, providing that the Public Utility Commission must "ensure that errors in estimates of demand elasticity or sales do not result in material over or under collections of the electrical corporations." CALIFORNIA PUB. UTIL. CODE § 739.10 (2001), http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PUC&section-Num=739.10

365 DSIRE, Glossary: Net Metering, DSIRE (2016), www.dsireusa.org/glossary.

366 DSIRE, Detailed Summary Maps, DSIRE (2016), http://www.dsireusa.org/resources/detailed-summary-maps/.

367 REN21, op. cit., 18.

368 MARIE LATOUR, EUROPEAN PHOTOVOLTAIC INDUSTRY ASSOCIATION, NET-METERING AND SELF-CONSUMPTION SCHEMES IN EUROPE 12 (2013), http://iea-pvps.org/fileadmin/dam/public/workshop/6-Marie_Latour_-_Self-consumption_and_net-metering_schemes_in_Europe.pdf; Ilias Tsagas, Greece applies generous net-metering, PV MAGAZINE (Jan. 12, 2015), http://www.pv-magazine.com/news/details/beitrag/greece-applies-generous-net-metering-_100017732/#axzz3x9AWfxgF.

369 PVGIS, Switzerland 2 (2008), https://static1.squarespace.com/static/5548ed90e4b0b0a763d0e704/t/555225a3e4b0e3 bbbdd883ae/1431446947561/Switzerland120508.pdf.

370 Linda Archibald, Net energy metering will take off in Malaysia by 3Q of 2015, THE MALAYSIAN RESERVE (Mar. 13, 2015), http://themalaysianreserve.com/new/story/net-energy-metering-will-take-malaysia-3q-2015.

Several of the major solar energy supplies left the state. The net metering policy changes led a solar industries group to file a lawsuit to overturn the policy decision. An effort is also underway to present Nevada voters with a ballot referendum or initiative that would overturn the Commission's decision.[371]

Costs of energy storage are dropping quickly. When electricity storage becomes more economically attractive, the threat to utilities of losing customers or losing load will be even more real, and a new paradigm for utility compensation will be needed to adequately reimburse utilities for their distribution systems. New York is taking the national lead on resolving this through its Reforming Energy Vision (REV) programme.[372]

The following are some of the key questions that policy makers must address with respect to net metering: 1) Which forms of renewable energy units will be eligible for net metering? In some jurisdictions, all renewables are eligible, while in others, only solar photovoltaics and/or wind are eligible; 2) Which customer classes are eligible? In some jurisdictions, net metering is limited to residential, small commercial and/or agricultural customers; 3) How will the electricity supplied to the utility be priced (the retail price or a value of solar price)? 4) Have policy makers prohibited utilities from imposing high backup rates or interconnection fees on net metering customers? As is discussed in the sections below, these are crucial issues.

B. Value of Solar

Some jurisdictions are working to develop "value of solar" rate design approaches to identify and provide utilities with compensation for the true value of solar distributed generation. These approaches could serve as an alternative or supplement to net metering policies, particularly for certain customers classes.

Value of solar policies use separate billing determinants for energy production and energy consumption. The specific rate attached to solar production aims to incorporate environmental and grid service benefits into the cost of solar energy, while consumption of grid-supplied electricity is typically billed at regular retail rates. [373] The production-billing determinant attached to a value of solar rate helps to incentivize the use of renewables to help relieve grid congestion and peak load stress. More granular pricing structures help bring market efficiencies where these efficiencies might otherwise not be realized.

Value of solar tariffs have been adopted in jurisdictions such as Minnesota and Austin, Texas. Under these tariffs, customers continue to purchase all of their energy at the utility's retail rate, but are compensated for solar PV generation at a separate "value of solar" rate in dollars per kilowatt hour. The value of solar rate accounts for solar PV's benefits to stakeholders net its costs.[374]

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371 See Nevada Public Service Commission, Proposed Order (Dec. 22, 2015); http://pucweb1.state.nv.us/PDF/AxImages/DOCKETS_2015_THRU_PRESENT/2015-7/8305.pdf; Nevada Public Service Commission, Modified Final Order, Docket Nos. 15-07041 and 15-07042 (Feb. 12, 2016),

372 New York State Dep't of Public Service, About the Initiative, NYDPS (2016), http://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument; see also Radina Valova, New York's Reforming Energy Vision Proceeding Continues to Make Strides Toward the Utility of the Future, PACE ENERGY AND CLIMATE CENTER (December 15, 2015), http://energy.pace.edu/blog/new-york%E2%80%99s-reforming-energy-vision-proceeding-continues-make-strides-toward-utility-future.

373 INTERSTATE RENEWABLE ENERGY COUNCIL AND KARL RÁBAGO, A REGULATOR'S GUIDEBOOK: CALCULATING THE BENEFITS AND COSTS OF DISTRIBUTED SOLAR GENERATION (Oct. 2013)

374 Nat'l Renewable Energy Laboratory, Value of Solar Tariffs, NREL (Oct. 2015), http://www.nrel.gov/tech_deployment/state_local_governments/basics_value-of-solar_tariffs.html.

As such, a value of solar rate helps to incentivize renewable energy development by helping the market recognize the actual services provided by solar customers to the utility and society at large. If properly regulated, using the value of solar as the rate of compensation for consumer excess production can provide appropriate support for scaling up solar power while also creating appropriate compensation to utilities for the transmission and distribution services they continue to offer.

The Interstate Renewable Energy Council Regulator's Guidebook for Calculating the Benefits and Costs of Distributed Solar Generation sets forth several major conclusions useful to policy makers who are interested in creating "value of solar" tariffs and understanding how distributed solar can impact an electricity market.

First, distributed solar generation often is an alternative to combined-cycle natural gas facilities, which should be reflected in avoided energy costs. [375]Second, distributed solar generation installations are predictable and should be included in utility forecasts of capacity and credited as such. [376] Finally, value of solar tariffs should consider external benefits, such as job growth, health benefits, and environmental benefits.[377]

Creating a more granular calculation of the long-term value proposition of renewable energy, beyond just energy production accentuates additional benefits of renewable energy. In terms of financing, this can help developers entering into long-term power purchase agreements and help alleviate policy risk due to distribution of grid costs that may emerge in other tariff designs.

Similar to a value of solar rate, certain jurisdictions are creating policies that create a granular rate for other types of renewable and distributed energy. Local Marginal Price (LMP) is a typical measure for determining wholesale energy market price.[378]Several policies aim to expand the energy value calculations to include geographic, time, and resource type as an additional value created by distributed resources.[379]The additional calculation is applied to all resources and thus changes the overall market price (versus changing just the energy costs for renewables).

The aim in calculating a distributed resource value is to compensate for avoided externalities (like a Value of Solar rate design), and send a market signal conveying the actual cost of the distribution network. By increasing price granularity, Locational Marginal Price plus distribution ("LMP+D") levels the differences between distributed renewables and traditional energy sources.[380]

New York's Reforming the Energy Vision proceeding aims to reorganize the electricity market to capture the benefits of various distributed energy solutions (including distributed and large-scale renewables) through fluid calculations of granular system values.[381] Although the 'value of distribution' proceeding discussed in REV is an on-going process, it is a worthwhile consideration for policy makers considering ways to encourage investment in renewable energy.

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375 Id.
376 Id.
377 Id.
378 See California Independent System Operator, Locational Marginal Pricing (LMP): Basics of Nodal Price Calculation, CAISO.COM (2004), http://www.caiso.com/docs/2004/02/13/200402131607358643.pdf.
379 See New York Public Service Commission, 14-M-0101 Reforming the Energy Vision; see California Independent System Operator, Distributed Energy Resource Provider (DERP).
380 See New York Public Service Commission, 14-M-0101 Reforming the Energy Vision; see California Independent System Operator, Distributed Energy Resource Provider (DERP).
381 New York Public Service Commission, 15-E-0751 – In the Matter of the Value of Distributed Energy Resources (Issued December 23, 2015).

C. Interconnection

For renewable distributed generation to flourish in grid-served areas, customers must be able to interconnect their on-site renewable energy systems to the utility electric grid with ease. In many areas, interconnection standards that vary from utility to utility make interconnection to the grid an unnecessarily cumbersome and expensive process. Experts identify inappropriate interconnection standards as a major barrier to distributed generation. [382] This is an important issue both for net metered systems, discussed above, and other forms of distributed generation.

It is crucial to establish uniform state, regional, or national interconnection and transmission standards that ensure electric safety and reliability, but that are not overly onerous, expensive, or time consuming to meet. An excellent alternative to utility-specific requirements for interconnection is to include appropriate safety and power quality protection through manufacturing specifications, with requirements based on consensus-based technical standards developed by independent standards organizations. In the U.S., such organizations include the Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), and the National Fire Protection Association, which publishes the National Electric Code (NEC).[383]

With the growing awareness of the importance of protective yet fair interconnection standards, many states are attempting to develop uniform interconnection standards that address these issues. At least 45 U.S. states have some sort of policy in place governing the interconnection of distributed generation resources.[384]

In the U.S., the National Association of Regulatory Utility Commissioners has developed model interconnection procedures for small distributed generation resources, [385]as has the Interstate Renewable Energy Council. [386] This is happening internationally as well. As part of its programme to promote the growth of renewable energy, Switzerland has developed national interconnection standards. Portugal has also promulgated laws designed to facilitate interconnection of distributed power sources (including renewables), though apparently without advancing a technical standard. [387] Similarly, Germany has enacted legislation mandating that renewable power producers receive priority in connection to the grid. The legislation includes requirements that cost estimates and studies necessary for interconnection of new sources be carried out within eight weeks of submission of a completed application.[388]

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382 R. BRENT ALDERFER ET AL., MAKING CONNECTIONS: CASE STUDIES OF INTERCONNECTION BARRIERS AND THEIR IMPACT ON DISTRIBUTED POWER PROJECTS 6-7, 35 (2000), http://www.nrel.gov/docs/fy00osti/28053.pdf; LAUREL VARNADO AND MICHAEL SHEEHAN, INTERSTATE RENEWABLE ENERGY COUNCIL, CONNECTING TO THE GRID: A GUIDE TO DISTRIBUTED GENERATION INTERCONNECTION ISSUES 1, (6th ed., 2009), http://www.solarelectricpower.org/media/8165/irecconnecting-to-the-grid09.pdf.

383 Id. at 87.

384 DSIRE, Summary Maps: Interconnection plus Solar PV, DSIRE (2016), http://programs.dsireusa.org/system/program/maps.

385 NATIONAL ASSOC. OF REG. UTILITY COMM'RS., MODEL INTERCONNECTION PROCEDURES AND AGREEMENT OF SMALL DISTRIBUTED GENERATION RESOURCES, NARUC (2003), http://regulationbodyofknowledge.org/wp-content/uploads/2013/03/NARUC_Model_Interconnection_Procedures.pdf.

386 INTERSTATE RENEWABLE ENERGY COUNCIL, MODEL INTERCONNECTION PROCEDURES, IREC (2013), http://www.irecusa.org/model-interconnection-procedures/.

387 KEMA LDA, REPORT: STUDY ON THE IMPACT OF DISTRIBUTED GENERATION ON THE NATIONAL ELECTRICITY SYSTEM 12 (2011), http://www.erse.pt/pt/electricidade/actividadesdosector/distribuicao/Documents/Report_DistributedGeneration.pdf.

388 See Res Legal, Germany: Overall Summary, RES LEGAL (2012), http://www.res-legal.eu/search-by-country/germany/; Ingrid Bozsoki, Connection to the grid, Res Legal (Nov. 12, 2014), http://www.res-legal.eu/search-by-country/germany/single/s/res-e/t/gridaccess/aid/connection-to-the-grid-1/lastp/135/; INGO STADLER, STUDY ABOUT INTERNATIONAL STANDARDS FOR THE CONNECTION OF SMALL DISTRIBUTED GENERATORS TO THE POWER GRID 20 (2011), http://www.americadosol.org/wp-content/uploads/2011/07/International-Standards-for-the-connection-of-Small-Distri.-Generators-Cologne-University-GIZ-2011.pdf.

The federal Public Utility Regulatory Policies Act (PURPA) [389] has also played a key role in incentivizing alternative energy. The Act does this in a number of ways, including with respect to the interconnection process for distributed generation. PURPA was enacted in 1978 as supplement to broader legislation aimed at responding to the 1973 oil crisis. PURPA requires utilities, when they need power, to purchase power from "qualifying facilities" at the wholesale power avoided cost; to provide back-up power to qualifying facilities; to interconnect with qualifying facilities; and to operate with qualifying facilities under reasonable terms and conditions. [390] The 2005 Energy Policy Act amended PURPA to further promote energy efficiency and the development of distributed electricity generation. [391] The amendment required state public utility commissions to: consider standards for utilities to make net metering available to consumers; diversify their fuel sources; develop a 10-year plan to increase generation efficiency; consider the deployment of smart meters; and provide interconnection of distributed electricity generation to homeowners when requested.[392]

Finally, the Federal Energy Regulatory Commission (FERC) has issued an order standardizing the interconnection process for interconnections subject to FERC's wholesale interstate power jurisdiction.[393]

D. Utility Back-Up Tariffs

Regulatory ratemaking can also create barriers to renewable distributed generation. Utilities often seek to assess excessive supplemental, back-up, and standby charges (often referred to collectively as "back-up tariffs") for customers utilizing on-site generation that requires backup electricity from the utility grid at certain times. "Supplemental Charges" refer to charges for service of loads that regularly require more power than that supplied by the customer's distributed generation. "Standby Charges" refer to charges for emergency supply necessary during unscheduled outages of distributed generation. Overly high back-up tariffs – which are sometimes assessed at prices near or even exceeding the prices previously charged for full electrical service – can discourage distributed power, outweighing the customer and electric system benefits from distributed generation and connection of any renewable energy resource.[394]

In the context of net-metered systems, some states have banned utilities from imposing backup charges. *See, e.g.*, N.Y. Pub. Serv. Law § 66-j(3)(d).[395]Another solution is for jurisdictions to

389 Professor Richard Ottinger, the lead author of this Guide, was a principal Congressional author of PURPA during his distinguished service as a U.S. Member of Congress.

390 Electric Power Supply Ass'n, What is PURPA?, EPSA (2016), https://www.epsa.org/industry/faqs/?fa=purpa.

391 Energy Policy Act of 2005, H.R. 6, 109th Cong. (2005) (enacted), https://www.gpo.gov/fdsys/pkg/BILLS-109hr6enr/pdf/BILLS-109hr6enr.pdf; see U.S. Envt'l Protection Agency, Summary of the Energy Policy Act, EPA.GOV (Feb, 8, 2016), https://www.epa.gov/laws-regulations/summary-energy-policy-act.

392 GREG DOTSON AND BEN BOVARNICK, CENTER FOR AMERICAN PROGRESS, A FORWARD-LOOKING AGENDA FOR THE NATION'S PUBLIC UTILITY COMMISSIONS (May 2015), https://cdn.americanprogress.org/wp-content/uploads/2015/05/PURPA-report-final.pdf.

393 Federal Energy Reg. Comm'n Order 792, Small Generator Interconnection Agreements and Procedures, 145 FERC ¶ 61,159, 78 Fed. Reg. 73239 (issued Nov. 22, 2013; published in Fed. Reg. Dec. 5, 2013) (amending 18 C.F.R. § 35). A summary of FERC's interconnection standards for small generators can be found here: http://www.ferc.gov/industries/electric/indus-act/gi/small-gen.asp.

394 ALDERFER ET AL., op. cit., 21, 36.

395 N.Y. PUB. SERV. LAW § 66-j(3)(d) states: "An electric corporation shall impose no other charge or fee, including back-up, stand by and demand charges, for the provision of net energy metering to a customer-generator, except as provided in paragraph (d) of subsection four of this section." Subsection four covers rates and mandates that "an electric corporation…use net energy metering to measure and charge for the net electricity supplied by the corporation and provided to the corporation by a customer-generator, according to …[the requirements listed]."

develop uniform back-up rates that properly balance the economic, environmental, and system reliability benefits of distributed generation with the utilities' economic needs.

V. ENVIRONMENTAL DISCLOSURE AND GREEN MARKETING

To provide additional support for renewable energy, legislators and regulators can create policies that support and encourage voluntary green marketing programmes. These include: 1) environmental disclosure programmes that require electric utilities to provide customers with information about the sources and environmental characteristics of the electricity that they provide; and 2) green marketing measures that ensure customers have access to retail green marketing choices, which provide customers with the ability to purchase some or all of their electricity from renewable resources.

A. Environmental Disclosure

Environmental disclosure programmes provide or direct utilities to provide their customers with information about the energy they are supplying. Disclosure programmes seek to help consumers make informed decisions about the energy and supplier they choose. This information often includes fuel mix percentages and emissions statistics. Fuel mix information, for example, can be presented as a pie chart on customers' monthly bills. Disclosure may be viewed as a policy tool to help educate customers about the environmental impacts of electricity.[396]

Environmental disclosure programmes can operate internationally. In 2003, the European Parliament adopted a directive requiring that energy suppliers disclose fuel mix data and a reference to a publicly available source of information on the environmental impact of the particular fuel mix they provide, with their bills and promotional materials. A revised version of this directive was released in 2009 and is still in effect.[397]

B. Green Choice Programmes

Traditionally, electric utility companies throughout the world have operated as monopolies. But since 1997, at least 18 U.S. states have been required by state laws to restructure, opening their electricity markets to competition, thus giving outside companies, including suppliers that draw all or a significant portion of their power from renewable resources, the right to compete for customers.[398] Restructuring also has occurred in other countries, with the United Kingdom a prominent example.[399] In Sweden, consumers are able to select from over 50 companies offering green power options.[400] While retail competition has not attracted a substantial number of residential customers in many

396 DSIRE, Glossary: Disclosure, DSIRE (2016), http://www.dsireusa.org/support/glossary.

397 Directive 2009/72/EC of the European Parliament and of the Council, 211/65 (July 13, 2009), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF.

398 See Energy Information Admin., Status of Electricity Restructuring by State, EIA (Sept. 2010), http://www.eia.gov/electricity/policies/restructuring/restructure_elect.html; American Coalition of Competitive Energy Suppliers State by State Information, ACCES (2016), http://competitiveenergy.org/consumer-tools/state-by-state-links/.

399 The UK has been a longstanding example of restructuring, which began there in the 1990s. CMS Cameron McKenna, CMS guide to electricity – United Kingdom, LEXOLOGY (Sept. 1, 2015), http://www.lexology.com/library/detail.aspx?g=73d192cb-47fd-4735-87d4-8d32421f8c4f. For an analysis of European market restructuring since the 1990s, see: Marie Hyland, Restructuring European Electricity Markets – A Panel Data Analysis, 38 UTIL. POL'Y 33-42 (Feb. 2016), http://dx.doi.org/10.1016/j.jup.2015.11.004.

400 LORI BIRD ET AL., NATIONAL RENEWABLE ENERGY LABORATORY, GREEN POWER MARKETING ABROAD: RECENT EXPERIENCES AND TRENDS 37 (May 2002), http://www.eere.energy.gov/greenpower/resources/pdfs/32155.pdf.

U.S. states, retail competition does at least provide greater opportunity for marketers of renewable energy to compete with traditional fossil fuel electricity producers.

In restructured markets, consumers have the potential to be confused about which energy service companies are offering renewable energy options and the conditions of offered options. Certification programmes have arisen to address this problem. Certification programmes, most notably the "Green-e" certification programme, assess green power offerings to assure that energy service companies are indeed utilizing the type and amount of renewable energy they advertise. The Green-e programme establishes technical criteria that electricity products must meet to be eligible for Green-e certification.[401]

Sweden and Norway have developed a joint green energy certificate programme aimed at making "green" electricity a more tradeable commodity and attracting renewable energy investors. The certificate itself is tradeable and serves to prove that a certain amount of electricity was produced from renewable energy resources. The joint certificate program is projected to generate 26.4 TWh from new renewable energy projects by 2020, with each country producing half the total expected generation (13.2 TWh).[402] This has encouraged the development of wind energy and other renewables, and is expected to further grow their market share.[403]

C. Green Pricing Programmes

In some jurisdictions, instead of choosing a specific electricity supplier other than the traditional utility, consumers can support renewable power by paying a small premium on their electric bills for renewable energy. This practice is called green pricing. As of 2015, over 850 U.S. utilities offered a green pricing option. [404] In addition to its Green-e certification, the Centre for Resource Solutions runs a green pricing accreditation programme to set standards for green pricing and ensure that utility companies are delivering on their promises to invest in renewable resources. [405]In Japan, all energy providers give customers the option to contribute to a green power fund for the development of wind and solar systems, and some companies will match the contribution.[406]

401 Center for Resource Solutions, Green-e, CRS (2016), http://www.green-e.org.
402 Norway Exports, Norway And Sweden Establish Green Certificate Market, Nortrade (Aug. 2011), http://www.nortrade.com/sectors/articles/norway-and-sweden-establish-green-certificate-market/.
403 Norway Exports, Norway And Sweden Establish Green Certificate Market, Nortrade (Aug. 2011), http://www.nortrade.com/sectors/articles/norway-and-sweden-establish-green-certificate-market/; Swedish Energy Agency, The Electricity Certificate System, SEA (Mar. 2015), http://www.energimyndigheten.se/en/sustainability/the-electricity-certificate-system/.
404 U.S. Dep't of Energy, Green Pricing, The Green Power Network (May 2015), http://apps3.eere.energy.gov/greenpower/markets/pricing.shtml.
405 Center for Resource Solutions, Green-e Programs, CRS (2016), http://www.green-e.org/getcert.shtml.
406 Japan for Sustainability, Citizen-funded Renewable Energy Projects Gain Momentum in Japan, JFS (Nov. 2008) http://www.japanfs.org/en/news/archives/news_id028569.html ("The Green Power Fund is funded by contributions from individuals and businesses as well as power companies. Contributors pay a certain amount, which is added to their electricity bill every month, while power companies pay a matching amount."); BIRD ET AL., op. cit.; see also Agency for Natural Resources and Energy, Green Power, Enecho (2014), http://www.enecho.meti.go.jp/about/pamphlet/new_energy/pdf/green_en.pdf.

VI. CONCLUSION

Many effective legislative and regulatory strategies encouraging the development of renewable energy have proven track records of success in both developed and developing countries. Policy makers should determine which of the policy tools outlined above will be most productive, given their region's natural resources, economics, and political climate. The time and effort put into developing the necessary policies to encourage renewable energy will be rewarded by substantial environmental and economic benefits and will provide global benefits by significantly reducing global warming emissions.

CHAPTER 5B. HYDROELECTRIC POWER

Phillip Musegaas*

I. INTRODUCTION

The use of hydropower to generate electricity enjoys several major benefits that make it attractive to developing countries seeking alternatives to fossil fuel based electricity production. It is a relatively pollution free form of energy production when in operation, and the operational costs can be low, since no fuel is required and the hydroelectric generating technology is well established and in wide use. In areas where the topography and natural environment favour the use of hydropower, it is often the most efficient method of producing large amounts of electricity. For example, Central and South America, Southeast Asia and parts of sub-Saharan Africa are conducive to hydropower development, due to the presence of large river basins.

However, the construction and operation of large hydropower projects has often been extremely controversial and resulted in significant, long term adverse effects on the environment and local communities. These include forced resettlement, loss of habitat and biodiversity, deleterious impacts on migratory fish species and methane emissions that contribute significantly to climate change. This is due to a number of factors, including lack of a cohesive benefit sharing approach, failure to conduct an adequate environmental impact review, and lack of capacity or willingness to ensure that measures to avoid or mitigate the impacts of dam construction and operation that are implemented and verified by independent public officials.

As a result, international agreements have cautioned against the building of large dams and have recommended strong protective legislation if new such dams are built. See the World Commission on Dams that has discouraged construction and issued prescribed comprehensive recommendations for building of such dames. See https://www.internationalrivers.org/campaigns/the-world-commission-on-dams and the International Commission on Large Dams at http://www.icold-cigb.org/home.asp,

In contrast to large hydropower projects or "mega dams," small scale and run-of-the-river hydropower offer benefits that make it worthy of consideration. Small dams that divert only a portion of a river's flow into a catchment basin will have much less impact on the river ecology as compared to a large dams that utilize an impoundment that blocks the natural flow of an entire waterway. The development of several small hydro facilities in rural areas in order to serve local energy demand is often preferable to, much more economic, and more reliable than, linking remote rural areas to large baseload generating facilities using high voltage transmission lines. Run-of-the-river hydropower does not require creation of dams or basins at all. Smalll hydro projects can be built using pre-existing designs, which reduces design, construction and maintenance costs. The permitting, environmental review and public approval processes can also move more quickly, and if done right can avoid protracted controversy and local opposition.

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The choice between large and small scale hydro and run-of-the river hydro depends greatly on site specific considerations of energy demand, water resources, competing demands for river resources, and the state of electricity transmission infrastructure in the country.

The cost-effectiveness of large scale hydro projects has also come into question, due to the frequent cost overruns and construction delays associated with these projects. In 2014, the Oxford University's Blavatnik School of Government sponsored a study assessing the long term economic viability of large dams. [407] The report looked at 245 dams in 65 different countries, and found that overall, construction costs on average are over 90% higher than the cost estimate at the time of approval.[408] This does not include environmental externality costs, or the economic effects of debt service costs over extended time frames.

The report also found that, on average, completion of large hydropower projects take nearly 50% longer than initial estimates.[409] Given the fact that large hydropower projects are often the largest and most expensive infrastructure projects undertaken in developing countries, these findings deserve careful consideration. In essence, the study found that the large majority of dam projects examined did not provide a good return on the country's investment, and often resulted in environmental, social and economic detriment in the long run. The report concludes by recommending a hybrid approach to energy generation utilizing smaller hydro, wind and solar to provide a diverse and reliable energy supply.

Another consideration is that when droughts occur, as is a more frequent occurrence with the advent of the consequences of climate change, large dams may stop generating electricity altogether, causing havoc in the areas that they serve. Recent droughts in Brasil resulted in blackouts and required electricity rationing.

For countries considering the use or expansion of hydropower resources, it is critically important to establish clear laws and policies that ensure robust public participation, equitable benefit sharing with affected communities, comprehensive environmental impact assessment, and an objective analysis of alternatives prior to selecting or approving a large or small hydropower proposal. A strong legal and regulatory regime, if adhered to, will lead to energy generation projects that are sustainable, reliable, economically viable and publicly supported.

II. ENVIRONMENTAL IMPACTS AND LEGISLATIVE RESPONSES

The following describes typical environmental impacts that have resulted from the construction and operation of large dams, and provides examples of legislation intended to address them.

A. How Can Legislation Address Habitat Loss Caused By Inundation Of The Reservoir?

The loss of habitat upstream of the impoundment created by large dam construction is often caused by the flooding of the river basin and the resulting reservoir. This has resulted in deleterious effects

407 Ansari, A., et al., Should we build more large dams? The actual costs of hydropower megaproject development. Energy Policy(2014), http://dx.doi.org/10.1016/j.enpol.2013.10.069i
408 Id.
409 Id.

India, National Forest Policy, Resolution No. 3A/86-FP, Sec. 4.4.1
Projects that involve the construction of dams include funds in the investment budget for regeneration or compensatory afforestation.
http://envfor.nic.in:80/legis/forest/forest1.html

Philippines, Presidential Decree No. 1515, Sec. 2(5), (7), (8)
Ministry of Energy shall prescribe, adopt, and issue rules regarding the development and conservation of existing vegetative cover and the afforestation and reforestation in "critically denuded watershed areas."
http://faolex.fao.org/docs/html/phi23048.htm

Bangladesh, Water and Power Development Boards Order, Art. 18(b)(2)
The Water Board may direct the owner of any public land to undertake conservation of forests and re-afforestation.
http://faolex.fao.org/docs/pdf/bgd19943.pdf

on biodiversity and disproportionate impacts on threatened or endangered species whose survival may depend on limited areas of critical habitat located in or near the areas submerged by the dam's reservoir. Areas of high biodiversity, such as rainforest river systems, are particularly at risk.

Attempts to offset these environmental impacts on biodiversity include legal requirements that forests flooded by reservoirs be replanted, ideally in close proximity to the area flooded, and at a greater than 1:1 ratio to account for loss or failure of afforested areas in the future as exemplified below.

General provisions are included in legislation to allow the entity in charge of development to promulgate regulations regarding the protection of wildlife and habitat. In order to ensure these

Canada, Province of Alberta, Hydro and Electric Energy Act, 5(1)(i)
The Board may make regulations regarding the protection of wildlife.
http://faolex.fao.org/docs/html/al40446.htm

Republic of South Africa, National Water Act, Art. 26(1)(g)
The Minister may promulgate regulations to protect riparian habitat.
http://faolex.fao.org/docs/texts/saf18718.doc

United States, Federal Power Act, 16 U.S.C. § 803(a)(1)
Specifications are to be developed regarding the "adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat)."
http://www4.law.cornell.edu/uscode/16/ch12.html

Uzbekistan, Water and Water Use, Art. 12
Siting, design, and construction of water projects are conditioned upon ensuring the compensation of damage to fish stocks, other aquatic animals, flora and the conditions for their preservation, rehabilitation and reproduction.
http://faolex.fao.org/docs/pdf/uzb5255.pdf

protections, it is preferable for the legislation to require the regulatory body responsible for approving the project to develop such regulations, rather than leaving it as a discretionary action.

B. What Provisions Should Be Included to Mitigate Damage Due to Disruption of the River Flow?

Disruption of the natural river flow can lead to excessive siltation in the reservoir, as well as downstream erosion of the riverbanks, further damaging the surrounding habitat.

Attempts to mitigate the impacts of disruption of the river flow include provisions such as the following that require the developer to pay compensation to those injured.

Vietnam, The Law on Water Resource, Art. 23(1)

Organizations that have the right to use water resources for electricity generation are obligated to financially compensate for any damage caused in the exploitation of the resource.

http://faolex.fao.org/docs/pdf/vie14294.pdf

China, Water Law, Art. 20

When building a water project having adverse effects on the flow in the Navigation waterway, the construction unit of the project shall take remedial measures or pay compensation.

http://faolex.fao.org/docs/pdf/chn1317.pdf

Legislation also includes legal provisions requiring the developer to mitigate erosion in the development area, such as:

C. How Can Legislation Address the Impacts to Fisheries Resources?

Negative impacts on both migratory and freshwater fisheries in the affected water body result in

Uzbekistan, Water and Water Use, Art. 103
Enterprises shall carry out activities necessary to prevent and abate the erosion of banks, embankments, and other works.
http://faolex.fao.org/docs/pdf/uzb5255.pdf
Nepal Electricity Act, Art. 24
Electricity generation shall be carried out such that no substantial adverse effect will be made on the environment by way of soil erosion.
http://faolex.fao.org/docs/texts/nep40799.doc
Bangladesh, Water and Power Development Boards Order, Art. 18(b)(2)
The Water Board may direct the owner of any private land to undertake anti-erosion operations.
http://faolex.fao.org/docs/pdf/bgd19943.pdf

the decline and, in some cases, the eradication of viable fisheries. This negatively impacts both biodiversity and the livelihoods of indigenous people who previously depended on the fishery for trade and sustenance.

Measures to permit migratory fish passage around large dam structures have traditionally focused on the utilization of fish ladders as provided below, but the success of this approach is mixed. Fish passage efforts are sometimes augmented by the use of fish hatcheries to restock and ideally stabilize depleted or declining fish populations. Hatcheries also have a mixed record of success, however, and can adversely affect the species' genetic diversity and behaviour if not managed properly. On the other hand, successful hatchery programs can help sustain and stabilize fish stocks while other long term measures are underway to restore healthy wild populations.

The use of small hydropower projects, including multiple sites in a single river, would be a reasonable alternative that avoids this impact almost entirely. Small hydro dams built with catchment basins can be designed to deter migrating fish from entering the basin, with enough space in the free-flowing portion of the river to allow migration and spawning to occur with much less disruption.

China Water Law, Art. 18
Where there is serious impact on fishery resources, the construction unit for the dam shall build fish passage facilities.
http://faolex.fao.org/docs/pdf/chn1317.pdf

Republic of Lithuania, Law on Water, Art. 20(2)
Free migration of fish shall be guaranteed through installation of facilities for fish migration.
http://faolex.fao.org/docs/texts/lit19801.doc

Kenya, The Water (general) Rules, Art. 99
Water Apportionment Board may authorize a permit holder to construct temporary works designed to improve the conditions of fish life, including fish ladders or other means of ingress and egress for fish.
http://faolex.fao.org/docs/pdf/ken2494.pdf

Moldova, Water Code, Art. Article 12(e)
Hydro-technical constructions are conditioned upon approved projects for the passage of fish.
http://faolex.fao.org/docs/texts/mol9890.doc

D. What Provisions Should Be Included to Mitigate Water Quality Problems Caused by Decomposition?

Water quality degradation can result from the decomposition of large amounts of organic matter, particularly where the area to be flooded upstream of the dam was not properly cleared of vegetation prior to impoundment. The decaying of this biomass results in oxygen depletion, which if severe can lead to fish kills and increased GHG emissions (particularly methane and CO_2). Nutrient loading

may also result from unregulated agricultural runoff or domestic sewage discharges into the dam reservoir, affecting the utility of the water supply for drinking water and irrigation purposes.

Efforts to minimize the impacts of changes in flow regime have included measures to restore the stream flow regime through the setting of environmental flow releases.

Uzbekistan, Water and Water Use, Art. 59
The energy institutions shall "provide sanitary and environment protection releases."
http://faolex.fao.org/docs/pdf/uzb5255.pdf

General provisions requiring water quality monitoring can be enacted to mitigate the effects on the water supply. For example:

Moldova, Water Code, Art. 75
Those in charge of the filling and maintenance of reservoirs are responsible for preventing water logging of land and eutrophication of water.
http://faolex.fao.org/docs/texts/mol9890.doc

New Zealand, Clutha Development (Clyde Dam) Empowerment Act, Part I (12)
The Minister of Energy must monitor and record the water quality of the lake and any climactic changes in the area.
http://faolex.fao.org/docs/texts/nze36991.doc

Ghana, Volta River Development Act, Part II, Sec. 11
The Volta River Authority is required to control the dam so as to prevent the harmful penetration of salt water up the river to a greater degree than preceding the construction of the dam.
http://faolex.fao.org/docs/pdf/gha41043.pdf

Provisions requiring proper clearing of vegetation such as those below are often enacted to prevent water quality problems that result from the decomposition of organic matter.

Canada, Regulations Respecting Dominion Water-Powers, Art. 34(3)
"Every licensee shall, to the satisfaction of the Minister, clear and keep clear from timber, brush and other material, all lands which are to be flooded."
http://faolex.fao.org/docs/html/can23871.htm

New Zealand, Clutha Development (Clyde Dam) Empowerment Act, Part I (13)
Before filling the water body, the Minister must remove all trees and shrub that would interfere with the upper 7 meters of the lake.
http://faolex.fao.org/docs/texts/nze36991.doc

E. What Provisions Should Be Included to Compensate Local Residents Who Are Displaced or Who Have Lost Necessary Resources?

The creation of the dam reservoir has often resulted in the forced displacement of local residents from their communities, the loss of valuable agricultural land, and the destruction of sites with cultural, archaeological and historic significance.

Funds required for the resettlement of residents are often included in the investment plan of the proposed hydropower project, such as the following:

China Water Law, Art. 23
Funds needed for the resettlement of relocatees shall be included in the investment plan of the project.
http://faolex.fao.org/docs/pdf/chn1317.pdf

Ghana, Volta River Development Act, Part IV, Sec. 28-30
The Minister responsible for social welfare is responsible for ensuring, so far as is practical, that no person suffers undue hardship or is deprived of necessary public amenities as a result of resettlement.
http://faolex.fao.org/docs/pdf/gha41043.pdf

Philippines, Presidential Decree No. 1515, Sec. 6
Ministry of Energy shall prescribe, adopt, and issue rules formulating plans of development programs for resettlement and relocation.
http://faolex.fao.org/docs/html/phi23048.htm

Guyana, Hydro-Electric Power Act, Art. 8-10
Compensation will be provided for the expropriation of private lands when required by the State.
http://faolex.fao.org/docs/pdf/guy39221.pdf

Laws of Western Samoa, Water Act, Part II, Section (6) (3)
The Head of State may take land on behalf of the Government for hydropower use provided that any person with an estate or interest in the land or any person who is injured or suffers any damage by the taking of land is compensated.
http://faolex.fao.org/docs/texts/sam42117.doc

III. GENERAL PROVISIONS THAT ADDRESS ALL HYDROPOWER ENVIRONMENTAL IMPACTS

There are three major areas of energy and environmental legislation that address the environmental impacts that flow from hydropower project development.

A. How Can Environmental Impact Statements Be Utilized to Mitigate Environmental Impacts?

The scale and complexity of large hydropower projects necessitates that a comprehensive Environmental Impact Assessment (EIA) process be followed before a project proceeds. Legislation often mandates the development of an EIA for all large hydro projects, and for small hydro projects that are reasonably likely to result in adverse impacts. The following are basic elements of an EIA that should be included.

- Full characterization of the baseline environmental conditions in the area that would be impacted by the dam, including descriptions of habitat, biodiversity, water quality, geology, the presence of endangered species, and other natural resources;
- Analysis of impacts, and measures to avoid, minimize or mitigate them, including the economic, cultural and social effects of the project on local communities;
- Analysis of the dam's potential to contribute to climate change due to methane emissions from the impoundment reservoir;
- Analysis of alternatives, including the effects of not building the project;
- Multiple and meaningful opportunities for public participation, including opportunity for scoping input, and formal consideration and response to public comments; and
- Post approval monitoring and compliance practices to ensure that mitigation efforts were successful.

In the case of small-hydro projects, the EIA process may be modified to reflect the different level of impacts from several single facilities. For example, legislation may require that the potential cumulative impacts of multiple sites in a discrete region be assessed in a single EIA, in order to promote the cumulative impacts of such projects.

Some examples of legislation mandating EIAs include:

Indonesia Government Regulation No. 27/1999, Art. 3(1)(b)
Analysis of environmental impacts is required for activities likely to give rise to major and significant impacts on the environment, including the exploitation of natural resources, either renewable or non-renewable.
http://faolex.fao.org/docs/pdf/ins36671.pdf

India Environmental Impact Assessment Notification, Art. 2(II)(c)
Hydropower projects are required to obtain environmental clearance to be evaluated by the Impact Assessment Agency.
http://faolex.fao.org/docs/pdf/ind4656.pdf

Belize, Environmental Protection Act, Part V Sec. 20
Any person intending to undertake a project that may significantly affect the environment shall cause an environmental impact assessment to be carried out by a suitably qualified person.
http://www.belizelaw.org/lawadmin/index2.html

Latvia, Law of Environmental Impact Assessment, Article 3. Principles of Impact Assessment
Section 5 - the resolution of environmental problems shall be commenced before comprehensive scientific proof of the negative impact of the Proposed Development on the environment is available. If there is justifiable doubt that the Proposed Development may have negative impacts on the environment, precautionary measures shall be taken and if necessary, the activity shall be prohibited (precautionary principle)

B. How Can Permitting and Licensing Requirements Implement Measures to Mitigate Environmental Damage?

1. Consultation With Other Agencies/Statutes

The government agency or ministry responsible for issuing a license or permit, or the renewal of a license or permit, is generally required to consult with all government agencies that will potentially be affected by the proposed project. This can include not only the agency responsible for environmental protection, but also federal agencies or ministries that may be affected such as agriculture, forestry, and health, for example. In addition, legislation may require that the license contain conditions for the protection and conservation of affected fish and wildlife such as those below.

Samoa Water Act, Art. 13
If the water supply will affect any State forest land, the Director of the Water Supply Committee will submit a scheme plan to the Minister of Agriculture, Forests, and Fisheries or if any other public lands, to the Minister of Lands.
http://faolex.fao.org/docs/texts/sam42117.doc

Belize, Macal River Hydroelectric Development Act, Art. 6
The Minister charged with the responsibility for the Environment may consult with such Government departments and agencies as he may deem necessary in making regulations regarding the design, financing, construction, and operation of the Chalillo Project.
http://www.belizelaw.org/lawadmin/index2.html

Vietnam, The Law on Water Resource, Art. 63(2)
National Water Resource Council will be composed of a Deputy Prime Minister, a member of the Minister of Agriculture and Rural Development, and other members "who represent a number of Ministries, branches, and localities together with a number of scientists and specialists."
http://faolex.fao.org/docs/pdf/vie14294.pdf

Turkey, Law Concerning the Organization and Duties of the General Directorate of State Hydraulic Works, Art. 21
The undertaking of projects involving the generation of power from water resources will be "determined jointly by representatives of the Prime Minister's Office, and the Ministries of Finance, Public Works, Economy and Commerce, Agriculture, Health and Social Welfare, and Enterprises on the basis of their productivity or in view of the exigencies."
http://faolex.fao.org/docs/texts/tur30975.doc

2. Dam Safety Regulations

Regulations usually require that the project applicant comply with the licensing agency's engineering and safety guidelines for the project during its complete life cycle, from construction to operation to abandonment. The applicant may also be required to submit plans for safety training of personnel, public safety, and the safe operation of the dam under all projected modes of operation, including during flood conditions. It is particularly important for the licensing agency to require that the applicant be required to properly maintain the dam during its entire life cycle. Recent examples of badly deteriorating and dangerous large dams, including the Mosul dam in Iraq and the Kariba dam in Zambia, point out the need for strong, enforceable licensing requirements to ensure public safety and the government or applicant's significant investment in the dam. Sample provisions include:

3. What Types of Provisions Should Be Included Regarding Monitoring, Compliance, and Enforcement?

Post-project monitoring and evaluation legislation may require that the licensing agency continue to monitor the licensee's compliance with the conditions of the project for its entire duration. Failure to

fully comply could result in financial penalties or, in the case of wilful non-compliance, rescission or suspension of the license altogether. Examples include:

While large dams play a large role in providing electricity in both developed and developing countries, the risks and costs they impose require careful examination, and protective legislation such as that described above should be considered if such dams are contemplated.

South Africa, National Water Act, Ch. 12
The owner of a dam with a safety risk must register that dam and an approved professional person must be appointed to carry out a dam safety evaluation.
http://www-dwaf.pwv.gov.za/Documents/Legislature/nw_act/NWA.doc

United States Federal Power Act, 16 U.S.C. § 808(a)(2)(B)
When granting a new license, the Commission will take into consideration the plans of the applicant to "manage, operate, and maintain the project safely."
http://www4.law.cornell.edu/uscode/16/ch12.html

Vietnam, Law on Water Resource, Art. 39(2)
Organizations that manage water reservoirs must implement a plan for safety of construction and prevention of damage from floods.
http://faolex.fao.org/docs/pdf/vie14294.pdf

IV CONCLUSION

Hydroelectricity plays a major world-wide role in electricity production. While it produces no pollution after its construction, large dams create serious environmental problems that must be considered. Small dams and run-of-the-river installations have great promise as renewable energy resources, being much less expensive and less environmentally problematic during construction, and much easier to implement in developing countries.

Guyana, Hydro-Electric Power Act, Art. 12
Any license under the Act can be cancelled in whole or in part upon failure of the licensee to make beneficial use of the water or non-compliance or non-observance of any terms contained in the license.
http://faolex.fao.org/docs/pdf/guy39221.pdf

Vietnam, Law on Water Resources, Art. 71(1)
Persons who cause serious deterioration or depletion of the water source may be subject to discipline, administrative fine, or examined for penal liability.
http://faolex.fao.org/docs/pdf/vie14294.pdf

United States, Federal Power Act, 16 U.S.C. § 823b(a)
The Commission is required to monitor and investigate compliance with the license and permit.
http://www4.law.cornell.edu/uscode/16/ch12.html

CHAPTER 5C. SOLAR AND WIND ENERGY

Alexandra S. Wawryk*

I. SOLAR ENERGY

A. Introduction

'Solar energy' refers to a number of ways of using the light of the sun to produce electricity with photoelectric cells and the heat of the sun for thermal applications. Solar energy most frequently is used to provide electricity and hot water or space conditioning to homes and commercial buildings. Solar photovoltaics and concentrated solar thermal power devices can also be used in large arrays to produce central station electricity, but these applications still are mostly experimental.

A major benefit of solar energy systems is that their operation emits no noise or pollution. Solar photovoltaic and thermal systems are often placed on the rooftops of buildings, although community distributed solar systems, now being rapidly adopted, are usually located centrally. These applications are commonly known as 'active solar systems'.

Solar energy also may be utilised by siting or orienting buildings toward the sun in order to increase winter heating potential and reduce cooling requirements in summer, thereby reducing the need for electricity and boiler fuels for heating and cooling. Also, demand for electricity for heating and cooling can be reduced by designing buildings to store the natural heat of the sun or use skylights, usages known as 'passive solar systems'.

B. Solar Energy Systems Protected By Legislation

Most legislation is directed at active solar energy systems rather than passive solar energy systems. Typical definitions of covered solar systems include the following examples.

California Shade Control Act.[1]

"Solar collector" means a fixed device, structure or part of a device or structure or part of a device or structure, on the roof of a building, that is used primarily to transform solar energy into thermal, chemical, or electrical energy. The solar collector shall be used as part of a system which makes use of solar energy for any or all of the following purposes: (1) water heating, (2) space heating or cooling, and (3) power generation.

[1] California Public Resources Code § 25981, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001 -26000&file=25980-25986.

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New Mexico Solar Rights Act.[1]

"Solar collector" means a device, substance or element, or a combination of devices, substances or elements, that relies upon sunshine as an energy source and that is capable of collecting not less than twenty-five thousand British thermal units on a clear winter solstice day or that is used for the conveyance of light to the interior of a building. The term also includes any device, substance or element that collects solar energy for use in:

(1) the heating or cooling of a structure or building;
(2) the heating or pumping of water;
(3) industrial, commercial or agricultural processes; or
(4) the generation of electricity.

1 Solar Rights Act, § 47-3-3 NMSA 1978, http://public.nmcompcomm.us/nmpublic/gateway.dll/nmsa1978/stat/ch47/17680/17683?f=templates$fn=document-frameset.htm$q=[field%20folio-destination-name:%2747-3-3%27]$x=Advanced#0-0-0-71621.

C. Consumer Protection

Consumer confidence in solar energy technology is crucial to establishing a successful solar energy industry. The main consumer complaints against solar energy manufacturers and sellers include: the installation of faulty devices; the improper installation of the solar collector, leading to leaks, roof damage and collectors being blown off the roof during storms; and false claims concerning the potential energy savings of the solar installation. Where consumers are unfamiliar with solar technology, and considering that the capital costs of installing solar equipment are significant investments, legislation is required to protect the consumer and to instil confidence in the solar industry. In particular, consumers need to be assured that the solar devices they purchase will be of a high quality, will be installed correctly, and that the initial up-front costs of purchase and installation will be recovered by savings in their energy bills over a certain period of time. If consumers cannot be assured of these things, then they will be reluctant to invest in solar energy technology. Should any problems occur with installation or should false claims be made, consumers need to be able to claim a remedy from the manufacturer or seller.

1. Safety and Performance of Solar Energy Systems and their Components

Consumer safety can be compromised when either the solar energy system or its parts, including panels/modules and their components, inverters, DC isolator products, and PV mounting frames, are faulty or of poor quality. The most widespread means by which governments ensure that the solar energy products are of good quality is to require that they meet mandated standards. Standards may be aimed at ensuring the safety of the system, or the thermal performance or efficiency of the system, or both. These may be voluntary or may be mandatory legal requirements incorporated in legislation. Either general legislation, energy/electricity market legislation, renewable energy legislation or specific solar energy legislation, regulations or other subordinate legislation may specify the particular product quality requirements that must be met.

Product standards may be established by a national or international standards organization. In the solar energy industry, the standards of the International Electrotechnical Commission (IEC) are often used. These may be incorporated directly into legislation or adapted for the specific climatic conditions of the country concerned. The government may establish a national accreditation and listing scheme, under which products are tested and accredited/certified as meeting required legal standards. Testing and accreditation/certification requirements may apply to both domestically-produced and imported solar energy systems and components. A list of accredited products and/or manufacturers need to be made available to the public to enable purchasers to choose products of a high quality and/or products from reliable manufacturers. Monitoring and enforcement is critical to establishing a successful accreditation scheme.

The testing, accreditation and listing of products may take place wholly by government agencies or by independent professional agencies that are approved/accredited by the government. Alternatively, under a purely voluntary scheme of industry self-regulation, a solar industry association can undertake one or more of these actions – testing, accreditation and listing – as well as monitoring and enforcement activities. Many industry self-regulatory schemes are co-regulatory schemes with government, where the industry association is supported by legislation that makes product standards mandatory and which incorporates statutory remedies and enforcement mechanisms for breach of the product standard and accreditation requirements.

The quality of installation and sale of solar energy systems may be addressed separately from the issue of manufacture of solar products, with legislation requiring persons to hold an electrical or other special licence or qualification to install solar systems. Alternatively, statutory schemes may place the licensing requirement on all parties involved in the solar energy industry, including manufacturers, installers and vendors/retailers. Thus, although this chapter examines the issue of quality of manufacture separately from the issue of quality of installation, legal regimes may address the issue of system reliability through a whole-of-cycle approach.

The renewable energy laws of Kenya and the Philippines, of which extracts are set out below, provide useful examples of comprehensive laws that (a) provide a whole-of-cycle approach, placing obligations on a range of parties including designers, manufacturers, vendors, suppliers and electricians, backed up by enforcement provisions that (b) apply in relation to a range of renewable technologies, including wind as well as solar. As well as being comprehensive, these laws are clear, easy to understand and readily accessible. Korea has also enacted a comprehensive renewable energy law which provides a useful example of mechanisms to addressing these matters, although in translation, the statutory language is not as clear and easy to read as those of Kenya and the Philippines.

Kenya requires the design, installation, repair and maintenance of a solar PV system to be in accordance with the relevant Kenya Standard, and solar PV design tools to be submitted to the Energy Commission for approval.

The Energy (Solar Photovoltaic Systems) Regulation 2012 (Kenya).[1]

Design, installation, repair and maintenance.

8. (1) The design, installation, repair and maintenance of a solar PV system shall be in accordance with the relevant Kenya Standard.

(2) Any solar PV system design and specifications shall take into account the electric energy needs and safety of the user, and ensure that these aspects are appropriately matched.

(3) A system design declaration indicating the user's electrical energy needs and proposed design shall be prepared by the vendor or contractor and signed by both vendor or contractor and the customer.

(4) A vendor or contractor shall be responsible for the design and specifications of complete solar PV systems, except in situations where customers purchase individual system components from different vendors. In which case the customers shall indicate in the signed system design declaration form that they did not require the said design or specifications from the vendor or contractors.

(5) A vendor or contractor shall submit the solar PV system design tools to the Commission for approval….

1 The Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya) http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf.

Philippines: *the Renewable Energy Act of 2008* regulates the manufacture and supply of solar energy equipment.[1]

SEC. 25. Registration of RE Developers and Local Manufacturers, Fabricators and Suppliers of Locally-Produced Renewable Energy Equipment. – RE Developers and local manufacturers, fabricators and suppliers of locally-produced renewable energy equipment shall register with the [Department of Energy], through the Renewable Energy Management Bureau. Upon Registration, a certification shall be issued to each RE Developer and local manufacturer, fabricator and supplier of locally-produced RE equipment to serve as the basis of their entitlement to incentives provided under Chapter VII of this Act.

SEC. 26 – All certifications required to qualify RE developers to avail of the incentives provided under this Act shall be issued by the DOE through the Renewable Energy Management Bureau.

The registration of manufacturers, fabricators and suppliers of locally-produced solar equipment, parts and components is governed by the Department of Energy (DOE) *Guidelines for the Accreditation of Manufacturers, Fabricators and Suppliers of Locally Produced Renewable Energy Equipment and Components (July 2009) under the Renewable Energy Act* (2008).[2]

SEC. 7. Obligations of Accredited RE Manufacturers, Fabricators and Suppliers. – The DOE-Accredited manufacturers, fabricators and suppliers of locally-produced RE equipment, parts and components shall comply with the terms and conditions set forth in the Certificate of Accreditation, in addition to the following: …

c. Adhere to standards, or in its absence, to industry-accepted norms and practices in the manufacture, fabrication or supply of RE machineries, equipment and components.

1 Republic Act No 9513 (the Renewable Energy Act of 2008) (Philippines), http://www.senate.gov.ph/republic_acts/ra%209513.pdf.

2 Government of the Philippines, Department of Energy, Guidelines for the Accreditation of Manufacturers, Fabricators and Suppliers of Locally Produced Renewable Energy Equipment and Components (July 2009) http://www.doe.gov.ph/doe_files/pdf/Issuances/DC/DC2012-11-0009.pdf.

In **Korea,** art 4 of the *Framework Act on National Standards* requires the Government to "formulate various policies for the establishment of national standards system and take administrative measures for legislation and finance and other necessary administrative measures".[410] This Act establishes a Committee for Deliberation on National Standards (art 5) and provides the basis for the establishment of a national system of product standards. The Act provides for product certification (art 22); the introduction of an examination system for certification of standards (art 22-2), the introduction of integrated national certification marks (art 22-3), and the accreditation of Testing and Inspection Institutes (art 23).

Korea has also passed the *Act on The Promotion of the Development, Use and Diffusion of New and Renewable Energy* to specifically provide for the certification of renewable energy technologies, to ensure they conform to international standards.[411] Under Art 13, any person who intends to sell 'new and renewable energy facilities' by manufacturing or importing them may obtain 'facility certification' from a designated 'facility certification institution'. To obtain facility certification, a person must file an application with a designated facility certification institution, undergo a performance test and inspection by a designated performance examination agency, and submit their written test results to the facility certification institution. The Ministry of Knowledge Economy is empowered to prescribe the 'scope of duties, procedures for certification, follow-up management of facility certification of a facility certification institution, the procedures for designation of a performance examination agency, and other matters necessary for facility certification': Art 13(6). Article 31 provides for the establishment of a New and Renewable Energy Centre, which the Minister of Knowledge Economy must designate as a facility certification institution.

Renewable Energy Law – The People's Republic of China, 26 December 2009.[1]

Article 11 The administrative department of standardization of the State Council shall formulate and publish national technical standards for grid synchronization of electricity generated by using renewable energies and national standards for other techniques and products relating to renewable energies for which there should be nationally uniform technical standards.
Article 17. …The administrative department of construction of the State Council shall, in conjunction with other relevant departments of the State Council, formulate technical and economic policies and technical criteria for the combination of solar energy utilization systems with the construction of buildings. …
With regard to a building already completed, the user may install a solar energy utilization system that meets the relevant technical criteria and product standards, provided that such installation shall not adversely affect the quality or safety of the building, and except that it is otherwise agreed to by the relevant parties.

1 *RENEWABLE ENERGY LAW* – THE PEOPLE'S REPUBLIC OF CHINA, 26 December 2009, http://en.cnrec.info/policy/domestic/comprehensive/2012-05-09-156.html.

410 *Framework Act on National Standards*, (Korea) Act No. 9590, Apr. 1, 2009, as amended, http://english.motie.go.kr/wp-content/uploads/2014/10/FRAMEWORK-ACT-ON-NATIONAL-STANDARDS.pdf.

411 *Act on The Promotion of the Development, Use and Diffusion of New and Renewable Energy* (Korea), Act No.10253, Apr. 12, 2010, as amended, *http://english.motie.go.kr/wp-content/uploads/2014/10/ACT-ON-THE-PROMOTION-OF-THE-DEVELOPMENT-USE-AND-DIFFUSION-OF-NEW-AND-RENEWABLE-ENERGY1.pdf*.

China has implemented a system of national standards, including testing and accreditation, applicable to solar energy systems and their various components.

China's series of technical standards for the solar industry are based largely on IEC standards. The National Standards for solar energy are designated by the government of China as "GB/T standards." Applying them is voluntary unless cited otherwise under laws and regulations. The Standardization Administration of China (SAC) has published numerous test methods and product standards for solar water heating and solar collectors, and their component parts. A list of the SAC's 72 GB/T standards, test methods and guides for solar engineering can be found by searching the SAI Global store.[412]

Where no national GB/T standard exists, 'industry' or 'professional' standards for specific industry sectors may be developed. The code for energy voluntary standards is 'NB/T'. Since 2012, 26 solar power standards have been issued in the 32,000 series, being NB/T 32001-2012 to NB/T 32026-2015, developed by the National Technical Committee for Standardization for Solar Energy (SAC/TC402) or the National Technical Committee for Standardization of Solar PV Energy (SAC/TC90).

The China National Certification and Accreditation Administration (CNCA) co-ordinates product certification and testing. PV product certification and accreditation is undertaken by the China Quality Certification Centre (CQC), a national professional certification body authorised by the CNCA. A Voluntary Product Certification service, called CQC Mark Certification, applies to solar product performance. Products that are verified as conforming to the required performance standards may use the CQC Mark.[413]

Although China has been active in developing product standards under its laws, under its system it is not easy to find out which standards are voluntary and which are compulsory, as access is required to legislation (which may not be available online or in English) to determine which, if any, standards have been cited and are compulsory, and which are not.

2. Ensuring the Safe Installation of Solar Energy Systems

Consumer safety can be compromised when solar energy systems are not installed correctly. The main means by which governments ensure that solar energy systems are installed correctly is through mandatory licensing requirements for undertaking electrical work. The law may require installers to hold a general electrical licence and to be registered by the relevant government agency. Some laws require installers to hold a specific licence for the installation of solar PV devices. Alongside mandatory licensing requirements, government agencies or industry associations may run accreditation and listing schemes of solar energy installers. As part of licensing and/or accreditation schemes, mandatory renewable energy training and continuing professional development may be required. Furthermore, licensing and/or accreditation requirements may make it mandatory for installers to abide by industry installation and design guidelines and standards.

412 The SAI Global store can be searched at *http://infostore.saiglobal.com/store/results2.aspx?searchType=simple&publisher=All&keyword=solar%20engineering*, (last visited 21 Jan., 2016).

413 China Quality Certification Centre, *http://www.cqc.com.cn/english/ProductCertification/CQCVoluntaryProduct/CertificationScope/webinfo/2009/12/1260812608422576.htm*, (last visited 21 Jan., 2016).

In Kenya, the *Energy (Solar Photovoltaic Systems) Regulation 2012* prohibits persons from carrying out the supply, installation, design, manufacture, distribution, promotion or sale of solar PV systems in Kenya without a licence from the Energy Regulatory Commission.[414]

Energy (Solar Photovoltaic Systems) Regulation 2012 (Kenya)

2.(1) These regulations shall apply to a solar PV system manufacturer, importer, vendor, technician, contractor, system owner, a solar PV system installation and consumer devices. …

Licensing of solar PV system technicians.

4. (1) A person shall not design or install any solar PV system unless he is licensed by the Commission.

(2) To be licensed by the Commission as a technician, a person shall be required to have the prescribed qualifications and experience as set out in the First Schedule, and appropriate certification recognised by the Commission.

(3) The Commission may on application being made to it, grant to the applicant any one of the following classes of licenses –

(a) Class T1 license, which shall entitle the holder to carry out solar PV system installation work for small systems or single battery DC system of up to 100 Wp.
(b) Class T2 license, which shall entitle the holder to carry out solar PV system installation work for medium systems or multiple batteries which may include an inverter.
(c) Class T3 license, which shall entitle the holder to carry out solar PV system installation work for advanced, including grid connected and hybrid systems.

Licensing of solar PV system manufacturers.

5. (1) A person shall not engage in the business of manufacture of any solar PV system and components unless he applies for and obtains a license from the Commission. …

Licensing of solar PV system manufacturer, importer, vendor or contractor.

6. (1) A person shall not import, distribute, promote, sell or install any solar PV system unless he is licensed by the Commission as a vendor.

(2) Where under this regulation a person who is not a technician applies to be licensed by the Commission as a vendor or contractor that person shall be required to have in his employment, a licensed Solar PV system technician. …

Compliance with other technical, legal and regulatory requirements.

11. The installation of solar PV system and battery based systems in premises shall be in compliance with all other relevant technical, legal and regulatory requirements applicable in Kenya.

414 Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya), *http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf*.

In the ***Philippines****, the Renewable Energy Safety, Health, and Environment Rules and Regulations of 2012 address* the safety of installation.[1]

Section 2.**Scope and Coverage.** This Circular apply to all employers, employees, contractors and other entities engaged in RE Operations in the Philippines.

Section 3. **Definition of Terms.** …

16. 'RE Operations' refers to all activities related to exploration, development and utilization of RE renewable resources including the manufacturing, fabrication and supply of locally produced RE machineries, equipment, components and parts'.

Section 21. **Electrical and Mechanical Works.** All electrical and mechanical installations, constructions and equipment shall be in accordance with the provisions of the latest edition of the Philippine Electrical Code and Philippine Society of Mechanical Engineering Code. Operations, maintenance and repair works of electrical and mechanical equipment or machinery shall be done by qualified and duly authorised personnel in complete adherence to RA 7920 … and RA 8495 … .

1 Renewable Energy Safety, Health, and Environment Rules and Regulations of 2012 made under the Renewable Energy Act of 2008 (Philippines) and the Department of Energy Act of 1992 (Philippines) http://www.doe.gov.ph/doe_files/pdf/Issuances/DC/DC2012-11-0009.pdf.

In Ghana, the **Renewable Energy Act 2011** prohibits a person from engaging in a range of commercial activities in relation to the provision of solar energy without a license.[415]

In Singapore, the **Electricity Act** requires 'all non-residential electrical installations, with demand exceeding 45 kilo volt ampere or kVA' to obtain an electrical installation license from the Energy Market Authority. An 'electrical installation' refers to 'any electrical wiring, fitting or apparatus used for the conveyance and control of electricity in any premises', and includes the installation of solar PV systems. 'The licence requires the owner of the electrical installation to engage a [Licensed Electrical Worker] to take charge of the electrical installation and comply with the relevant safety standards and requirements.'[416]

3. Information and Misinformation

To maintain confidence in the performance of solar devices, consumers need to have access to adequate and accurate information about matters such as the performance of PV systems and future electricity bills, the size of PV systems, the availability of government incentives, the suitability of the PV system for their building or other installation, and the qualifications of people performing services such as electricians and plumbers. To meet these requirements the law may take a dual approach.

415 Renewable Energy Act 2011 (Act No. 832) (Ghana) *http://energycom.gov.gh/files/RENEWABLE%20ENERGY%20ACT%202011%20%28ACT%20832%29.pdf*.

416 Singapore Energy Market Authority and Singapore Building and Construction Authority, Handbook for Solar Photovoltaic (PV) Systems (no date) p 20 *https://www.bca.gov.sg/publications/others/handbook_for_solar_pv_systems.pdf*.

First, governments can ensure accurate and comprehensive information is disseminated to consumers in a number of ways. Secondly, measures to ensure the effective dissemination of correct information can be supported by legislation that prohibits manufacturers or sellers of solar equipment from making false claims about the quality of solar collectors and/or the energy-saving potential of the installation.

The comprehensive renewable energy laws of Kenya, Singapore. India, and the Philippines described below provide some useful examples of statutory provisions obliging private parties and the government to provide information to consumers.

a Provision of Accurate and Comprehensive Information

The law may set out mandatory statutory requirements regarding information that must be given to consumers by various actors involved in the manufacture, sale and installation of solar energy systems. Legislation may:

- prescribe legal formalities for the contracts for sale of solar systems, for example, that contracts, including warranty provisions, are set out in writing, and contain certain minimum information for the consumer;
- require consumers to be given certificates of installation and/or repair, containing certain specified information;
- require solar devices to be labelled; and/or
- require the government to maintain lists or registers of accredited solar products and accredited contractors, and make this information publicly available.

In a self-regulatory or co-regulatory scheme, such as that in Australia, industry associations may undertake activities including: publishing module rating systems and product lists; publishing consumer guides to solar energy systems and accredited manufacturers/installers; and specifying, through industry codes of conduct or guidelines, the information/documents that should be given to consumers. Where an industry code of conduct is supported or approved by government legislation, such as consumer protection legislation, this will strengthen the code through the availability of statutory penalties and remedies for a breach of the code.

Kenya: Energy (Solar Photovoltaic Systems) Regulation 2012.[1]

Design, installation, repair and maintenance.

8. (6) A solar PV system technician or contractor shall issue an installation completion certificate, showing as a minimum, the date of installation, details of the person installing, details of the owner, the location, capacity and warranty upon the commissioning of the solar PV system.

Use and disposal of solar PV systems and components.

10. (1) All manufacture, sale, installation, use and disposal of solar PV systems and components shall be in accordance with the provisions of the Environmental Management Coordination Act, No 8 of 1999 and the Occupational Safety and Health Act, No15 of 2007.

(2) A manufacturer or vendor of a solar PV system and components shall affix thereon appropriate safety and health warning labels.

(3) A technician or contractor shall affix appropriate safety and health warning labels on completed solar PV system installations.

Documentation by the Commission.

12. (1) The Commission shall maintain a register of all licensed solar PV systems manufacturers, importers, vendors, technicians and contractors, which shall be available for inspection by the public during working hours free of charge.

(3) All vendors, technicians and contractors shall provide to the owner of a solar PV system the prescribed documentation as set out in the Fifth Schedule.

(4) All manufacturers, importers, vendors, technicians and contractors shall provide with the Commission information on the annual sales volumes in watts, and value of solar PV systems and components manufactured, sold and installed, by the 31st March of the year following the manufacture, sale or installation.

(5) A solar PV system manufacturer, importer, vendor, technician or contractor shall maintain any documentation required under these Regulations for a minimum period of five years.

1 Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya), http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf.

India:Technical specifications for Solar Photovoltaic Water Pumping Systems for the year 2015-16.[1]

IX. OPERATION AND MAINTENANCE MANUAL

An Operation and Maintenance Manual, in English and the local language, should be provided with the solar PV pumping system. The Manual should have information about solar energy, photovoltaic, modules, DC/AC motor pump set, tracking system, mounting structures, electronics and switches. It should also have clear instructions about mounting of PV module, DO's and DONT's and on regular maintenance and Trouble Shooting of the pumping system. Name and address of the person or Centre to be contacted in case of failure or complaint should also be provided. A warranty card for the modules and the motor pump set should also be provided to the beneficiary.

1 Government of India, Ministry of New and Renewable Energy, Technical specifications for Solar Photovoltaic Water Pumping Systems for the year 2015-16, http://mnre.gov.in/file-manager/UserFiles/technical-specification_spwps_2013_14.pdf.

Solar Energy Products Warranty Act of New York (for solar thermal systems)

S 12-104. Contracts and sales practices.[1]

1. Every agreement for the sale or installation of a solar thermal system shall be in writing and be subscribed by the seller or installer, or his lawful agent, and by the customer or his lawful agent.

2. Every such agreement shall contain or have annexed thereto:
(a) The name and address of the system manufacturer of the solar thermal system together with the system's name and model number;
(b) Operation, maintenance and installation instructions, except that installation instructions need not be provided in an installation agreement;
(c) Copies of all express warranties provided to the customer; and
(d) Other such information as may be required by the commissioner.
3. Every such agreement shall display the following statement on the face of the agreement in a clear and conspicuous manner: "No specific thermal performance for this solar system is warranted unless stated herein".

4. No seller shall offer for sale a solar thermal system unless such seller makes available to a prospective customer the information specified in subdivisions two and three of this section.

See also 12-106, requiring all express warranties and service agreements pertaining to any solar thermal system or component thereof to be in writing and in compliance with rules and regulations promulgated by the commissioner.

1 Solar Energy Products Warranty Act of New York, s 12-104, http://codes.lp.findlaw.com/nycode/ENG/12.

In the Philippines, the *Renewable Energy Guidelines on Small Solar Photovoltaic Project Development in the Philippines* (October 2014) provide that the qualified end user shall

In Singapore, the Energy Market Authority has published a *Handbook for Solar (PV) Photovoltaic Installations* (no date) to provide information to installers and consumers.[417]

b. Prohibition of False or Misleading Information

Statutory provisions can prohibit manufacturers or sellers of solar equipment from making false claims about the quality of solar collectors or the energy-saving potential of the installation. Such provisions can be contained in general legislation that prohibits businesses from making false claims about their products or services, or in solar-specific or renewable energy legislation. When a manufacturer or seller makes false claims about the performance of a solar collector, damages for loss or damage suffered is the most common remedy, although the law may also give courts the power to award any other appropriate remedy. The general consumer protection laws of Australia, for example, provide a broad prohibition on engaging in misleading and deceptive conduct, a wide range of statutory remedies, and also permit the Australian Consumer and Competition Commission to undertake legal action on behalf of consumers.

417 Handbook for Solar Photovoltaic (PV) System, above n 358.

Australian Consumer Law.[1]

18. Misleading or deceptive conduct

(1) A person must not, in trade or commerce, engage in conduct that is misleading or deceptive or is likely to mislead or deceive.

29 False or misleading representations about goods or services

(1) A person must not, in trade or commerce, in connection with the supply or possible supply of goods or services or in connection with the promotion by any means of the supply or use of goods or services:

(a) make a false or misleading representation that goods are of a particular standard, quality, value, grade, composition, style or model …; or
(b) make a false or misleading representation that services are of a particular standard, quality, value or grade; or
make a false or misleading representation with respect to the price of goods or services; or
(m) make a false or misleading representation concerning the existence, exclusion or effect of any condition, warranty, guarantee, right or remedy (including a guarantee under Division 1 of Part 32); …

1 The Australian Consumer and Competition Act 2010, Schedule 2, s 18(1) https://www.comlaw.gov.au/Details/C2011C00003/Html/Volume_3.

4. Remedies and Enforcement

Legislation is needed to give consumers effective legal remedies when the solar collector fails to perform according to required specifications or to the manufacturers' specifications, or when the manufacturer or seller makes false claims about the performance of a solar collector.

a Warranties, Consumer Guarantees and Remedies for Breach

Warranties may be established as statutory warranties or consumer guarantees contained in general consumer legislation. Alternatively, specific solar laws may require warranties to be a term of a contract of sale of a solar energy system. These warranties guarantee that solar collectors will perform according to manufacturers' and government specifications. Warranties usually provide consumers with a right of repair, replacement or refund where solar energy systems (i.e. products) are faulty. Consumers may also be entitled to compensation ('damages') for any loss or damage suffered by a faulty system. Warranties or guarantees regarding installation or performance of other services provide a right to compensation for any loss or damage suffered by inadequate installation, and/or a right to payment to allow services to be redone by another technician. The law may also give courts the power to award any other appropriate remedy.

In Singapore, a PV module warranty usually includes first, a 'workmanship warranty' to repair, replace or refund the purchase in case of defects. The typical period is two to five years, but

Kenya: The Energy (Solar Photovoltaic Systems) Regulation 2012.[1]

Warranty on system and components.

9. (1) A manufacturer, vendor, technician or contractor shall provide a warranty to the customer for the components in the solar PV system and the PV Installation for the periods set out in the Fourth Schedule.

(2) Consumer devices which incorporate the use of solar PV systems shall have a warranty for the periods set out in the Fourth Schedule.

(3) A manufacturer or vendor shall ensure the warranty period is clearly indicated on any displayed solar PV system product.

FOURTH SCHEDULE (r.9(2))

MINIMUM WARRANTY ON SOLAR PV SYSTEM AND COMPONENTS

Component	Warranty period
Controller/regulator	10 years
Inverter	10 years
Battery	1 year
Light bulbs/LEDs	1 year
Panels	20 years
Light fittings/device	2 years

Interpretation

3. … "warranty" means an assurance or guarantee given to the purchaser by a manufacturer or his agent stating that a product will perform as stated, is reliable and free from known defects and that the manufacturer shall, without charge, repair or replace defective parts within a given time limit and under certain conditions.

1 Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya), http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf.

In **India,** technical specifications for certain solar applications require a warranty to be offered. See, for example, Technical specifications for Solar Photovoltaic Water Pumping Systems for the year 2015-16.[1]

VIII. WARRANTY

The PV Modules must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years. The whole system including submersible/surface pumps shall be warranted for 5 years. Required Spares for trouble free operation during the Warrantee period should be provided along with the system.

1 Government of India, Ministry of New and Renewable Energy, Technical specifications for Solar Photovoltaic Water Pumping Systems for the year 2015-16, http://mnre.gov.in/file-manager/UserFiles/technical-specification_spwps_2013_14.pdf

may vary from one to ten years. Secondly, a 'limited power output warranty' provides a remedy where the PV module's output drops below a certain level. Most manufacturers warrant at least 90% of the minimum rated output for 10 years, and 80% of the minimum rated output for 20-25 years. Remedies include: repairing the defective PV modules; supplying enough new PV modules to replace the lost power output in a PV array; or paying a refund for the lost power output.[418]

b. Access to justice

Taking legal action in the courts is expensive. Therefore it is important that legislation make provisions for a consumer to recover the reasonable costs of hiring a lawyer (attorney) to represent him or her in court. If consumers cannot afford to go to court to obtain a remedy, and/or the cost of legal fees is greater than the compensation sought, the legislation will be ineffective in protecting consumers' rights. Another less expensive means for assisting consumers to obtain a remedy is through the use of industry self-regulatory schemes, such as reporting problems to a solar industry association. These schemes may be supported by options for punitive action by the solar industry association, backed by government legislation. Some examples of legislative provisions are the:

Solar Energy Products Warranty Act of New York.[1]

§ 12-110. Violations. 1. Whenever the attorney general has reason to believe that any violation of this article is a repeated or persistent practice, he may bring an action to enjoin such practice and to obtain restitution for any aggrieved party or parties. …

2. Any owner of a solar thermal system injured by a violation of any provision of this article issued pursuant thereto may bring an action in his own name to enjoin such violation and to recover his actual damages. In such action, there may be awarded reasonable attorney's fees and costs to the plaintiff. … Provided, however, that such individual action shall be precluded if, prior to its commencement, the attorney general has commenced an action for an injunction and restitution pursuant to the provisions of subdivision one of this section.

1 Solar Energy Products Warranty Act of New York, s 12-110, http://codes.lp.findlaw.com/nycode/ENG/12/12-110.

California: Civil Code, 714(f)-(g).[1]

(f) Any entity, other than a public entity, that wilfully violates this section shall be liable to the applicant or other party for actual damages occasioned thereby, and shall pay a **civil** penalty to the applicant or other party in an amount not to exceed one thousand dollars ($1,000).

(g) In any action to enforce compliance with this section, the prevailing party shall be awarded reasonable attorney's fees.

1 California, Civil Code, 714(f)-(g), *http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=00001-01000&file=707-714.5.*

418 Handbook for Solar Photovoltaic (PV) System, above n 358, pp 17-18.

See also: **US** Clean Air Act, s 304(d), Citizen suits, Award of costs; security;[419] and **United States Uniform Commercial Code,** Remedies in consumer disputes.[420]

Australia: The Clean Energy Council (CEC) deals with complaints involving a breach of the CEC's voluntary Accreditation Code of Conduct, as well as Australian Standards relating to solar PV system installation. Disputes and complaints relating to the Accreditation Code of Conduct and Terms and Conditions may be lodged with the CEC online.[421] Similarly, consumers who believe an approved Solar Retailer has breached the Code of Conduct, may notify the CEC using the online Code of Conduct complaints form. [422] The main advantage to consumers of this scheme is that it is easily accessible and inexpensive.

Korea: Act on The Promotion of the Development, Use and Diffusion of New and Renewable Energy.[1]

Article 15 (Revocation of Facility Certification and Revocation of Designation of Performance Examination Agencies)

(1) When any person has obtained facility certification by false or other illegal means, the certification institution shall revoke such certification, and if it is found that any new and renewable energy facilities, manufactured or imported, and sold after having been certified, fail to satisfy the certification examination criteria under Article 13 (5), it may revoke such certification.
(1) [sic] Where a person who has obtained facility certification by false or other fraudulent means, a facility certification institution shall revoke such certification, and where it is found that any new and renewable energy facilities manufactured, imported and sold after having been certified fail to satisfy the criteria for certification examination under Article 13 (5), it may revoke such certification.
(2) Where a performance examination agency falls under any of the following subparagraphs, the Minister of Knowledge Economy may either revoke the designation thereof, or may order the suspension of all or part of its business, specifying a period of up to one year, as prescribed by Presidential Decree: Provided, That in cases under subparagraph 1, he/she shall revoke the designation thereof:
1. When it has obtained the designation by false or other fraudulent means;
2. When it fails to commence performance examination affairs for not less than one year from the date of designation without any justifiable grounds, or has suspended performance examination affairs for not less than one consecutive year;
3. When it fails to meet the designation criteria referred to in Article 13 (3).

1 Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya) http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf.

419 United States Code, 42 U.S.C, Title 42, Ch 85 §7604(d), http://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapIII-sec7604.htm.
420 15 USC 50 §2310(d)(2), https://www.law.cornell.edu/uscode/text/15/2310.
421 See Clean Energy Council, http://www.solaraccreditation.com.au/consumers/solar-pv-warranties-complaints-and-disputes/dispute-form.html (last visited 21 Jan., 2016).
422 See Clean Energy Council, http://www.solaraccreditation.com.au/retailers/complaints-form.html (last visited 21 Jan., 2016).

c. Punitive provisions

Legislation may contain punitive provisions to deter breaches of the law, and to punish such breaches. Punitive provisions may include: the suspension and/or cancellation of licences, accreditation or certification; civil penalties; and criminal penalties such as fines and imprisonment. Examples are given below.

i. Suspension or cancellation of accreditation or licensing

Australia: The Clean Energy Council (CEC) investigates complaints against accredited installers according to its Compliance Procedure. Clause 6 of the Accreditation Terms and Conditions sets out the actions the CEC is entitled to take where an Applicant or Accredited Person has breached any of the Accreditation Scheme Terms and Conditions, including the Code of Conduct. These include: taking steps to investigate the conduct of, or work undertaken by, an Accredited Person; requiring an Accredited Person to `remedy any fault or undergo additional training; downgrading, suspending, cancelling or imposing a variation, restriction or condition on an accreditation; or putting an Accredited Person on probation.[423]

This scheme is given legal effect through the *Renewable Energy (Electricity) Act 2000*, under which registration is necessary for people and entities to be able to create renewable energy certificates. When determining whether a person who applies to be registered is a 'fit and proper person', the Clean Energy Regulator must take into account whether the applicant has: (i) sought or been granted accreditation by, or membership of, a clean energy organisation; or (ii) been refused accreditation by, or membership of, a clean energy organisation; or (iii) had the applicant's accreditation by, or membership of, a clean energy organisation suspended or revoked.[424]

ii Statutory offences and penalties

Kenya: Energy (Solar Photovoltaic Systems) Regulation 2012.[1]

Offences and penalties.

16. Any person who—

(a) by himself, servant, or agent undertakes or carries out any solar PV system manufacture, import, vending or installation work without being the holder of a licence then in force appropriate to the work undertaken or carried out or without being under the direction of such a license-holder; (b) contravenes or fails to comply with any of the terms and conditions of any licence issued under these Regulations or wilfully gives false or misleading information under or for the purposes

423 Clean Energy Council, *http://www.solaraccreditation.com.au/installers/compliance-and-standards/accreditation-guide-lines/accreditation-terms-and-conditions.html* (last visited 21 Jan., 2016).
424 Renewable Energy (Electricity) Regulations 2001 (Cth) reg 3L *https://www.comlaw.gov.au/Details/F2015C00690*.

of these Regulations;
(c) submits or causes to be submitted to the Commission or its agent a completion certificate which he knows or has reason to believe is false in any material particular;
(d) being an owner or occupier of any premises or a developer or contractor of any premises under construction, causes or permits to be carried out upon the premises any solar PV system installation work in contravention of these Regulations, or
(e) contravenes or fails to comply with any of these Regulations or who fails to comply with any prohibition or order of the Commission under any of these Regulations,
commits an offence and shall, on conviction, be liable to a fine not exceeding one million shillings, or to imprisonment for at term not exceeding one year, or to both.

1 Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya) http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf.

Korea: Act on The Promotion of the Development, Use and Diffusion of New and Renewable Energy Act.[1]

Article 35 (Fines for Negligence)

(1) A person under any of the following subparagraphs shall be punished by a fine for negligence not exceeding ten million won:
1. A person whose facilities are certified by false or other fraudulent means;
2. A person who displays the indication of building certification, any other indications similar thereto, or publicise as if he/she obtained building certification, without obtaining building certification from a building certification institution;
3. A person who displays the indication of facility certification, any other indications similar thereto, or publicise as if he/she obtained facility certification, without obtaining facility certification from a facility certification institution.

1 The Energy (Solar Photovoltaic Systems) Regulation 2012, made under s 110 of the Energy Act 2006 (Kenya) http://www.kenyacic.org/sites/default/files/Solar_regulation_2012.pdf.

See also Ghana: Renewable Energy Act 2011 s 8(4).[425]

425 Renewable Energy Act 2011 (Act No. 832) (Ghana) *http://energycom.gov.gh/files/RENEWABLE%20ENERGY%20ACT%202011%20%28ACT%20832%29.pdf*.

C. Solar Access

Solar energy users require unobstructed access to sunlight for the optimum performance of both active and passive solar energy systems. Active solar energy systems such as rooftop photovoltaic arrays require large initial up-front costs to purchase and install the equipment, and this cost is recouped over a number of years through savings on energy bills. Legal systems must provide investors in solar systems with a legal right to unobstructed access to sunlight, otherwise potential developers will not invest in solar energy systems. The obstruction of sunlight is a particular problem in built-up urban or suburban areas, where buildings and trees on neighbouring properties may block the path of sunlight to a solar energy system. A number of legislative options to protect solar access are described below.[426]

1. Express Agreements Between Landowners

A statute may regulate the right of neighbouring landowners to enter into agreements to convey the right to use the airspace above their property as an unobstructed path for sunlight. In countries such as the United States, the United Kingdom and Australia, these agreements are known as easements. The airspace overlying the property neighbouring the solar collector's property will be described in an instrument of conveyance. The right conveyed is to an 'adjoining solar use'. The statute will set out the features that must be contained in such an agreement. These differ between jurisdictions in the US, but may include a number of matters.

First, legislation ordinarily requires a description of the airspace to be used above the neighbouring property. Statutes vary in the descriptive detail they require, for example, that:

- the airspace be 'sufficiently described';
- the dimensions of the portion of airspace that is the subject of the right be included in the conveyance;
- the airspace be described in the form of a height restriction about the land over which the agreement exists, which may not be obstructed by the neighbouring landowner; and
- the description includes the hours of the day and days of the year when the solar collector is to remain unobstructed.

Second, provisions concerning remedies may be required to be inserted in the agreement. New and unforeseen circumstances may arise where the neighbour may be required to violate the agreement, or there may be more beneficial use of the neighbour's property than protecting access to sunlight. The usual requirement is for monetary compensation, should access to sunlight be obstructed.

Third, the legislation may specify that certain legal formalities must be observed. For example, the

426 For a discussion of the advantages and disadvantages of various means of protecting solar access, see Australian PV Association, Best Practice Guidelines for Local Government Approval of Photovoltaic Installations, Report for the Low Emissions Technology and Abatement – Renewables Group, (June 2009), http://apvi.org.au/best-practice-guidelines-for-local-government-approval-of-solar-photovoltaic-installations/; Sara C Bronin, "Solar Rights" (2009) 89 Boston University Law Review 1217; and CM Kettles, Florida Solar Energy Research and Education, A Comprehensive Review of Solar Access Law in the United States: Suggested Standards for a Model Statute and Ordinance (Solar America Board for Codes and Standards, 2008), *http://www.solarabcs.org/about/publications/reports/solar-access/pdfs/Solaraccess-full.pdf*.

agreement must be in writing, or the agreement must be registered with the relevant government agency as a property right where legal procedures exist for registration.

Iowa Code Ch. 564A.7: Solar Access Easements.[1]

1. Persons, including public bodies, may voluntarily agree to create a solar access easement. A solar access easement whether obtained voluntarily or pursuant to the order of a solar access regulatory board is subject to the same recording and conveyance requirements as other easements.
2. A solar access easement shall be created in writing and shall include the following:
a. The legal description of the dominant and servient estates.
b. A legal description of the space that must remain unobstructed expressed in terms of the degrees of the vertical and horizontal angles through which the solar access easement extends over the burdened property and the points from which these angles are measured.
3. In addition to the items required in subsection 2 the solar access easement may include, but the contents are not limited to, the following:
a. Any limitations on the growth of existing and future vegetation or the height of buildings or other potential obstructions of the solar collector.
b. Terms or conditions under which the solar access easement may be abandoned or terminated.
c. Provisions for compensating the owner of the property benefiting from the solar access easement in the event of interference with the enjoyment of the solar access easement, or for compensating the owner of the property subject to the solar access easement for maintaining that easement.

1 Iowa Code, Ch. 564A.7, https://coolice.legis.iowa.gov/cool-ice/default.asp?category=billinfo&service=iowacode&ga=83&input=564A#564A.7.

2. Statutory Nuisance

The law may provide a statutory remedy for the user of a solar collector where a neighbouring landowner undertakes specific activities that obstruct access to sunlight. Legislation may declare certain activities that would unreasonably obstruct access to sunlight for a solar energy system, to be a 'nuisance'. The law provides a remedy to the owner/user of the solar collector where a neighbouring landowner undertakes an activity that is declared by law to be a nuisance.

California, City of Berkeley Municipal Code, § 21.36.040, Solar access easements.[1]

For any division of land for which a tentative map is required pursuant to Section 66426 of the Subdivision Map Act, the Planning Commission may require, as a condition of approval of the tentative map, the dedication of easements for the purpose of assuring that each parcel or unit in the subdivision for which approval is sought shall have the right to receive sunlight across adjacent parcels or units in the subdivision for which approval is sought for any solar energy system, provided that such easements meet the following requirements. …

1 California Public Resources Code §§ 25980-25986, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25980-25986.

California Public Resources Code §§ 25980-25986 (codifying the Solar Shade Control Act).[1]

Section 25982 of the Code prohibits a person owning or in control of property from allowing a tree or shrub to be placed or to grow so as to cast a shadow greater than 10% of the collector absorption area upon the solar collector surface installed on a neighbouring property between the hours of 10am and 2pm. The prohibition only applies to trees or shrubs to be placed or grown after the installation of the solar collector, that is, the solar collector must be 'first in time'. The statute sets out requirements for the location of a solar collector in terms of minimum setback requirements from the property boundary and minimum height restriction of the location of the solar collector.

A tree or shrub that is maintained in violation of the section is declared to be a private nuisance if the person who maintains, or permits the tree or shrub to be maintained, fails to remove or alter the tree or shrub after receiving a written notice from the owner or agent of the affected solar collector requesting compliance with the requirements of Section 25982.[2] Remedies for private nuisance comprise either a civil legal action, or abatement.[3] A person injured by a private nuisance may abate it by removing, or, if necessary, destroying the thing which constitutes the nuisance, without committing a breach of the peace, or doing unnecessary injury.

1 California Public Resources Code §§ 25980-25986, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25980-25986.
2 California Public Resources Code § 25983, 'Private nuisance' as defined in Section 3481 of the California Civil Code.
3 Remedies for private nuisance are found in §§ 3501-3503 of the California Civil Code, *http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=03001-04000&file=3501-3503*

3. Prior Appropriation

A statute may create a legal right for unobstructed access to sunlight based on the solar collector being the first-in-time user of the airspace for the collection of sunlight. For example, the Solar Rights Act of New Mexico, USA declares the right to use the natural resource of solar energy to be a property right, known as a 'solar right'. 427 The Act provides for 'prior appropriation', that is, in disputes involving solar rights, priority in time shall have the better right. A 'solar right' is a "right to an unobstructed line-of-sight path from a solar collector to the sun, which permits radiation from the sun to impinge directly on the solar collector".428 These rights are freely transferable. Any person claiming a solar right must record the right under the Solar Recordation Act by filing a solar right declaration with the county clerk of the county in which the property is situated.429

4. Permits or Administrative Allocation

Solar access may be protected through the establishment of an administrative system, whereby a regulatory board reviews applications for solar access permits that protect access to sunlight. When

427 Solar Rights Act [47-3-1 to 47-3-5 NMSA 1978] *http://www.emnrd.state.nm.us/ECMD/LawsRegulationsExecutiveOrders/documents/SolarRightsAct.pdf*.
428 Solar Rights Act § 47-3-3B NMSA 1978.
429 Solar Recordation Act [47-3-6 to 47-3-12 N.M.S.A. 1978].

legislating for this type of procedure, there are a number of matters that the statute may address. The statute may:

- define 'solar collector' (see above for alternative definitions);
- set out the matters the application must address;
- set out procedural requirements;
- set out the conditions under which a board may grant or refuse to grant an easement/permit;
- require compensation to be paid to the burdened landowner by the user of the solar collector;
- establish rules for termination of solar access rights; and
- establish remedies for interference with the easement.

For example, the *Solar Energy – Access and Use Act* of the State of Iowa, USA, establishes a 'solar access regulatory board' to receive and act on applications for solar access easements. [430] The easement will give the solar collector user the right to use the airspace above their neighbour's property as an unobstructed path for sunlight. An owner of property may apply to the board for an order granting a solar access easement. The application must be filed before the installation or construction of a solar collector. The board will only grant an easement where the applicant has attempted to voluntarily negotiate an agreement but failed.

5. Solar Envelopes

Legislation may protect solar access by the use of 'solar envelopes'. This is a 3-dimensional 'envelope' of space, the dimensions of which are drawn over a neighbouring property to land on which a solar collector is situated. Should the owner of the neighbouring property construct a building outside the bounds of the envelope that blocks sunlight to the existing solar collector on the adjoining property, the user of the collector is entitled to seek compensation?

For example, the *Solar Access Act* of the State of Wisconsin, USA, allows installers of an active or passive solar system to receive compensation for an obstruction of solar energy by a structure outside a neighbour's 'building envelope'. [431] A 'building envelope' is a 3-dimensional area on a lot, and is defined by the existing ground level and height restrictions, setback requirements, and side yard requirements or rear yard requirements. The building envelope is defined by zoning restrictions in force at the time the solar collector is installed. The legislation defines 'obstruction' to mean the portion of a building or other structure which blocks solar energy from a collector surface between the hours of 9am and 3pm standard time, if the portion of the building or structure is outside the building envelope.

430 Solar Energy – Access and Use Act [81 Acts, ch. 184 §§ 3-11], now codified in the Iowa Code 2003, Supplement: Sections 564A.1 – 564A.9. *https://coolice.legis.iowa.gov/cool-ice/default.asp?category=billinfo&service=iowacode&ga=83&input=564A#564A.4*

431 Wis. Stat. Ann. § 700.40 (1981), Solar and Wind Access, codified in Wis. Code, Ch 354, §10. *https://docs.legis.wisconsin.gov/statutes/statutes/700/41*

6. Solar Fences

The concept of 'solar fences' can be used to protect access to sunlight.

City Ordinance of Boulder, Colorado, USA.[1]

This ordinance divides the city into three 'Solar Access Areas' - SA Area I, SA Area II and SA Area III - to provide maximum solar access consistent with different planned densities, topography and lot configurations and orientations of the city. A different level of protection for solar access is provided in the three areas, which are delineated on a map of the city.

SA Areas I and II are designed to protect solar access principally for south yards, south walls, and rooftops in areas where, because of planned densities, topography and lot configurations and orientations, the majority of lots in the Area currently enjoy solar access and where protecting solar access should not unduly restrict permissible development. The Ordinance specifically allocates certain zoned districts to SA Areas I and II. SA Area I includes outer suburban areas with large blocks and low development, while SA Area II is the inner suburban area, and mainly comprises 2 story buildings. SA Area III includes all areas not specifically identified in SA Areas I and II. SA Area III includes areas where, because of planned densities, topography and lot configurations and orientations, uniform solar access protection for south yards, south walls, and rooftops may unduly restrict permissible development. SA Area III is the inner city, characterised by high-rise development.

In SA Areas I and II, 'solar fences' are hypothesized. A solar fence is a conceptual device, an imaginary fence running along the boundary of a property, which completely encloses the lot in question; it is absolutely vertical and lacks any thickness. The lower the solar fence, the less area may be shaded and the greater the area of protection. The Ordinance provides that in SA Area I, no person shall erect a structure or object that would shade a protected lot to a greater degree than the lot would be shaded by a solar fence 12 feet in height, between 2 hours before and after local solar noon on a clear winter solstice day. In SA Area II, no person is permitted to erect a structure or object that would shade a protected lot to a greater degree than the lot would be shaded by a solar fence 25 feet in height, between 2 hours before and after local solar noon on a clear winter solstice day. In SA Area III, no solar fences are hypothesized, but protection is available through applications for permits.

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1 Boulder, Colo. Rev. Code, Title 9, Chapter 9, Solar Access, § 9-9-17 (1981), *https://www.municode.com/library/co/boulder/codes/municipal_code?nodeId=TIT9LAUSCO_CH9DEST_9-9-17SOAC*.

7. General Planning Law

General planning law may provide laws against overshadowing at certain times of the day. For example, in the Australian states, each local council area has a local development plan or

local environment policy, incorporated under the state planning law, which contain objectives and principles to guide development. These local development plans or environmental policies may contain principles of development control that solar collectors in particular, or buildings in general, require access to sunlight during certain hours of the day, and/or may not be subject to overshadowing at certain times of the day. When deciding whether or not to give consent to a new development, the local council must take into account the principles of development control. A feature of this type of control is that any principles relevant to access to sunlight are only one of many principles to be taken into account by a decision-maker when deciding whether or not to grant consent to a new development.

Australia, State of South Australia, City of Adelaide Development Plan.[432]

Within the City Living Zone, the Adelaide Historic (Conservation) Zone or the North Adelaide Historic (Conservation) Zone, sunlight to solar panels should be maintained for a minimum of 2 consecutive hours between 9.00am and 3.00pm solar time on 22 June provided it does not restrict the reasonable development of adjoining sites.

8. Prohibiting Restrictions on Solar Collectors

Solar energy devices can be seen as ugly and visually distinct, and agreements known as restrictive covenants may seek to prevent a landowner from installing rooftop solar panels. The owners of homes in subdivisions may enter into restrictive covenants, or aesthetic covenants, that prevent the installation of solar energy devices on aesthetic grounds. Various state laws in the United States prohibit counties, towns and villages from placing any restrictions on the installation or use of a solar energy system, on aesthetic or other grounds.

California Civil Code, §714(a)-(b).[1]

(a) Any covenant, restriction, or condition contained in any deed, **contract**, security instrument, or other instrument affecting the transfer or sale of, or any interest in, real property that effectively prohibits or restricts the installation or use of a **solar energy** system is void and unenforceable.

(b) This section does not apply to provisions that impose reasonable restrictions on **solar energy** systems. However, it is the policy of the state to promote and encourage the use of **solar energy** systems and to remove obstacles thereto. Accordingly, reasonable restrictions on a **solar energy** system are those restrictions that do not significantly increase the cost of the system or significantly decrease its efficiency or specified performance, or that allow for an alternative system of comparable cost, efficiency, and **energy** conservation benefits.

1 Boulder, Colo. Rev. Code, Title 9, Chapter 9, Solar Access, § 9-9-17 (1981), https://www.municode.com/library/co/boulder/codes/municipal_code?nodeId=TIT9LAUSCO_CH9DEST_9-9-17SOAC.

432 *City of Adelaide Development Plan* (Consolidated 24 September 2015) Principle of Development Control 28, http://www.dpti.sa.gov.au/__data/assets/pdf_file/0008/178253/Adelaide_Council_Development_Plan.pdf.

New Mexico Solar Rights Act § 3-18-32.[1]
A. A county or municipality shall not restrict the installation of a solar collector as defined pursuant to the Solar Rights Act … except that placement of solar collectors in historic districts may be regulated or restricted by a county or municipality. …
Source:

1 Solar Rights Act § 3-18-32, http://public.nmcompcomm.us/nmpublic/gateway.dll/nmsa1978/stat/ch3/1543/1576?f=templates$fn=document-frameset.htm$q=[field%20folio-destination-name:%273-18-32%27]$x=Advanced#0-0-0-6847.

II. WIND ENERGY

A. Mapping the Wind Resource

The first step in developing a wind energy facility is identifying an appropriately windy site. An important initiative is the measurement of wind speed and subsequent mapping of wind resources in the form of a wind energy atlas, also called a wind resource study or wind resource map. Wind energy companies will consult the wind atlas (if any) to broadly identify possible areas for development. Governments can assist the development of a wind energy industry by sponsoring the development of wind atlases, either by arranging for a government department to develop the wind resources map, or by funding a quasi-government agency or independent research organization to develop the wind atlas.

China: Meteorology Law of the People's Republic of China 1999, Article 34.[433] Competent meteorological departments at all levels shall arrange for climatic feasibility studies relating to city planning, key national construction projects, major regional economic development projects and large projects for the exploitation of climatic resources such as solar and wind energy.

In October 2015, the International Renewable Energy Agency (IRENA) and the Technical University of Denmark (DTU) launched the on-line Global Renewable Energy Atlas.[434] As part of this, the DTU Wind Energy Atlas 'provides a high resolution wind climatology at 50, 100, 200m hub heights above the surface for the whole world', including onshore and 30 km offshore.[435]

B. The Assessment of Wind Speed at Particular Sites

1. Measurement of Wind Speed

The sensitivity of energy yield to wind speed can only be accurately determined by actual on-site measurements. To gather more specific information about a potential site, the developer may gather long-term wind data collected from a wind measurement station located closest to the site, if such a station exists. They may also use computer models to assess wind speed at the site. The developer will usually collect data for at least one full year to determine annual average wind speed in the absence of existing evidence.

433 *http://www.china.org.cn/environment/2007-08/27/content_1034467.htm*.
434 Available at *http://irena.masdar.ac.ae/*.
435 See *http://irena.masdar.ac.ae/?map=103*.

The instrumentation used for wind assessment includes 3 major components: anemometers, which are sensors to measure wind speed and direction; equipment to log the data; and a meteorological mast or tower. Anemometers continuously record and measure wind speed. These are the first structures to be built at a potential location to determine whether there are sufficient wind resources for cost-effective development. The towers may be temporary and moveable when collecting data prior to construction of the wind farm. Once the wind farm is constructed and under operation, permanent anemometers may be used to transmit information about wind speed and direction to each turbine and to a control facility, where data about the wind is stored. The anemometers may be placed on the turbines, which will begin operating once the anemometers have detected sufficient wind speed.[436]

2. Planning Approval for Anemometers

Planning approval may need to be sought to erect an anemometry tower. Governments should consider the height of towers for which planning permission must be sought and the period of time for which approval will be given. To encourage measurement of wind speeds, some governments, such as the state of Victoria in Australia, do not require companies to obtain planning approval for anemometer masts. In populated areas, publicity should be given to the erection of anemometry equipment, so that local communities are made aware of the possibility of the equipment being erected and a wind farm being constructed.

Ireland: Department of Environment, Community and Local Government, *Wind Energy Planning Guidelines 2006.*[1]

Planning applications for wind anemometers and measuring masts are generally sought for a limited period only. Permissions should be granted for approximately a two-year period, in consultation with the developer, to allow a wind resource analysis to be carried out. It would be inadvisable for the planning authority to grant planning permission for a wind measuring mast in an area where there is a presumption against wind energy development in the development plan. In a case where a developer wishes to extend the period of the permission an application must be made to the planning authority to retain the wind measuring mast; otherwise the developer should be required to remove it..

1 Department of Environment, Community and Local Government, Wind Energy Planning Guidelines 2006, made under s 28 of the Planning and Development Act 2000, '4.2 Wind Measuring Masts', p17 *http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,1633,en.pdf*.

436 P. Coppin, K. Ayotte & N. Steggle, Wind Resource Assessment in Australia – A Planners Guide, Australian Community and Scientific Independent Research Organisation Wind Energy Unit, CSIRO Land and Water (2003), http://www.soe-townsville.org/windmonitoring/coppin_2003a.pdf. Substantial guidance on minimum technical requirements for anemometers can be found in the standards and recommendations of international bodies such as the International Electrotechnical Committee (IEC) http://www.iec.ch/ (last visited Jan. 23, 2016) and the International Network for Harmonised and Recognised Wind Energy Measurement (MEASNET) http://www.measnet.com/ (last visited Jan 23., 2016).

3. Gaining Access to the Land

To conduct on-site investigations, the developer must gain access to the land. In the United States and Australia, developers may secure options for long-term leases or simple anemometer agreements (also known as wind monitoring agreements) from the landowner. The developer obtains the landowner's permission to erect anemometers to conduct wind measurements during the option period. The agreements specify the terms and conditions of the arrangement between the parties, including matters such as:

- liability for damage to equipment or damage caused by equipment;
- the right to enter the land for installation and maintenance;
- the conduct of the developer on the site;
- ownership of data recorded;
- the duration of the agreement; and
- details of any payments to be made.

As these are contractual or private agreements, they are usually confidential and copies are not made publicly available.

C. Site Selection

In some countries such as Australia, individual companies may identify potential sites for wind energy facilities, after which they will approach the various approvals authorities to obtain the necessary permissions to construct and operate the facility. This is a flexible approach that allows proponents to put forward proposals in relation to any land not expressly exempt from development, with the proposal assessed on its merits.

Alternatively, governments can support the establishment of the wind energy industry by conducting strategic environmental assessment (SEA), a process by which the government, proponents and communities identify possible locations for wind energy, based on the assessment of a range of matters such as the strength of the wind resource, the impact of development on the natural, social and cultural environment, and other competing interests in land. After assessing locations according to the criteria, the government can designate areas where wind energy developments are permitted or given priority, and/or areas where wind farms will not be given permission to be constructed ('no go' areas).

The process of defining areas for wind energy through SEA requires a thorough and transparent reservation process, entailing the commitment of significant government investment and resources, and can be time-consuming. However, it has a number of advantages for proponents and the community. SEA can help to avoid community conflict and potentially costly and damaging planning disputes, by providing certainty that projects will be located in pre-defined, preferred areas where wind energy facilities will have minimal or lower impacts, and conversely, removing areas of high conservation from contention as potential sites. It reduces the costs for proponents, as the areas

for investigating prospective wind energy sites are already narrowed.[437] Applicants are usually required to obtain the necessary consents after an environmental impact assessment (EIA) has been conducted, in order to identify, assess and manage the impacts of the particular proposal.

1. Priority Areas For Wind Farms

In Wales, the Assembly Government has determined that large-scale onshore wind developments (25MW or more) should be concentrated in particular areas defined as Strategic Search Areas (SSAs). Seven SSAs have been identified through means /criteria outlined in the Technical Advice Note. Wind energy developments are not prohibited outside SSAs, but most areas outside SSAs should remain free of large wind power schemes.[438]

In Denmark, wind energy projects must be located in accordance with the spatial planning process set out in the *Planning Act*, regional plans and detailed local municipal plans. Apart from household and small turbines, wind turbines may only be erected in specific wind turbine areas designated by the municipalities in municipal plans. The regulations for siting are set out in the *Planning Act* and implemented in *Wind Turbine Circular no. 9295 of 22 May 2009*.[439]

2. "No-go" Areas

The government may declare particularly sensitive areas to be 'no go' areas for wind farms. These areas may be sensitive for a number of reasons – they may be of unique or an 'above–average' scenic beauty, of importance for biodiversity, or of particular cultural or religious significance to indigenous peoples. For example, the government may identify 'no go' areas on the basis of existing categories of protected areas in protected areas legislation, such as national parks and reserves,

India, Guidelines for diversion of forest land for non-forest purposes under the Forest Conservation Act, 1980 – For projects utilizing wind energy thereof.[1]

2(i) – **Siting Restrictions** – Areas like national Parks and Sanctuaries, areas of Outstanding Natural Beauty, Natural Heritage Site, sites of Archaeological importance and sites of Special Scientific Interests and other important landscapes should not be considered for wind energy farms.

2(iv) – **Distance from Villages** – wind farms must be at a safe distance from highways and **village habitation** – 300m considered safe.

1 Ministry of Environment and Forests, F. No. 8-84/2002-FC - Guidelines for diversion of forest land for non-forest purposes under the Forest Conservation Act, 1980 – For projects utilizing wind energy thereof, *http://forestsclearance.nic.in/writereaddata/public_display/schemes/2146926545$guildeline%202.pdf*.

437 State of Victoria, Department of Sustainability and Environment, Marine Energy in Victoria: Discussion Paper (2010).

438 Government of Wales, Technical Advice Note 8: Planning for Renewable Energy (July 2005) pp 6-7 *http://gov.wales/docs/desh/publications/050701techical-advice-note-8-en.pdf*.

439 Planning Act, Consolidated Act No. 813 of 21 June 2007, Denmark, *http://naturstyrelsen.dk/media/nst/Attachments/planlovenpengelsk2007.pdf*. See also
Danish Energy Agency, Wind Turbines in Denmark, November 2009, pp12-13 *http://www.ens.dk/sites/ens.dk/files/dokumenter/publikationer/downloads/wind_turbines_in_denmark.pdf*.

or may identify 'no go' areas as a part of the SEA process based on a range of criteria and after engaging in extensive consultation. Legislation may also prohibit wind energy development in or near sensitive or protected areas if the development is likely to have a significant impact on those areas. The remainder of land is available for wind energy development, with proposals assessed under the usual planning and environment laws.

Oregon US, Oregon Administrative Rules, Chapter 345, Division 22.

The Energy Facility Siting Council may not issue a site certificate for the construction of energy facilities in designated protected areas listed in the standard, which include national and state parks, national monuments, wilderness areas, wildlife refuges and other areas that have special scenic, natural or environmental value. To issue a site certificate for a proposed facility located outside the listed areas, the Council must find that, taking into account mitigation, the design, construction and operation of the facility are not likely to result in significant adverse impact to these listed areas.[1]

1 Oregon Administrative Rules, OAR 345-022-0040, http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_345/345_022.html.

D. Allocation of Rights

Allocation of rights to develop a wind energy facility may be acquired through individual ad-hoc applications under planning or other laws. Under these systems, individual companies identify potential sites for projects and approach the various approvals authorities to obtain the necessary permissions to construct and operate the facility. As part of the procedure, companies will conduct EIA as part of obtaining development and environment authorisation, any relevant electrical licences required, and obtain any agreements necessary to enter the land from private or public landowners.

Alternatively, competitive procedures such as reverse auctions or tendering procedures can be used, particularly where states wish to encourage large-scale wind energy facilities. The winning company may be awarded not only the right to develop a wind energy facility in a certain pre-defined area, but also an incentive such as a power purchase agreement with electricity utilities and/or a feed-in tariff. Competitive processes are increasingly being used for their transparency and to ensure facilities are developed at a competitive cost. For example, in 2015, renewable energy auctions were used in 12 of the 20 Latin American countries.[440]

A range of matters must be addressed under a competitive procedure, as demonstrated by the legal framework for reverse auctions for large-scale renewable energy generation projects in the

440 IRENA, Renewable Energy Policies in Latin America 2015: An Overview of Policies (June 2015) p 11, Table 1. For case studies of renewable energy auctions in Brazil, China, Morocco, Peru and South Africa, see IRENA, Renewable Energy Auctions in Developing Countries (2013) *https://www.irena.org/DocumentDownloads/Publications/IRENA_Renewable_energy_auctions_in_developing_countries.pdf*.

Electricity Feed-in (Large-scale Renewable Energy Generation) Act 2011 (A.C.T.).[1]

6 Meaning of large renewable energy generator and renewable energy source

(1) In this Act:
large renewable energy generator means a generating system that—
- (a) generates electricity using a renewable energy source; and
- (b) has a capacity of more than 200kW.

11 FiT entitlement—grant

(1) The Minister may grant a person a FiT entitlement under a FiT capacity release in relation to a large renewable energy generator. …

(5) In granting a FiT entitlement, the Minister must have regard to the following:
- (a) probity and ethical behaviour;
- (b) management of risk to the Territory;
- (c) the objects of this Act;
- (d) if the entitlement is granted under a FiT capacity release made available by a competitive process—open and effective competition.

12 FiT entitlement—conditions

(1)(c) [A FiT entitlement is subject to] any other condition imposed by the Minister that the Minister considers appropriate to protect the interests of the Territory or promote the objects of the Act.

(2) The conditions imposed under subsection (1) (c) may include conditions about any of the following:

- (a) establishing a schedule for construction of the large renewable energy generator and meeting stated deadlines in relation to its construction;
- (b) complying with a stated law in relation to the construction, connection or operation of the large renewable energy generator within a stated time;
- (c) establishing and meeting stated deadlines in relation to financing arrangements necessary for the construction, connection or operation of the large renewable energy generator;
- (d) entering into an agreement with a network service provider to connect the large renewable energy generator to the interconnected national electricity system within a stated time;
- (e) connecting the large renewable energy generator to the interconnected national electricity system and supplying electricity to the system within a stated time;
- (f) where a large renewable energy generator must be located and connected to the interconnected national electricity system;

(g) the kind of generating system that must be used;
(h) the minimum quantity of eligible electricity that must be generated by the large renewable energy generator in a stated time;
(i) the maximum quantity of eligible electricity, in a financial year, in relation to which the holder is entitled to be paid a FiT support payment;
(j) allowing reasonable access to the premises of the holder of a FiT entitlement and where the large renewable energy generator is located to check the holder's compliance with the conditions of the FiT entitlement;
(k) amending a FiT entitlement, including imposing a new condition or amending an existing condition.

1 Available at http://www.legislation.act.gov.au/a/2011-56/. See also the Ministerial Electricity Feed-in (Large-scale Renewable Energy Generation) FiT Capacity Release Determination 2015 (No 1) (A.C.T.) http://www.legislation.act.gov.au/a/2011-56/li.asp.

Australian Capital Territory, Australia.[441] In March 2014, the Minister for the Environment appointed an independent Wind Auction Advisory Panel to oversee the Wind Auction assessment process and make recommendations to the Minister for the awarding of a grant of feed-in tariff entitlement to successful proponents.

E. Assessment and Approval Procedures for Wind Farms.

1. The General Legal Procedures For Assessing And Approving Wind Farms

Wind turbines are large installations. Most turbines have 3 blades, which are generally around 30m in length. The towers of a turbine are typically between 3 and 5 meters in diameter and taper to about 2 meters at the top. While the height of the tower varies with the size of the generator and the length of the blades, a common size is around 70m. A 70m high tower with 30m blades gives a total height of 100m, which is roughly the equivalent of a 23-storey building. The number of turbines depends on the location and capacity of turbines, and can vary from a very few turbines to over 100 turbines.

The construction of a wind farm has the potential to cause significant environmental impacts, including social and cultural impacts. These impacts need to be identified, assessed and properly managed. The usual way for this to occur is through environmental impact assessment (EIA), which requires the prediction, avoidance or mitigation, and monitoring, of the environmental, social and cultural impacts of a proposed wind energy facility. In many countries EIA processes are legally mandated as part of planning or environment law. This means the developer of the wind farm must submit an Environmental Impact Statement (EIS) as part of the process of seeking development

441 For a discussion of the matters to be addressed under a competitive procedure and the advantages and disadvantages of competitive procedures, see IRENA & CEM, Renewable Energy Auctions: a Guide to Design 1 (2015), *http://www.cleanenergyministerial.org/Portals/2/pdfs/IRENA_RE_Auctions_Guide_2015_1_summary.pdf;* IRENA & CEM, Renewable Energy Auctions: a Guide to Design 2 (2015), *http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Auctions_Guide_2015_2_policies.pdf*.

approval for the project. The EIS will, at a minimum:

- describe the details of the proposed wind farm;
- describe the possible impacts on the environment;
- suggest measures to avoid, minimise or mitigate the impacts, including consideration of alternative sites; and
- contain measures about monitoring the impacts.

After considering the EIS, and any public comments on the EIS, the relevant government decision-maker will determine whether or not to grant development consent for the proposed wind farm. Where consent is granted, conditions will usually be attached to the planning approval to ensure the environmental impacts of the wind farm are properly managed.

Many jurisdictions have put in place different planning procedures for wind energy projects, depending on the size of the project. In the case of smaller scale development, the local council is usually the decision maker. For large-scale and/or politically sensitive wind developments, applications will be lodged with (and assessed by) the relevant state department and the relevant Minister is responsible for granting or refusing development consent. The relevant department and Minister may be the Department/Minister for Planning, for Environment, for Trade, or for Energy. A key reason for this is the complexity of issues raised by large-scale wind farms. Large wind farms require the consideration of a range of economic, environmental and social effects, and opportunity must be provided for a wide range of people and organizations to make submissions on the proposed facility. In some jurisdictions, there are also different EIA requirements for wind energy projects, depending on the size of the project. An EIA may be discretionary for small wind power projects but mandatory for large projects. The definition of 'small' and large' differs between countries. See for example:

England: Local planning authorities are the consent authorities for onshore wind farms with a capacity of less than 50MW. Under the *Town and Country Planning (Environmental Impact Assessment) Regulations 2011*, EIA should be considered where a development consists of two or more wind turbines, or where the hub height of any individual turbine exceeds 15m.[442] Small developments of single turbines, or pairs of machines, can be exempt from the need for EIA. Wind energy generating facilities with a capacity of greater than 50MW require a consent under s 36 of the *Electricity Act 1989* from the UK Secretary of State for Energy and Climate Change. Development consent is required from the Planning Inspectorate under the *Planning Act 2008* for the construction of onshore electricity generating stations of over 50 MW, including wind energy facilities.[443]

Denmark: For wind turbines over 150 metres high, the Environment Centres within the Danish Ministry of the Environment are the planning authority. Local municipalities are responsible for the assessment and approval of wind turbines with a total height of up to 150 metres. An EIA must be conducted for a wind turbine project involving turbines with a total height of more than 80m or

442 *Town and Country Planning (Environmental Impact Assessment) Regulations 2011*, reg 2(1) and Sched. 2, Table item 3(i), http://www.legislation.gov.uk/uksi/2011/1824/pdfs/uksi_20111824_en.pdf.

443 ***Electricity Act 1989*** (UK), *http://www.legislation.gov.uk/ukpga/1989/29*; ***Planning Act 2008*** (UK), *http://www.legislation.gov.uk/ukpga/2008/29*; ***Localism Act 2011*** (UK), *http://www.legislation.gov.uk/ukpga/2011/20*. See National Infrastructure Planning, Planning Inspectorate role, *http://infrastructure.planninginspectorate.gov.uk/application-process/planning-inspectorate-role/* (last visited 23 January 2016).

a group of more than three turbines. The local council screens other wind energy proposals and decides whether the consequences for the environment are such that an EIA must be conducted. Household and small turbines will not normally require an EIA. A household wind turbine is a smaller, stand-alone turbine with a total height of less than 25 metres that is erected and directly connected to existing housing in the open countryside, usually in a rural zone. Small wind turbines are stand-alone turbines with a rotor area of up to 1.5 m^2.[444]

US, Oregon: Developers of large energy facilities must obtain a site certificate from the Oregon Energy Facility Siting Council, which is staffed by members of the Oregon Department of Energy. For wind facilities, a large energy facility is defined as a facility with an average electrical generating capacity of 35MW or more. Applications to construct a wind energy facility with an average electrical generating capacity of less than 35MW will be dealt with by the local land use planning authority.[445]

US, Minnesota: The Public Utilities Commission is the body with the authority to issue site quality permits to construct a Large Wind Energy Conversion System (LWECS). A LWECS is any combination of wind turbines and associated facilities with the capacity to generate 5 MW or more of electricity. Applications to construct Small Wind Energy Conversion Systems are dealt with by local government bodies.[446]

In Sri Lanka, certain listed 'projects and undertakings' located wholly or partly outside the coastal zone as defined by *Coast Conservation Act No 57 of 1981*, including all Renewable Energy based electricity generating stations exceeding 50 MW, require approval under the *National Environmental Act of 1980 (SL).* Furthermore, all Renewable Energy based electricity generating stations, irrespective of their magnitudes, located wholly or partly within 100m from the boundaries of or within any area declared a National World Heritage Wilderness Act also require approval.[447]

India: All new infrastructure projects are required to obtain various levels of consent/clearances at the planning stage of the project. The regulatory authorities charged with environmental regulation are the federal Ministry of Environment and Forests (MEF) and the various state Pollution Control Boards. Wind energy projects do not require EIA or an environmental clearance for the diversion of forest land for non-forest purposes from the MEF, as that agency has determined the impact on the environment is negligible.[448] However, wind energy projects require 'No Objection Certificates' issued by State Electricity Bodies and State Nodal Agencies.[449] Consent must also be obtained from the relevant state Pollution Control Boards, unless exempted by the relevant state government.

444 Planning Act, Consolidated Act No. 813 of 21 June 2007 (Denmark) *http://naturstyrelsen.dk/media/nst/Attachments/planlovenpengelsk2007.pdf* Danish Energy Agency, Wind Turbines in Denmark, November 2009, pp 12-13 *http://www.ens.dk/sites/ens.dk/files/dokumenter/publikationer/downloads/wind_turbines_in_denmark.pdf*.

445 Oregon Revised Statutes 2013 ed, Chapter 469, 469.320 and 469.300 (11)(a)(J)), *https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2013ors469.html*.

446 Minnesota Statutes 2015, §§ 216F.01-216.081, *https://www.revisor.mn.gov/statutes/?id=216F*.

447 *Order Published under the Gazette Notification No 722/22 dated 24.06.1993 Re Procedure for approval of projects and prescribed projects*, *http://www.cea.lk/web/images/pdf/eiaregulations/reg772-22.pdf*.

448 Government of India, Ministry of Environment and Forests, Environmental Impact Assessment (EIA) Notification, September 2006, *http://envfor.nic.in/legis/eia/so1533.pdf*. The lack of mandatory EIA has been criticised: see Centre for Science and Environment New Delhi, Green Norms for Wind Power – Independent publication 2013 (2013), *http://re.indiaenvironmentportal.org.in/files/file/Green%20Norms%20for%20wind%20power%20full.pdf,*

449 Government of India, Ministry of Non-Conventional Energy Sources, Revised Guidelines for Wind Power Projects, No.66/241/95-WE/PG (13 June 1996), http://niwe.res.in/assets/Docu/Revised_WPP_13_06_1996.pdf.

Maharashtra (State), for example, has exempted certain wind power projects from obtaining consent from the Maharashtra Pollution Control Board, although 'No Objection Certificates' from local bodies are still mandatory.[450]

Most developing countries do not have specific, separate EIA requirements for wind farms. However, environment assessment and approval may be required as part of general EIA law and/or electricity law. For example, in **Namibia**, under the *Environmental Management Act* 2007, environmental assessment and an environmental clearance certificate is required for the construction of natural electricity generating operations.[451]

2. Guidance for Decision-Makers on Environmental Assessments

Because wind energy developments raise complex issues and involve the assessment of a number of impacts, governments may develop guidelines to assist local councils in assessing proposals for wind energy facilities. These guidelines may be introduced directly into legislation, or introduced through the amendment of local council development plans, or the legislation may refer to guidelines contained in a separate document. Some guidelines have no legal force and are prepared only to aid decision-makers. Usually the guidelines will contain a statement of the government's policy in relation to the promotion of renewable energy, and contain principles by which specific environmental impacts are to be assessed and weighed. The specific major environmental impacts are discussed in more detail at Heading F below. The guidelines issued to guide decision-makers also provide a useful source of information to proponents and the community. See, for example, **United Kingdom** National Policy Statement for Renewable Energy Infrastructure (EN3), July 2011.[452]

F. Assessing and Managing Specific Environmental Impacts

1. Visual impacts

Because of the nature of the wind resource, the turbines must be sited where the wind is of sufficient speed to make the farms efficient and economical. Wind farms are often sited in exposed, elevated positions likely to be visible from many locations. In particular, many of the best wind speeds may be along the coast. However, coastal areas are often areas of particularly scenic beauty, and the turbines are exposed and visually intrusive. The cumulative impact of a number of turbines/wind farms can exacerbate concerns regarding visual impact.

The perceived effect of wind turbines on the landscape is subjective and the perception that wind

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450 Government of Maharashtra State, Industries, Energy and Labour Department, Government Resolution Number NCE-2015/C.R.49/Energy-7 - Comprehensive Policy for Grid-connected Power Projects based on New and Renewable (non-conventional) Energy Sources 2015, Part 2 (in Marathi and English), http://www.mahaurja.com/PDF/MEDA_ConsolidatedPolicy2015.pdf. For more information, see Ministry of Non-Conventional Energy Sources, Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects (September 2013), http://mnre.gov.in/file-manager/UserFiles/report-on-developmental-impacts-of-RE.pdf.

451 Government Gazette of the Republic of Namibia Government, Notice No 29 of 2012 – List of Activities that may not be undertaken without environmental clearance certificate: Environmental Management Act 2007, Annexure, 'Energy Generation, Transmission & Storage Activities – 1(a)', p 3 *http://www.met.gov.na/Documents/EMA%20regulations.pdf*.

452 UK Department of Energy and Climate Change, National Policy Statement for Renewable Energy Infrastructure (EN3), July 2011, issued pursuant to s 5(9) of the Planning Act 2008, *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf*.

turbines detract from landscape values depends on a range of factors. The technical design of the turbines, their size, colour, shape and number of blades affect the visual quality. In developed countries, the effect on visual amenity has been of concern to local residents, not only for aesthetic reasons, with some viewing them as intrinsically ugly, but because of the perceived negative effect on property values and tourism. However, many people perceive that wind turbines enhance the landscape.

South Australia: Land Not Within a Council Area (Coastal Waters) Development Plan (Consolidated 4 July 2013).[1]

Wind Farms and Ancillary Development

54 The visual impacts of wind farms and ancillary development (such as substations, maintenance sheds, access roads and wind monitoring masts) should be managed through:

(a) wind turbine generators being:
- (i) setback at least 1000 metres from non-associated (non-stakeholder) dwellings and tourist accommodation;
- (ii) setback at least 2000 metres from defined and zoned township, settlement or urban areas (including deferred urban areas);
- (iii) regularly spaced;
- (iv) uniform in colour, size and shape and blade rotation direction;
- (v) mounted on tubular towers (as opposed to lattice towers);

(b) provision of vegetated buffers around substations, maintenance sheds and other ancillary structures.

1 Department of Transport and Urban Planning, Land Not Within a Council Area (Coastal Waters) Development Plan (Consolidated 4 July 2013), Coastal Waters Principles of Development Control 54,

Some visual impact is unavoidable and must be accepted or no wind farms will be allowed to proceed, thereby defeating government policy on the promotion of renewable energy. Increasing public education and awareness about the benefits of wind farms, and developing a clear policy and action plan for encouraging wind farms, with the informed participation and support of the community, are key means to increase community acceptance of wind turbines.

There is no consistent legislative approach to dealing with visual impact. Conducting prior SEA to identify priority areas for wind farms, and /or "no go" areas, can help to locate areas where objections on the grounds of visual impact are less likely to occur. In areas that are open to wind farms, the usual planning procedures will usually apply, where the effect on visual amenity is simply one of the factors to be taken into account by the decision-maker when deciding whether or not to grant development approval. In such cases, the law may provide guidelines to local decision-makers on how to assess the visual impact of the turbines. In some cases the decision-maker may refuse to approve the project; in others, visual impact can be mitigated by careful design and siting and the imposition of permit conditions regarding the colour, design and screening of turbines.

2. Noise

Noise from wind turbines arises from two sources. The first is aerodynamic noise, caused by the movement of blades relative to the air, described as a "swishing" noise. This is high frequency noise not audible over long distances and, with a suitable minimum (buffer) distance from the turbines to dwellings, is drowned by the noise of the wind itself, and should not be a major cause of complaint. The second type of noise is mechanical noise associated with the operation of the gearbox within the nacelle and the noise of the generator. Complaints about this type of noise regard to the "persistent tonal quality" of the noise. Careful design, siting and operation and the use of acoustic enclosures and gearless turbines can mitigate this noise. Noise from the machinery can consist of a high-pitched wailing (high frequency) or buzzing sounds (low frequency). Low frequency noise is technically defined as noise within the frequency range of 10 – 160 Hz (between 10 and 160 cycles per second). Wind turbines also emit infrasound, which is sound at very low frequencies. The technical definition of infrasound is sound that is lower in frequency than 20 Hz.

Recently, there has been controversy in Australia, America, Canada and some European countries such as Denmark, about the possible negative health impacts of noise and vibration from wind energy turbines, in particular from low frequency noise and infrasound. Many studies have been undertaken into the claimed negative health impacts of wind turbine noise.[453] The weight of findings suggest that there is no evidence that wind turbine noise directly causes any negative health impacts. This is particularly so for noise experienced from turbines placed with setback provisions (ranging from 1km to 2km from dwellings) and operating under noise limits set by the World Health Organisation.

Where infrasound is inaudible, it does not affect health. If sufficiently strong and audible to the human ear, infrasound can become annoying, which may then cause some adverse impacts such as lack of sleep. The Danish Environmental Protection Agency (EPA) has stated that modern wind turbines emit very weak infrasound, which is below hearing threshold, even when in close proximity.[454] However, because of community concerns, the Danish EPA has recently amended its noise guidelines to include limits for infrasound (see below).

While annoyance has been statistically associated with wind turbine noise, it has been found to be more strongly related to visual impact, attitude to wind turbines and individual sensitivity to noise. Thus, the level of annoyance with noise may be interrelated with other issues such as visual impact. Some complainants may suffer from the 'nocebo effect '– an adverse outcome,

453 Health Canada, Wind Turbine Noise and Health Study: Summary of Results (3 October 2014), *http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php*; Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health, Wind Turbine Health Impact Study: Report of Independent Expert Panel (2012), *http://www.mass.gov/eea/docs/dep/energy/wind/turbine-impact-study.pdf*; American Wind Energy Association and Canadian Wind Energy Association, Wind Turbine Sound and Health Effects An Expert Panel Review (2009), *http://awea.files.cms-plus.com/FileDownloads/pdfs/AWEA_and_CanWEA_Sound_White_Paper.pdf*; McMaster Institute of Environment & Health (MIEH), Wind Energy Power Plants (Wind Farms) Review and Analysis (2010), *http://www.mcmaster.ca/mihe/documents/publications/Wind_Farms_2010.pdf*; The University of Adelaide/ National Health and Medical Research Council, Systematic review of the human health effects of wind farms (2013), *https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh54_systematic_review_of_the_human_health_effects_of_wind_farms_december_2013.pdf*; but see Commonwealth of Australia, The Senate Select Committee on Wind Turbines, Final Report (August 2015), *www.aph.gov.au/Parliamentary_Business/Committees/Senate/Wind_Turbines/Wind_Turbines/~/media/Committees/wind_ctte/Final_Report/report.pdf*.

454 Danish EPA website, *http://eng.mst.dk/topics/noise/wind-turbines/low-frequency-noise-from-wind-turbines/qa--low-frequency-noise-from-wind-turbines/*(last visited Jan.12, 2015). See also South Australian Environmental Protection Agency and Resonate Acoustics, Infrasound levels near windfarms and in other environments (2013), *http://www.epa.sa.gov.au/files/477912_infrasound.pdf*.

or worsening of mental or physical health, based on fear or belief in adverse effects.[455] There is also some evidence of an association between levels of annoyance and whether or not objectors are able to directly participate in, or receive benefits from, wind energy developments, and their understanding of the environmental benefits of wind energy. Thus, early consultation and community engagement,[456] measures to encourage community participation in the benefits of wind farms, and general education about the benefits of wind energy, can help to avoid community objections. Examples of measures available to address the issue of audible noise, and to help to reduce the level of annoyance in general, are set out below.

a. Noise limits and setback requirements

Planning approvals for wind farms are generally subject to permit conditions about noise limits. There are different standards and guidelines for assessment and measurement of noise, and the maximum permissible level of noise. In most jurisdictions with a significant wind energy industry, the relevant Environment Agency has prepared noise guidelines that relate specifically to wind energy. Environment and planning law and wind energy guidelines will direct local councils or other decision-makers to the relevant legal noise standards. Also, once granted, planning permits will refer to the maximum noise limits established by law/guidelines and any conditions to be observed, such as minimum distances ('setbacks') between the turbines and dwellings.

While setbacks help to avoid the impact of noise (as well as visual impact), they reduce the area of land available for wind energy development. The industry in Australia has argued a legislated minimum setback of over 1.5 km proposed by Queensland state government is arbitrary and unduly onerous, and that the current requirement of 1km in the states of South Australia (see above, under 'visual impact') and Victoria is sufficient.[457]

455 S. Chapman et al., Spatio-temporal differences in the history of health and noise complaints about Australian wind farms: evidence for the psychogenic "communicated disease" hypothesis, (University of Sydney Research Paper 2013) *http://ses.library.usyd.edu.au/handle/2123/8977*.

456 See Clean Energy Council, *Community Engagement Guidelines for the Australian Wind Industry* (2013), *https://www.cleanenergycouncil.org.au/technologies/wind-energy/community-engagement-guidelines.html*. [if text omitted, footnotes must follow]

457 See, for example, Clean Energy Council, *Submission to Queensland's draft wind farm state code and planning guideline* (11 December 2015), *https://www.cleanenergycouncil.org.au/policy-advocacy/submissions/submissions-archive.html*, (last visited Jan.12, 2015).

Denmark Ministry of the Environment, *Statutory Order on Noise from Wind Turbines* (no. 1284 of 15 December 2011). Note: the new low frequency limits apply only to turbines registered with the municipalities before January 1st, 2012.[1]

SECTION 4. The total noise impact from wind turbines may not exceed the following limit values:
1) At the most noise-exposed point in outdoor living area no more than 15 metres from dwellings in open countryside:
(a) 44 dB(A) at a wind speed of 8 m/s.
(b) 42 dB(A) at a wind speed of 6 m/s.
2) At the most noise-exposed point in areas with noise-sensitive land use:
(a) 39 dB(A) at a wind speed of 8 m/s.
(b) 37 dB(A) at a wind speed of 6 m/s.
Subsection 2. The total low-frequency noise from wind turbines must not exceed 20 dB at a wind speed of 8 m/s and 6 m/s indoors in dwellings in open countryside or indoors in areas with noise sensitive land use respectively.
Subsection 3. The limit values laid down in subsections 1 and 2 do not apply to the wind turbine owner's dwelling.

1 Denmark, Ministry of the Environment, Statutory Order on Noise from Wind Turbines (no. 1284 of 15 December 2011) (replacing Order no. 1518 of 14 December 2006), issued under the Danish Environmental Protection Act and the Danish Act on the Protection of Marine Environment, http://eng.mst.dk/media/mst/66206/engelsk_vind-moellebekendtgoerelse.pdf.

b. Noise Measurement And Monitoring

As part of ensuring companies adhere to standards of performance in relation to issues such as noise control and impacts on wildlife, planning approvals may require the ongoing monitoring of facilities by the proponent as a licence/permit condition, and reporting to the relevant approvals body or environmental protection authority. In order to ensure the monitoring is conducted to certain standards, countries may adopt international/national standards. The International Electrotechnical Commission (IEC) has produced standards for monitoring and control of wind power plants.[458] Also, the International Measuring Network of Wind Energy Institutes (MEASNET) has produced standardised procedures for taking high quality wind measurements.[459]

C. Community participation in the benefits of wind developments

Denmark: Promotion of Renewable Energy Act.[1]
Measures to promote the expansion of wind energy
Local citizens' option to purchase wind turbine shares
13.(1) Any person who erects one or more wind turbines of at least 25m in height onshore, or offshore wind turbines established without a tendering procedure, cf. section 23(4), shall, prior to commencement of erection, offer for sale at least 20 per cent of the ownership shares to the persons entitled to make an offer pursuant to section 15.
…

15.(1) Any person over 18 years who, at the time of the offer for sale, according to the National Register of Persons, has his or her permanent residence at a distance of no more than 4.5 km from the site of installation, shall be entitled to make a purchase offer. If several turbines are erected in a group, the distance shall be calculated from the nearest turbine.
(2) Furthermore, any person over 18 years, who at the time of the offer for sale, according to the National Register of Persons, has his or her permanent residence in the municipality in which the wind turbine is to be installed shall be entitled to make a purchase offer. Where offshore wind turbines are installed without a tendering procedure, the municipality mentioned in the 1st clause shall be the municipality with a coastline closest to the turbine.
…

1 Promotion of Renewable Energy Act, Act no. 1392 of 27 December 2008 (Denmark) http://www.ens.dk/sites/ens.dk/files/supply/renewable-energy/wind-power/onshore-wind-power/Promotion%20of%20Renewable%20Energy%20Act%20-%20extract.pdf.

Scotland: The government has established and maintains the Scottish Government Register of Community Benefits from Renewables, which shows details of renewable energy projects in Scotland and allows developers and communities to record the details of community benefits resulting from renewable energy projects. The register can be accessed through the Local Energy Scotland website, along with other initiatives to help communities benefit from wind farms and other renewable projects. [460] These include funding and information on establishing community-owned wind farms, and good practice guides on community benefits prepared by the Scottish government.[461]

India, *Guidelines for diversion of forest land for non-forest purposes under the Forest Conservation Act, 1980 – For projects utilizing wind energy thereof.*[1]

6 (i) Utilisation of Medicinal Plant Gardens – 65-70% of lease out areas for wind farms shall be utilised for developing medicinal plant gardens, wherever feasible, by Forest Department at the cost of the user agency…the intervening areas between two wind mills footprints should also be planted up by dwarf species of trees at the project cost.
…

1 Ministry of Environment and Forests, F. No. 8-84/2002-FC - Guidelines for diversion of forest land for non-forest purposes under the Forest Conservation Act, 1980 – For projects utilizing wind energy thereof, s 6(i), *http://forests-clearance.nic.in/writereaddata/public_display/schemes/2146926545$guildeline%202.pdf*.

460 See http://www.localenergyscotland.org/ and http://www.localenergyscotland.org/view-the-register.
461 See Local Energy Scotland, *Scottish Government Good Practice Principles for Community Benefits from Onshore Renewable Energy Developments* (2014); *Scottish Government Good Practice Principles for Shared Ownership of Onshore Renewable Energy Developments* (2015); and *Scottish Government Good Practice Principles for Community Benefits from Offshore Renewable Energy Developments* (2015) *http://www.localenergyscotland.org/good-practice/*.

d. Compensation to Those Experiencing Documented Loss of Property Values

Denmark: Promotion of Renewable Energy Act.[1]

Measures to promote the expansion of wind energy
Loss of value to real property due to the erection of wind turbines

6.(1) Any person who, upon erecting one or more wind turbines, causes the loss of value to real property, shall bear the costs of this, cf. however subsections (2) and (3). If the owner of the real property has contributed to the loss, the amount to be paid may be reduced or not be payable at all.
(2) Subsection (1) shall not include wind turbines of less than 25m in height or offshore wind turbines established following a tendering procedure, cf. section 23.
(3) Claims for payment pursuant to subsection (1) shall lapse if the loss of value constitutes one per cent or less of the total value of the property. …

1 Promotion of Renewable Energy Act, Act no. 1392 of 27 December 2008 (Denmark) http://www.ens.dk/sites/ens.dk/files/supply/renewable-energy/wind-power/onshore-wind-power/Promotion%20of%20Renewable%20Energy%20Act%20-%20extract.pdf.

3. Birds and Bats

Wind farms may impact on birds and bats, especially migratory bird species and birds of prey, through collisions with turbines. The majority of collisions occurred in the U.S. in the 1980s, where turbines were constructed using lattice towers, which provide an area for birds to roost, and/or where turbines were built densely together in the path of migratory birds. The modern design of solid towers eliminates the ability for birds to roost in towers and, as regards migratory birds, the height of the towers and their spacing can be designed so as to minimise the chance of structures being built across migration paths. In countries with little or no experience of wind power, little will be known about the impact of wind turbines on birds, and owners/operators of wind farms should be placed under permit conditions to observe and monitor the impact on birds.

See also: US National Wind Coordinating Committee, *Studying Wind Energy/Bird Interactions: A*

India, Guidelines for diversion of forest land for non-forest purposes under the Forest Conservation Act, 1980 – For projects utilizing wind energy thereof.[1]

s 2(iii) 'Bird Hits' – 'The vane tips of the wind turbine shall be painted with orange colour to avoid bird hits. The state government should take sufficient precaution in considering the location of wind mills so that it should not stand in the migratory path of the birds and should not be near breeding sites of the migratory birds as the turbine of the wind mill produces a humming sound, which may cause disturbance for the avian habitat.'

1 Ministry of Environment and Forests, F. No. 8-84/2002-FC - *Guidelines for diversion of forest land for non-forest* purposes under the Forest Conservation Act, 1980 – For projects utilizing wind energy thereof, s2(iii) *http://forests-clearance.nic.in/writereaddata/public_display/schemes/2146926545$guildeline%202.pdf.*

Guidance Document, Metrics or Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites, December 1999.[462]

Environment **Canada** and Canadian Wildlife Service, *Wind Turbines and Birds: A Guidance Document for Environmental Assessment,* v6, March 2006, and *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds,* April 2007.[463]

4. Electromagnetic Interference

Wind turbines may cause electromagnetic interference with microwave, television and radio signals. If a wind turbine is sited between a transmitter and receiver it can interfere with the signal as it arrives at the receiver. Usually means of mitigation, avoidance and remedy can be found, including changing the location of particular turbines, the choice of generator, tower design or blade material. The best way to identify and address potential adverse effects is to consult with communications operators at an early stage.

Victoria, Australia, *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria:* 'The siting of wind turbines in the 'line of sight' between transmitters and receivers should be avoided.'[464]

5. Aviation

Because of the height of turbines, if there is an airport in the vicinity of a wind farm, flight path envelopes must be avoided. Usually the relevant government authority, such as a Civil Aviation Authority should be consulted about a proposed development.

Kenya: "Potential generators of energy from wind resources must obtain a permit for each mast/turbine to be erected from the Kenya Civil Aviation Authority. The Authority is located at the Kenyatta International Airport of Nairobi. The duration of the procedure depends very much on the location of the windmills due to the obligatory onsite inspection."[465]

In the **UK,** the wind energy industry, aviation industry and UK government signed a Memorandum of Understanding in 2008, updated in 2011. This led to the establishment of an Aviation Fund, which promotes research into methods of reducing the effects of wind farms on radars, and the establishment of an Aviation Management Board, chaired by the Department for Energy and Climate Change (DECC), which also includes representatives from RenewableUK.[466]

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462 Available at https://www.nationalwind.org/wp-content/uploads/assets/archive/Studying_Wind_Energy-Bird_Interactions_-_A_Guidance_Document__1999_.pdf.

463 Available at *http://www.bape.gouv.qc.ca/sections/mandats/eole_matane/documents/DB15.pdf* *http://www.anev.org/wp-content/uploads/2012/06/CANADA4.pdf*.

464 *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria*, July 2012, p. 31 *http://www.dtpli.vic.gov.au/__data/assets/pdf_file/0009/231768/Policy-and-planning-guidelines-for-development-of-wind-energy-facilities-in-Victoria-July-2012.pdf*.

465 Kenya, Energy Regulatory Commission, Civil Aviation Clearance – Wind Power Projects Only, Renewable Energy Portal *http://www.renewableenergy.go.ke/index.php/license/id/763*.

466 Available at *https://www.gov.uk/government/publications/wind-turbines-and-aviation-radar-mitigation-issues-memorandum-of-understanding-2011-update*.

India, *Ministry of Civil Aviation (Height Restrictions for Safeguarding of Aircraft Operations)* Rules 2015, s [1]

'Restrictions on constructions, erections, trees, etc.— (1) No structure shall be constructed or erected, or any tree planted or grown on any land within a radius not exceeding twenty kilometers from the Aerodrome Reference Point of the civil and defence aerodromes, as specified in Schedule III to Schedule VII, without obtaining a No Objection Certificate for the height clearance, except in cases specified in subrule (2) of rule 7.'
'Structures' are defined in s3(ix) to include wind farms.

1 Available at http://civilaviation.gov.in/sites/default/files/gsr%20751%20dated%2030.9.2015%20English.compressed.pdf.

Also, a variety of guidelines have been developed to guide the assessment and mitigation of the impacts of wind turbines on aviation. The Civil Aviation Authority (CAA), through the Airspace and Safety Initiative Windfarm Working Group, has published the following guidance for Planning Authorities: ***Managing the Impact of Wind Turbines on Aviation*** (1 July 2013).[467] The CAA has also produced a number of policy statements addressing aviation and onshore and offshore wind energy, including: CAP 764: *Policy and Guidelines on Wind Turbines* (updated as of June 2013); *Failure of Aviation Warning Lights on Offshore Wind Turbines* (27 April 2012); *Lighting of Wind Turbine Generators in United Kingdom Territorial Waters* (22 November 2012).[468]

G. Product/Quality Standards and Installation

As with solar energy, poor quality wind turbines and/or their component parts can undermine confidence in both onshore and offshore wind, and can lead to increased costs for operators. For example, it has been reported that in Mongolia, screw connections on large wind turbines have failed, causing them to blow over, and poor quality wind turbines have led to delays in energy production.[469] The rapid expansion of China's onshore wind energy industry also led to concerns about quality control, while in relation to offshore wind energy, there is a general concern amongst turbine manufacturers that components for offshore wind facilities are of inadequate quality.[470]

467 DECC, Memorandum of Understanding 2011 Update: wind turbines and aviation radar (mitigation issues) (2 August 2011) *http://airspacesafety.com/wp-content/uploads/2013/09/20130701ManagingTheImpactOfWindTurbinesOnAviation_Script_FINAL_V1.pdf*.

468 Available at *http://www.caa.co.uk/Safety-Initiatives-and-Resources/Safety-projects/Windfarms/Windfarms/*.

469 DLA Piper, Renewable Energy in the Asia Pacific: A Legal Overview (2013), *https://www.dlapiper.com/~/media/Files/Insights/Publications/2013/08/Renewable%20Energy%20in%20the%20Asia%20Pacific%20A%20Legal%20Ove__/Files/Renewable_Energy_in_Asia_Pacific_3rd_Edition/FileAttachment/Renewable_Energy_in_Asia_Pacific_3rd_Edition.PDF* (last visited 23 Jan., 2016).

470 Centre for Sustainable Energy Studies, China's Offshore Wind Industry 2014: An overview of current status and development (2014) pp 15 and 22, *https://www.ntnu.no/documents/7414984/202064323/Offshore+Wind+in+China+2014.pdf/b0167dd4-6d47-40cc-9096-b3139c1459ef*

The IEC has published a series of international standards for onshore and offshore wind turbines, which have the reference number 61400 and are entitled *Wind Turbine Generator Systems*.[471] The IEC standards address matters such as turbine design requirements and engineering integrity, conformity procedures for testing and certification, measurement techniques (for example, of noise), and communication systems for monitoring and control. These have already been adopted by several countries around the world or used as the foundation for the development of national standards to ensure standards are appropriate for countries' individual geographic and climactic conditions. Conformity with the standards may be required under general law, laws regarding product standards, electricity law, or as a requirement to obtain incentives such as feed-in tariffs or tradeable certificates under renewable energy laws.

The experience of China and India demonstrate that even where adequate laws are in place to enable country's to adopt product standards, it is of crucial importance that the standards themselves are appropriate. China has recently approved a series of technical standards designed to improve standards in the country's onshore wind industry, largely based on the IEC standards. The rapid expansion of the industry made it clear that by 2010, existing standards were not sufficient to ensure installations were of sufficiently high quality. In 2010, the National Energy Bureau established the Energy Industry Wind Power Standardization Technical Committee (SAC/TC50) to develop and revise industry (NB/T) standards for wind energy, to operate in addition to national Standards for wind energy that are GB/T standards. As of 2015 there were some 70 wind power standards in the 31,000 series, being NB/T 31003-2011 to NB/T 31074-2015. Also, from 2011, all turbines manufactured overseas must be tested and certified according to Chinese Standard GB/Z 25458-2010.

Before its current regime was put in place, India adopted Denmark's technical standards for wind energy installation, as in the establishment of India's wind energy industry, many turbines were initially imported from Denmark. However, the Danish standards were not suitable for Indian conditions, and a number of problems were experienced with the installations. India thus developed testing and certification facilities to ensure turbines meet product standards suitable to the country's geographical conditions. The National Institute of Wind Energy (NIWE), an autonomous institution under the Ministry of New and Renewable Energy (MNRE) undertakes the development of standards, certification and testing. Its functions include: developing and implementing wind turbine certification systems; according type approval/type certification to wind turbines in accordance with the *TAPS 2000, Provisional Type Certification Scheme for Wind Turbine Generator Systems in India*; preparing Indian standards on Wind Turbines; and periodically preparing and issuing a Revised List of Models and Manufacturers (RLMM) of wind turbines. The testing services of NIWE have been certified as conforming to the Quality Management System ISO 9001:2008 since 12 August 2010, and assessed and accredited in accordance to the requirements of the ISO/IEC 17025:2005 since 23 June 2006.[472]

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471 IEC 61400 – ONLINE COLLECTION – Wind turbines, *https://webstore.iec.ch/publication/22259 (last visited 23 Jan., 2016)*.The 22 existing published standards (as of 15 December 2015) can be previewed, and a list of standards under development and/or review under the IEC work programme, can be viewed, (follow links at "IEC TC 88 Wind energy generation systems:") *http://www.iec.ch/dyn/www/f?p=103:22:0::::FSP_ORG_ID,FSP_LANG_ID:1282,25* (last visited 23 Jan, 2016).

472 See: NIWE website *http://niwe.res.in/aboutus_charter.php*; Certification Scheme, *http://niwe.res.in/department_sc.php*; and MNRE, TAPS 2000, Provisional Type Certification Scheme for Wind Turbine Generator Systems in India, Amended April 2003 *http://niwe.res.in/assets/Docu/TAPS_2000amended.pdf*.

For other examples of laws regarding wind energy quality standards, the comprehensive renewable energy laws and regulations of Kenya, the Philippines and Korea, discussed above in relation to product standards and safety of installation for solar energy, also apply in relation to wind energy as a renewable energy technology.

H. Issues Relating To Offshore Wind Farms

1. Introduction

Offshore wind resources provide a valuable potential source of energy. Constructing wind farms offshore may avoid the controversies over siting that have occurred in developed countries, particularly in relation to visual impact, noise impacts, and construction in or near sensitive areas such as national parks. To date, the relatively higher costs associated with constructing wind farms offshore compared to onshore have meant that only a small number of countries, mainly in Europe, have existing offshore wind installations. However, as technology improves, the costs of offshore wind farms should fall.

Strategic environment assessment/marine spatial planning is of particular importance in the context of offshore wind energy, where it is increasingly being used to identify and assess impacts on the environment and other users of the sea, and assist governments to select appropriate offshore sites to release for wind energy development. Although individual wind companies may identify potential sites and apply for planning approval on an ad-hoc basis, most nations with offshore wind energy industries use a competitive process such as auctions to award rights in large-scale offshore wind farms.

The management of impacts on the environment and other users of the sea are key issues here. Some of the environmental impacts of offshore windfarms are of a similar type to those of onshore wind energy installations and need to be identified through EIA procedures, and the impacts avoided or mitigated, and monitored. These include, for example, the impact on birds, sea mammals, and fish, on fauna and the seabed. There are other issues specific to offshore development that also need to be considered, including conflicts with navigation and fisheries, the safety of installations at sea, and the decommissioning of offshore wind turbines. These are discussed in more depth below.

The rights and obligations of countries wishing to develop offshore wind energy resources, and the rights of other users of the sea, such as rights of navigation, will depend upon international law. Each nation should be aware of its rights and obligations according to which Conventions concerning the sea it has ratified, in particular the 1958 Geneva Convention on the Continental Shelf, and the 1982 United Nations Convention on the Law of the Sea, as well as rules of customary international law. The rights and obligations of states and users of the sea will depend upon the maritime zone in which the offshore windfarm is to be installed, as international law differentiates between rights and obligations in the internal waters of a state (harbours and ports), the territorial sea, the high seas, the Exclusive Economic Zone (if claimed) and the continental shelf.

Few countries outside Europe have an offshore wind energy industry. Moreover, there is little in the way of legislation and regulations that have been translated into English. Because the UK has

significant installed capacity,[473] and its laws are readily available in English, the next section will focus on the legislative regime of the United Kingdom to provide an example of the types of laws that could be considered.

2. Legislative Example: the Offshore Regime of England and Wales

a. General Framework

The UK government has undertaken a strategic approach to offshore energy developments, including offshore wind energy. SEAs have been conducted to determine the impact of offshore wind development on the marine environment and other users of the sea. An initial wind-specific SEA round was first conducted in 2002-03. To 2008, separate SEAs were conducted for offshore oil and gas. Most recently, two Offshore Energy SEAs, OESEA (conducted in 2007-2009) and OESEA2, incorporated the entire United Kingdom Continental Shelf (with the exception of Northern Ireland and Scottish territorial waters for renewable energy), for all offshore energy technologies, including wind power. The Environmental Report for OESEA2 was published in February 2011 with a period of currency of 5 years. The Department of Energy and Climate Change (DECC) is currently undertaking OESEA3, with a view to publishing the Environmental Report in 2016.[474]

The UK has established a Renewable Energy Zone where offshore renewable energy facilities may be installed in areas beyond the UK's territorial sea.[475]

Tenure: The Crown Estate owns virtually the entire seabed out to the UK 12nm territorial limit, and has rights under the *Energy Act 2004* to issue licences for offshore wind development beyond the territorial waters but within the UK Renewable Energy Zone (REZ). A lease from The Crown Estate is required in order to construct an offshore wind farm in UK territorial waters or the REZ.[476]

For offshore wind energy projects of 100MW capacity or less, two principal consents are required: a consent under s 36 of the *Electricity Act 1989* (UK) and a marine licence under s 71 of the *Marine and Coastal Access Act 2009* (UK). The Marine Management Organisation (MMO) is the responsible authority for issuing both these consents.[477] For 'nationally significant infrastructure projects', including offshore wind farms with a capacity of more than 100MW, a Development Consent Order under the *Planning Act 2008* (UK) is required. The Planning Inspectorate will assess the project and make a recommendation to the Secretary of State for Energy and Climate Change

473 With 13,602MW installed capacity, the UK is third in Europe behind market leader Germany (44,946MW) and Spain (22,035MW): European Wind Energy Association, Wind in power 2015: European statistics (February 2016), 4 *http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA-Annual-Statistics-2015.pdf* (last visited 19 Feb., 2016). The UK had the highest level of investments in 2015, attracting -12.6 bn for the construction of new onshore and offshore wind farms. This accounts for 48% of the total investments made in 2015: ibid, 13.

474 Department of Energy and Climate Change, Offshore Energy Strategic Environmental Assessment (SEA): An overview of the SEA process, *https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process*.

475 *Energy Act 2004* (UK) ss 84-88 *http://www.legislation.gov.uk/ukpga/2004/20/part/2/chapter/2/crossheading/renewable-energy-zones*.

476 Crown estate website, *http://www.thecrownestate.co.uk/energy-and-infrastructure/offshore-wind-energy/working-with-us/statutory-consents/*.

477 Note: The Electricity Act 1989 s 36, consenting power was transferred from the Secretary of State to the MMO under the Marine and Coastal Access Act 2009 (UK) s 12.

as to whether to grant or to refuse consent.478 A marine licence under s 71 of the Marine and Coastal Access Act 2009 (UK) is required but may be deemed as part of the planning process under the Planning Act.479

b. Particular Issues in Relation to Offshore Wind Energy

The *Energy Act 2004* **(UK)** provides for the regulation of key issues associated with offshore wind farms, including the safety of installations, sea and air navigation, and the decommissioning of installations. Regulations may be passed to deal with these matters in more detail.

i Navigation and Civil Aviation

The construction of offshore wind energy installations may pose a risk to ship and air traffic. To eliminate or minimise the risk of collisions with ships, wind turbines may need to be prohibited from offshore areas where shipping lanes exist and areas where ships lay anchor to enter harbours. Alternatively, navigation routes may be altered, if possible, to minimise collision risks, in accordance with the rules of the International Maritime Organization. The marking of turbines in accordance with national or international guidelines will reduce the risk of collisions. Usually collision risk analyses will be required as part of the EIA process.

Countries may wish to regulate the rights of navigation through legislation in order to ensure wind turbines have priority over navigation, although such restrictions should be in accordance with the rights of navigation existing in international law.

The *Energy Act 2004* (UK) amends the *Civil Aviation Act 1982* (UK) so that regulations can be made concerning aircraft flying in the vicinity of offshore renewable energy installations. Furthermore, Air Navigation Orders may be made regarding renewable energy installations located within a Renewable Energy Zone as if those installations were located in a part of the United Kingdom.[480]

Regarding military navigation, the Ministry of Defence ensures that any planned developments do not adversely impact its operational capability through its "safeguarding" process.[481]

478 From 1 March 2010, projects defined as "nationally significant infrastructure projects", were licensed by the Infrastructure Planning Commission (IPC) under the Planning Act 2008 (UK), ss 1, 14, 15 & 31. However, the IPC was abolished by the Localism Act 2011 (UK), and its decision-making powers transferred to the UK Secretary of State for Energy and Climate Change.

479 Electricity Act 1989, *http://www.legislation.gov.uk/ukpga/1989/29*; Marine and Coastal Access Act 2009, *http://www.legislation.gov.uk/ukpga/2009/23*; Planning Act 2008, *http://www.legislation.gov.uk/ukpga/2008/29*; Localism Act 2011: *http://www.legislation.gov.uk/ukpga/2011/20*. See also the Planning Inspectorate website: *http://infrastructure.planninginspectorate.gov.uk/application-process/the-process/*.

480 *Energy Act 2004* (UK) s101. *http://www.legislation.gov.uk/ukpga/2004/20/section/101*.

481 Ministry of Defence Guidance, *Wind farms: MOD safeguarding*, 18 November 2014, *https://www.gov.uk/government/publications/wind-farms-ministry-of-defence-safeguarding*.

Energy Act 2004 (UK), ss 99-101, Navigation and Civil Aviation, inserting the following sections 36A and 36B into the Electricity Act 1989 (UK):[1]

Note: *The powers of the Secretary of State under ss 36A and 36B have been transferred to the Marine Management Organization under s 12 of the Marine and Coastal Access Act 2009 for offshore wind developments that are not 'nationally significant infrastructure projects" i.e. that are less than 100MW capacity.*

36A Declarations extinguishing etc. public rights of navigation

(1) Where consent is granted by the Secretary of State or the Scottish Ministers in relation to-

(a) the construction or operation of a generating station that comprises or is to comprise (in whole or in part) renewable energy installations situated at places in relevant waters, or

(b) an extension of a generating station that is to comprise (in whole or in part) renewable energy installations situated at places in relevant waters or an extension of such an installation,

he or (as the case may be) they may, at the same time, make a declaration under this section as respects rights of navigation so far as they pass through some or all of those places.

(2) The Secretary of State or the Scottish Ministers may make such a declaration only if the applicant for the consent made an application for such a declaration when making his application for the consent.

(3) A declaration under this section is one declaring that the rights of navigation specified or described in it-

(a) are extinguished;

(b) are suspended for the period that is specified in the declaration;

(c) are suspended until such time as may be determined in accordance with provision contained in the declaration; or

(d) are to be exercisable subject to such restrictions or conditions, or both, as are set out in the declaration.

…

36B Duties in relation to navigation

(1) Neither the Secretary of State nor the Scottish Ministers may grant a consent in relation to any particular offshore generating activities if he considers, or (as the case may be) they consider, that interference with the use of recognised sea lanes essential to international navigation-

(a) is likely to be caused by the carrying on of those activities; or

(b) is likely to result from their having been carried on.

…

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1 *Energy Act 2004* (UK) s 99, http://www.legislation.gov.uk/ukpga/2004/20/section/99.

ii Safety Zones for Installations

Countries may consider passing legislation to establish safety zones around offshore wind turbines to ensure the reasonable safety of navigation and the structures themselves. Legislation may make it an offence to enter a safety zone. Legislation should have due regard to the rights of navigation in international law.

Energy Act 2004 (UK), §§ 95-98, Safety Zones for Installations.[1]

Note: The powers of the Secretary of State under s 95 have been transferred to the Marine Management Organization under s 13 of the Marine and Coastal Access Act 2009 (UK) for offshore wind developments that are not 'nationally significant infrastructure projects.

95(2) If the Secretary of State considers it appropriate to do so for the purpose of securing the safety of-

(a) the renewable energy installation or its construction, extension or decommissioning,

(b) other installations in the vicinity of the installation or the place where it is to be constructed or extended,

(c) individuals in or on the installation or other installations in that vicinity, or

(d) vessels in that vicinity or individuals on such vessels,

he may issue a notice declaring that such areas as are specified or described in the notice are to be safety zones for the purposes of this Chapter.

…

96 Prohibited activities in safety zones

(1) A vessel is not to enter or remain in a safety zone except where permission for it to do so is granted-

(a) by or in accordance with provision contained in a notice under section 95; or

(b) by or in accordance with provision contained in regulations made by the Secretary of State.

(2) A person must not carry on an activity wholly or partly in a safety zone if his doing so is prohibited by or in accordance with provision contained in a notice under section 95.

…

97 Offences relating to safety zones

(1) Where a vessel enters or remains in a safety zone in contravention of section 96(1), the vessel's owner and her master are each guilty of an offence.

(2) Where-

(a) a vessel enters or remains in a safety zone with a permission granted for the purposes of section 96, and

(b) there is a contravention of a condition of that permission in relation to the vessel or individuals on the vessel, the vessel's owner and her master are each guilty of an offence.

(3) A person who carries on an activity wholly or partly in a safety zone in contravention of section 96(2) is guilty of an offence

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1 Energy Act 2004 (UK) ss 95-97, http://www.legislation.gov.uk/ukpga/2004/20/section/95, as amended by *http://www.legislation.gov.uk/ukpga/2009/23/section/13#section-13-2*; *http://www.legislation.gov.uk/ukpga/2004/20/section/96*; and http://www.legislation.gov.uk/ukpga/2004/20/section/97.

iii Fisheries

The construction of wind farms offshore may cause a conflict of interest with fishing interests. Early consultation with fishing interests is recommended. In order to reduce the potential for conflict with fishing interests and to protect fish stocks, authorities should consider avoiding the construction of turbines in sensitive spawning areas or areas of high commercial or conservation value; and/or avoiding construction during important breeding, nursery or feeding periods. Even where no property right exists requiring the payment of compensation, governments may consider requiring financial compensation to be paid to fishing interests if fishing is actually reduced.

Various groups have commissioned or prepared best practice guidance to help avoid and mitigate the impacts of offshore wind energy facilities on fishing interests, including the Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW). Comprised of fishing industry bodies and representatives from developers, government and The Crown Estate, with the latter providing secretariat services, the group was set up in 2002 to foster good relations between the fishing and offshore renewable energy sectors and encourage co-existence of the industries.[482] Examples of guidance documents include the *FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison, January 2014, and the FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds,* August 2015.[483]

See also:_UK Centre for Environment, Fisheries and Aquaculture Science, *Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements, June 2004.*[484] *Note: FEPA is the Food and Environment Protection Act* (UK) 1985 and CPA is the *Coast Protection Act* (UK) 1949.

v. Post-Consent Monitoring

As with any planning and licensing scheme, monitoring the compliance with approval conditions is essential. The Marine Management Organization (MMO) is responsible for post-consent monitoring of offshore windfarms. The MMO recently published a comprehensive review of data collected by post-consent monitoring, and after analysing the data, made recommendations for requirements for future monitoring.[485]

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482 See http://www.thecrownestate.co.uk/energy-and-infrastructure/offshore-wind-energy/working-with-us/floww/.

483 Available at *http://www.thecrownestate.co.uk/media/5693/ei-km-in-pc-fishing-012014-floww-best-practice-guidance-for-offshore-renewables-developments-recommendations-for-fisheries-liaison.pdf* and *http://www.thecrownestate.co.uk/media/501902/floww-best-practice-guidance-disruption-settlements-and-community-funds.pdf*.

484 Available at *http://www.cefas.co.uk/publications/files/windfarm-guidance.pdf*.

485 MMO (2014). ***Review of post-consent offshore wind farm monitoring data associated with license conditions***. A report produced for the Marine Management Organization, pp 194. MMO Project No: 1031. ISBN: 978-1-909452-24-4. *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf* (last visited Jan. 12, 2015).
See also Cefas, (2012) ***Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects*** (Cefas contract report: ME5403 – Module 15. Version 11 2012) p 99. *https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_AssessmentGuidance.pdf* (last visited Jan. 12, 2015).

Energy Act 2004 (UK), Chapter 3, Decommissioning of Installations (as amended by *Energy Act 2008* (UK).[1]

105 Requirement to prepare decommissioning programmes

(1) This section applies where-

(a) there is a proposal by a person to construct a relevant object in waters regulated under this Chapter, or to extend a relevant object in such waters;

(b) there is a proposal by a person to operate or to use a relevant object in such waters on the completion of its construction, or of any extension of it in such waters; or

(c) a person is constructing, extending, operating or using a relevant object in such waters or has begun in such waters to decommission such an object.

(2) The Secretary of State may by notice require

(a) a person falling within subsection (1)(a), (b) or (c), or

(b) if a person to whom paragraph (a) applies is a body corporate, a body corporate associated with that person (subject to section 105A)

to submit to him a programme for decommissioning the relevant object (a "decommissioning programme").

…

(8) A decommissioning programme-

(a) must set out measures to be taken for decommissioning the relevant object;

(b) must contain an estimate of the expenditure likely to be incurred in carrying out those measures;

(c) must make provision for the determination of the times at which, or the periods within which, those measures will have to be taken;

(d) if it proposes that the relevant object will be wholly or partly removed from a place in waters regulated under this Chapter, must include provision about restoring that place to the condition that it was in prior to the construction of the object; and

(e) if it proposes that the relevant object will be left in position at a place in waters regulated under this Chapter or will not be wholly removed from a place in such waters, must include provision about whatever continuing monitoring and maintenance of the object will be necessary

109 Carrying out of decommissioning programmes

(1) Where a decommissioning programme is approved by the Secretary of State, it shall be the duty of the person who submitted the programme to secure-

(a) that it is carried out in every respect; and

(b) that all the conditions to which the approval is subject are complied with.

110 Default in carrying out decommissioning programmes

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1 *Energy Act 2004* (UK), http://www.legislation.gov.uk/ukpga/2004/20/section/105 as amended by http://www.legislation.gov.uk/ukpga/2008/32/section/69; http://www.legislation.gov.uk/ukpga/2004/20/section/109; and http://www.legislation.gov.uk/ukpga/2004/20/section/110.

(1) Where-

(a) a decommissioning programme approved by the Secretary of State is not carried out in a particular respect, or

(b) a condition to which the approval is subject is contravened,

the Secretary of State may, by notice, require a person subject to the duty under section 109(1) in relation to the programme to take such remedial action as may be specified in the notice.

(2) Remedial action required by a notice under this section must be taken within such period as may be specified in the notice.

(3) A person who fails to comply with a notice given to him under this section is guilty of an offence.

vi Decommissioning of Installations

The limited lifespan of turbines, to some 20 years, give rise to the issue of the decommissioning of installations. International obligations exist concerning the decommissioning and removal of offshore installations under the Geneva Convention on the Continental Shelf and the United Nations Convention on the Law of the Sea. Various options exist to decommission offshore installations, including abandoning the structures where they stand, or full or partial removal of the structure. Where the structures are fully or partially removed, disposal becomes an issue. Governments may consider requiring wind energy companies to put in place decommissioning plans before granting approval to construct the wind farm.

China: Two government agencies – the National Energy Administration (NEA) and the State Oceanic Administration (SOA) – have published regulations and interim measures for the development of China's offshore wind industry, including the NEA's *Interim Measures for Management of the Development and Construction of Off-Shore Wind Power* (2010) and the SOA/NEA *Implementation Rules on Interim Measures for the Administration of Offshore Wind Power Development and Construction* (2011).[486]

The *Interim Measures* (2010) were established to "standardise the management of the development and construction of off-shore wind power projects, promote off-shore wind power's orderly development, [and] standardise construction and sustainable development" (Art 1). 'Off-shore wind power projects' are 'wind power projects in sea-areas below the multi-year average for the coastal high-tide line, and include wind power projects on uninhabited islands within corresponding sea-area development' (Art 2). Rights to construct and operate offshore windfarms must be awarded through a tendering procedure.[487] Only 'Chinese-funded enterprises or Chinese-foreign enterprises where the Chinese party has a controlling stock interest (over 50 percent of stock ownership)' may develop and operate offshore wind farms (Art 14).

486 Interim Measures for Management of the Development and Construction of Off-Shore Wind Power, No. 29 [2010] of the National Energy Administration, *http://en.cnrec.info/policy/domestic/wind/2012-05-09-155.html*; Implementation Rules on Interim Measures for the Administration of Offshore Wind Power Development and Construction (2011) (not available online).

487 See also the Law of the People's Republic of China on Tenders and Bids (2000) *http://en.cnrec.info/policy/domestic/comprehensive/2012-05-11-162.html*.

Interim Measures for Management of the Development and Construction of Off-Shore Wind Power.

Art. 4 State energy authorities are responsible for nationwide management of off-shore wind power development and construction. Energy authorities of coastal provinces (regions, municipalities), under the guidance of State energy authorities, are responsible for local management in the development and construction of off-shore wind power. Responsibility for management of off-shore wind power construction technology is entrusted to the centralised management work unit for national wind power technology.

Art. 5 State marine administration authorities are responsible for the management and supervision of sea-use and environmental protection for off-shore wind power development and construction.

Articles 4 and 5 of the *Interim Measures* (2010) allocate broad responsibility for the 'management of off-shore wind power development and construction' between various authorities. Chapters 2 and 3 provide further detail on the allocation of responsibility for the management of development and construction of off-shore wind power.

The *Implementation Rules on Interim Measures for the Administration of Offshore Wind Power Development and Construction* (2011) (not available in English) introduce a standardised process of site selection, project application, approval, construction and operation. Offshore wind farms 'must, in principle, be deployed in sea areas that are no less than 10km from the coast and where the seawater depth is no less than 10m when the tidal flat width is over 10km and that such locations must be suitable for avoiding sea-use conflicts between different industries and reducing development enterprises' investment risks.'[488] Projects need approval from the NEA and a license from the SOA. Provincial governments may approve projects, but all projects need a license from the SOA. Installation of the first wind turbine foundation must take place within two years of receiving approval, or the authorities can revoke the approval and the license for seabed usage.[489]

See also **Denmark:** *Promotion of Renewable Energy Act,* Act no. 1392 of 27 December 2008, Part 3, Access to exploiting energy from water and wind offshore.[490]

III. CONCLUSION

Solar and wind have tremendous potential as energy resources, but there are significant obstacles to making that potential a reality. However, these obstacles are being addressed through legislation described in this chapter, with a considerable degree of success.

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488 Global Wind Energy Council, China Wind Energy Outlook (2012), *http://www.gwec.net/publications/country-reports/china-wind-energy-outlook-2012/*.

489 Id; Centre for Sustainable Energy Studies, 'China's Offshore Wind Industry 2014: An overview of current status and development'(2014) pp 8-9, *https://www.ntnu.no/documents/7414984/202064323/Offshore+Wind+in+China+2014.pdf/b0167dd4-6d47-40cc-9096-b3139c1459ef*.

490 Promotion of Renewable Energy Act, Act no. 1392 of 27 December 2008 (Denmark) *http://www.ens.dk/sites/ens.dk/files/supply/renewable-energy/wind-power/onshore-wind-power/Promotion%20of%20Renewable%20Energy%20Act%20-%20extract.pdf*.

CHAPTER 5D. ENERGY FROM BIOMASS

Teresa Malyshev*

I. INTRODUCTION

The International Energy Agency estimates that, in 2002, biomass and waste[491] accounted for some 11% of global energy demand.[492] In OECD countries, biomass use is concentrated largely in the pulp and paper sector and to a lesser extent in the residential and transport sectors. In developing countries, biomass is used predominately as a fuel for cooking and heating, but additional uses include brick-making, fish-smoking, food processing and other small industries.[493]

Biomass is expected to play a key role in meeting renewable energy objectives in the European Union, Japan and the United States. Compared with oil, gas and coal, biomass used for energy does not contribute to global warning.[494] Biomass offers a carbon-neutral source of energy that is renewable on a short time scale, and hence provides an attractive means of climate change mitigation. Most of the growth of biomass use in OECD countries will be due to policies that support its use. Except for the industry sector, where biomass technologies are economic, most of the technologies used in the residential and transport sectors are costly compared with fossil fuel ones. Moreover, energy prices in most countries do not reflect negative externalities from fossil fuel use.

In developing countries, demand for biomass is also expected to rise; some 2.8 billion people are expected to continue to rely on traditional biomass to meet their heating and cooking needs in 2030.[495] The technologies used to convert biomass feedstock into energy in OECD countries are considerably more efficient than those used in many developing countries. A major challenge for policy makers is how to tackle the problems posed by the traditional use of biomass, such as low combustion efficiency and health hazards.[496]

Given increased global interest in the role of biomass for meeting energy security and climate change goals, it is important for policy makers and legislators to understand the environmental effects, on soil, water, air and biodiversity, of using biomass for energy. These effects can be

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491 Biomass resources include agricultural crops, agricultural residues, sugar industry wastes, forestry crops, forestry residues, black liquor, animal waste, sewage, industrial waste, and biodegradable portion of municipal solid waste, see http://www.iea.org/Textbase/subjectqueries/keyresult.asp?KEYWORD_ID=4116.

492 *World Energy Outlook 2004,* IEA/OECD, Paris, France. http://www.iea.org.

493 Technologies for utilising biomass sources include direct combustion in cookstoves, boilers or as a fuel in engines or turbines; advanced thermal conversion of biomass to a secondary fuel by thermal gasification or pyrolysis, followed by combustion in an engine or turbine; biological conversion to methane by bacterial anaerobic digestion and chemical or biochemical conversion of organic material to produce methanol, ethanol or biodiesel (Renewable Sources of Energy, IEA, 1987), http://www.iea.org.

494 As they grow, plants use and store carbon dioxide. This is released when the plant material is burned. Other plants then use the carbon dioxide that has been released. Carbon is converted from carbon dioxide in the atmosphere and stored in carbon sinks or forests planted for the purpose. Using biomass closes this cycle of storing carbon dioxide.

495 International Energy Agency, *World Energy Outlook 2002,* Paris, France. See http://www.worldenergyoutlook.org/pubs/weo2002/EnergyPoverty.pdf

496 World Energy Council, *Survey of Energy Resources,* 2004. http://www.worldenergy.org/wec-geis/publications/reports/ser/wood/wood.asp.

mitigated in a proper legislative framework. The environmental impacts of biomass energy can be summarised as follows:[497]

- Biodiversity (i.e. changes in the use of chemical inputs, changes in crop rotations, possible arable conversion of grassland and forests, potential creation of landscape elements);
- Soil (organic matter content, soil structure, nutrient content);
- Quality of water and watersheds;
- Air and atmosphere (ozone, acidification, particulate emissions, greenhouse gas emissions);

Human health (pollution of air and water, allergenic pollen from crops).

Legislation addressing biomass energy is complex because of the interaction between the agriculture, forestry and energy sectors. Laws aimed at mitigating the environmental impact of the production and conversion of biomass feedstock for distribution will differ from laws guiding the final use of biomass energy, such as for power generation or transport. Growing and maintaining agricultural or forestry biomass, particularly sustained production of energy crops on the same surface of land, has an environmental impact on biodiversity, soil and water. Production of biomass for energy may affect the quality of air and human health, either positively or negatively.

Since legislation is a tool to achieve a given set of policy objectives, it is necessary to identify the environmental policy objectives for biomass energy development. Any legislative framework should emphasise coherence among its component laws, rules and regulations *vis-à-vis* the desired policy objectives; the ease of its enforcement, monitoring and impact measurement; transparency of institutional responsibilities; and implementation costs in terms of data and human resources. This chapter analyses the legislative needs for achieving environmental policy objectives and cites specific legislation in developing and developed countries. First, legislative definitions of biomass are provided. The following two sections address legislative responses to the environmental impacts of cultivating agricultural and forestry biomass. Finally, the chapter focuses on laws impacting final use of biomass energy.

II. DEFINING BIOMASS

A. What Is an Accurate Legislative Definition of Biomass?

Biomass needs to be defined accurately and completely, in order to avoid ambiguity in legislation. It should be defined in such a way as to provide for necessary adjustments with respect to technological developments. A comprehensive definition of biomass will also allow for harmonisation of policies and laws among countries and, eventually, to standardisation of the characteristics of all biomass types.

497 Jane Feehan and Jan-Erik Petersen, "A Framework for Evaluating the Environmental Impact of Biofuel Use," OECD Workshop on Biomass and Agriculture, 10-13 June 2003, Vienna, Austria. http://webdomino1.oecd.org/comnet/agr/BiomassAg.nsf.

United States: Biomass Energy Equity Act of 2003, Bill HR 804, Section 2 (5)

The term "biomass" means any solid, non-hazardous, cellulosic waste material that is segregated from other waste materials and that is derived from:

(A) any of the following forest-related resources: mill residues, pre-commercial thinnings, slash, and brush, but not including old-growth timber (other than old-growth timber that has been permitted or contracted for removal by any appropriate Federal authority through the National Environmental Policy Act or by any appropriate State authority),

(B) solid wood waste materials, including waste pallets, crates, dunnage, manufacturing and construction wood wastes (other than pressure-treated, chemically-treated, or painted wood wastes), and landscape or right-of-way tree trimmings, but not including municipal solid waste (garbage), gas derived from the biodegradation of solid waste, or paper that is commonly recycled, or

(C) agriculture sources, including orchard tree crops, vineyard, grain, legumes, sugar, and other crop by-products or residues.

Available at: http://thomas.loc.gov/cgi-bin/query/z?c108:H.R.804.IH.

European Union: European Commission Directive 2001/77/EC in the *Official Journal of the European Communities* (27.10.2001 L 283) that defines biomass.

"… the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste."

http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf.

Biofuels are transportation or boiler fuels derived from biological sources, such as cereals, grains, sugar crops, rapeseed, soybean, sunflower, grasses, trees and organic waste material. Legislation addressing the environmental impact of biofuels also needs to be based on an accurate and complete definition.

Canada: Alternative Fuels Act, 1995, c. 20, that defines biofuels as an alternative fuel:

"alternative fuel" means fuel that is:

(a) for use in motor vehicles to deliver direct propulsion,

(b) less damaging to the environment than conventional fuels, and

(c) prescribed by regulation, including, without limiting the generality of the foregoing, ethanol, methanol, propane gas, natural gas, hydrogen or electricity when used as a sole source of direct propulsion energy…"

http://laws.justice.gc.ca/en/a-10.7/1549.html.

III. ADDRESSING THE ENVIRONMENTAL IMPACTS OF BIOMASS ENERGY

A. What are the Environmental Impacts of Growing Biomass Feedstock for Energy and How Has Legislation Addressed These Impacts?

Bio-energy programs, when coupled with agro-forestry and integrated farming, have the potential to improve food production while growing energy crops and expanding rural incomes. Increasing agricultural production of biomass can be achieved by substituting for other agricultural crops that are in surplus, intermixing energy crops with food or forage crops in an agro-forestry approach, and incorporating into land conservation systems such as windbreaks. There is also potential to increase the use of crop residues, provided this is consistent with the levels of organic matter and control of erosion.[498]

The potential resource from energy crops, such as short rotation trees or other plantations, is estimated to be extremely large. In parallel with the prospects of increased food production, there are large areas of deforested and degraded land that would benefit from the establishment of biomass plantations, with estimates ranging up to over 300 million hectares available for reforestation and agro-forestry.[499] Other studies of the potential cropland resources in developing countries have indicated that these countries will be using only 40% of their potential cropland in 2025.[500] The balance between higher yields in good lands and the benefits of bringing degraded lands back into production is an important issue.

Erosion is a problem related to the cultivation of annual crops. The best-suited energy crops are perennials, with much better land cover than food crops. During harvest, the removal of soil can be

498 See http://www.ieabioenergy.com/ourwork.php?t=31#31.

499 UN FAO/Netherlands, "Conference on the Multifunctional Character of Agriculture and Land", Maastricht, September 1999, http://csdngo.igc.org/agriculture/agr_Dutch.htm. Another study by Hall et. al puts the potential even higher. Assuming that plantations have an average yield of 15 dry tonnes per hectare per year, with a heating value of 20 gigajoules per tonne, and that plantations are established on 10% of the world's land that is now woodland, cropland and permanent pasture, a total of 890 million hectares of biomass would produce around 260 exajoules per year, equivalent to over 72,000 TWh of electricity generation. (Hall, D.O., Rosillo-Calle, F. Williams, R.H. & Woods, J. (1993) Biomass for Energy: Supply Prospects. Chapter 14. in *Renewables for Fuels and Electricity,* ed. B.J. Johansson, et al, Island Press, Washington. To get an idea of how large this potential is, the International Energy Agency estimates that global electricity demand was only some 16,000 TWh in 2002. http://www.iea.org/Textbase/publications/newfreedetail2.asp?F_PUBS_ID=582.

500 World Agriculture towards 2010, UN FAO, Rome, 1996, http://www.mindfully.org/Food/FOA-Food-Outlook.htm.

kept to a minimum, since the roots remain in the soil. Another positive effect is that the formation of an extensive root system adds to the organics matter content of the soil. The choice of crop can have a considerable effect on water-use efficiency. Some eucalyptus species have very good water-use efficiency, considering the amount of water needed per ton of biomass produced. Mono-cultural crops also create problems of erosion and loss of biodiversity. But a eucalyptus plantation on a large area could increase the local demand for groundwater and could affect its level. The impacts of the hydrological situation should be evaluated at the local level.

The net effect of growing energy crops on soil quality depends to a large degree on the alternative uses of the land. Converting cropland to energy crops may have minimal impacts. If dedicated energy crops that need little fertiliser or pesticides, such as perennial switchgrass, are mown instead of ploughed, they can enrich soil nutrients and provide ground cover, thus reducing erosion. They may also provide better habitats for birds and other wildlife than annual crops.

United States: The U.S. Farm Security and Rural Investment Act of 2002 (P.L. 107-171, Section 2101, Conservation Title II)

Allows biomass harvesting on Conservation Reserve Program lands where consistent with soil, water, and wildlife habitat goals of the CRP program. CRP payments are reduced by economic value of the biomass activity. http://bennelson.senate.gov/Crs/Energy%20Provisions.pdf.

England: The Energy Crops Scheme in the United Kingdom

Provides grants for establishing short rotation tree projects. The crops must be grown for power generation, combined heat and power or heat production. http://www.dti.gov.uk/energy/renewables/index.shtml

The Energy Crops Regulations (2000), SI 2000/3042, are available at http://www.legislation.hmso.gov.uk/si/si2000/20003042.htm.

The use of biomass for energy has raised the issue of the risk of depletion of soil carbon stocks in biomass production systems, due to a higher proportion of the organic matter and nutrients being removed from the site compared with conventional agricultural and forestry systems. A recent study indicates that although there may be some decline in soil carbon associated with biomass production, this is negligible in comparison with the contribution of bio-energy systems towards greenhouse gas mitigation through avoided fossil fuel emissions.[501] In Sweden, some 15,000 hectares of willow trees are commercially grown.[502] The harvested fuel is used together with forest residues in municipal heat and combined heat and electricity production plants.

European Union: The E.U.'s "Forestry Strategy" [41z], The Official Journal of the European Communities (26.6.1999 L 160, p. 80).

The European Commission emphasised that the potential of forests as a source of energy, either by short rotation plantation or by the use of forest residues, should be favoured. Furthermore, the Commission in its Communication "Directions toward sustainable agriculture" [42] stressed the role

501 The study can be accessed at: http://www.joanneum.at/iea-bioenergy-task38/projects/task38casestudies.

502 For recommendations on how to plan and run a profitable short-rotation coppice plantation, see Birger Danfors, Stig Ledin, Hakean Rosenquist, Short-Rotation Willow Coppice Growers Manual (1998). http://www.shortrotationcrops.com/taskreports.htm.

of biomass for combating climate change and made a reference in this context to the objectives of the White Paper on renewable energy, thereby introducing the climate change considerations into the concept of sustainable development. It was also underlined that increased biomass exploitation from forest residues would at the same time constitute a means to prevent forest fires, often caused by non- removed residues. The above Communications also provide useful guidance for the selection of projects to be supported in the field of biomass under Community programmes in the framework of Rural Development. http://europa.eu.int/eur-lex/pri/en/oj/dat/1999/l_160/l_16019990626en00800102.pdf.

Fertilisers and pesticides have an important impact on rivers and other water bodies. While the introduction of low-fertiliser crops, such as certain grasses and trees and sugar cane, will lower nitrogen release and run-off, increasing agricultural activity for grain based biofuels production can increase the use of fertilisers and pesticides during crop production. Then, nitrogen fertiliser run-off increases the nitrification of nearby water bodies. In such cases, best practice fertiliser application should be used, with precision farming methods, geographic information systems, and "little and often" fertiliser application strategies to minimise pollution as well as to lower production costs.[503]

B. How Does Management of Forestry Resources Relate to Biomass Energy and What Legislation Is Required for Sustainable Management?

The development of a legislative framework for wood energy is complex since there is no single set of policies exclusively for wood energy. Legislation is often derived as a corollary of other national and sectoral policies. In many countries environmental goals emphasising forest conservation have resulted in policy measures that adversely affect the movement and trade of wood and wood fuels derived from sources other than forests. Redirecting such policies to allow the non-detrimental use of wood fuels would require a better understanding of the nature of wood energy and the ways in which it can be promoted without compromising environmental goals. Legislation should address the following key policy issues.[504]

1. Land Ownership, Tenure

Land ownership issues often represent the most important political barrier to biomass energy projects. See for example:

Lesotho: National Forestry Policy, 1997 and the Forestry Act, 199

The Forestry Act aims to divest the State Forest Reserves to the local level and states, Section 11, that after consulting with the appropriate local authority, the Chief Forestry Officer "shall advise the Minister on the transfer of ownership, control and management of any forest reserve to individuals, groups of individuals, communities, organizations or cooperatives". Transfer will be embodied in a written agreement "binding on both the parties and shall provide that the Minister shall have a right to reclaim the forest reserve if the said agreement is breached materially." Liremo and matsema,

503 http://www.pda.org.uk/leaflets/20/no20-print.htm.
504 Food and Agriculture Organization of the United Nations, Regional Wood Energy Programme in Asia, Policies, Legislation and Institutions for Sustainable Wood Energy Development, Summary of Proceedings of Expert Consultation on Sustainable Wood Energy Programmes: Policy and Institutional Issues, 29-31 July 1998, Hua Hin, Thailand.

small natural forest groves and woodlots previously vested in the Basotho Nation and given to local chiefs to administer, will now be declared Community Forests.

Legislation pertaining to the Forestry Act of 1998 is available at http://faolex.fao.org/docs/pdf/les20800.pdf. (See also http://www.fao.org/docrep/x8080e/x8080e04.htm)

2. Access To Wood Resources

Gambia: Forestry laws in Gambia, since 1998, have covered community forests and community participation in forest management. The laws provide legal encouragement for tree-planting on farmland and pasture and along roadsides. People are allowed the usage of both forest and non-forest trees growing outside the forest but the harvesting and felling of forest trees is regulated by Article 6 of the Forest Bill. Non-forest trees belong to the person or community planting or inheriting them, but the transport of logs from these trees requires a special permit (Article 7).

Legislation pertaining to the Forest Bill, 1998 (Gambia) is available at http://www.crdfp.org/material/downloads/forest_act_1998.pdf. (See also http://www.fao.org/docrep/005/y2328e/y2328e06.htm)

India: Legislative responses to forestry offences in the Indian Forest Act 1927

The Indian Forest Act is the principal legislation regulating the management of forests. While in some states the Act has been brought into force, several others have enacted their own acts that are adapted versions of the Central Act. These Acts provide for penalties for various forest offences. However, with steep increase in prices of forest produce over the years, the incidences of forest offences have increased and an amendment of IFA has been recognized.

The proposed amendments are:

- Increase in penalties for forest offences to match their market prices.
- Delegating more powers to forest officers for confiscating (not just seizing) all tools, arms, vehicles, etc. used in commission of forest offences.
- Make serious forest offences cognizable and non-bailable.

Other matters needing special attention are:

- The existing laws, rules and regulations on different aspects of land use should be combined into a legal framework integrating the principles of comprehensive land use.
- All laws compelling a farmer to obtain permission for felling trees grown on his own land must be repealed.
- Rules and regulations for a farm forester to obtain transit passes for the movement of his forest produce should be withdrawn.

Source: Wood Energy Policy Paper, India, FAO/RWEDP, draft manuscript. For more information on the Indian Forest Act 1927, see http://www.indialawinfo.com/bareacts/IFA.html.

3. Wood Extraction and Wood Product Movement

A ban on harvesting trees to be used in silviculture can be detrimental to the health of forests.[505] See for example:

India: The National Forest Policy 1988 imposed a blanket ban on felling of green trees. This ban led to a rise in the unit prices of wood fuel and an increase in illicit harvesting and trade. Rules on transit of forest produce in most States are detrimental to free trade in wood fuels. Most State Governments are levying charges on fuel wood collected from forests. http://envfor.nic.in/

China: The Forestry Law of the People's Republic of China, effective from January 2000, lays out the general provisions, forest operation and management, tree planting and afforestation, tree harvesting and legal liabilities for implementation of the law.

(Promulgated by Decree No. 278 of the State Council on January 2, 2000) http://www.zhb.gov.cn/english/law_detail.php3?id=54

4. Wood and Wood Trade

In India, some states have imposed a complete ban on inter-state movement of certain high value species of wood. For example, there is ban on inter-state movement of red sanders in Andhra Pradesh, rosewood in Karnataka, and sandalwood in Andhra Pradesh, Karnataka and Tamil Nadu.[506] While this ban on certain high value species is affecting their production and effective utilization, it is also giving rise to imports.

5. Wood Energy Use

Detailed studies in many areas worldwide have rarely documented cases in which fuel demand is a cause of deforestation. Indeed the causation is more often the reverse; the shortage of fuel wood is due to deforestation, rather than the other way around. There are localised cases where fuel wood demand seems to contribute to forest depletion, most prominently in Sub-Saharan Africa where commercial charcoal production is practised. Temporary kilns, legal or illegal, in forested areas are used until local wood resources are depleted; then the kilns are moved or rebuilt elsewhere.[507] Although energy policy in some African countries favours development and promotion of improved charcoal cookstoves, charcoal making remains illegal. There is a need to officially recognise charcoal as a legal and taxable commodity.

6. New Technology Development

Thailand: The Strategic Plan for Energy Conservation ("Strategic Plan 2002-2011") supports technological development of renewable energy, in particular biogas. See also Energy Conservation Promotion Act B.E. 2535, available at http://faolex.fao.org/docs/texts/tha41045.doc.

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505 See "Wood Energy Policy Paper", India, FAO/RWEDP, draft manuscript.
506 *Ibid.*
507 http://216.239.59.104/search?q=cache:d93t-OmGR1YJ:www.acts.or.ke/PB%2520-%2520KITUYI-WSSD.PDF+WEC+kilns+illegal+wood+resource+&hl=en.

C. What Are the Environmental Impacts of Energy Production from Biomass and How Has Legislation Addressed These Impacts?

1. Construction of Solid Biomass Power Generation Facilities

Many countries have enacted very specific urban land-use planning laws for the citing of biomass electricity generating plants. In Germany, electricity generation plants are commercial installations. Depending on their disruptive impact on the environment, they may, under the legal provisions applicable to built-up areas, be erected either in all building areas or exclusively in industrial zones.

Germany: See German laws regarding the establishment of biomass facilities in Report of administrative procedures for the admission of plants for the Production of Electricity from Renewable Sources of Energy, available at http://europa.eu.int/comm/energy/res/legislation/country_profiles.

Brazil: It is necessary to acquire permits through Electrobras for the citing of new biomass plants (text in Portuguese at www.mme.gov.br)

2. Operating Solid Biomass Power Generation Facilities

Biomass plants for the production of electricity as well as combined heat and power production plants[508] have been supported by legislation including: minimum tariffs for delivering electricity to the grid; special financial support and subsidies; higher taxation of fossil fuels; and penalizing grid operators that do not meet a minimum amount of biomass-electricity.[509] For example, the United States Internal Revenue Code of 1986 was amended to support open and closed-loop biomass for electricity production.

508 Combined heat and power is the joint production of both heat and electricity from a single fuel source. Conventional power production converts on average about 35% of the total energy contained in fossil fuels such as coal or natural gas into electricity. The rest of the energy is released from the power plant in the form of heat and is lost. Combined heat and power systems collect and make productive use of this rejected heat energy. This process is sometimes referred to as cogeneration and can result in total efficiencies of more than 70%. The heat energy can be used for many purposes, such as space heating a large commercial building or industrial processing. These systems are appropriate for facilities that require both electricity and heat at the same time. (http://www.eere.energy.gov/state_energy_program/topic_definition_detail.cfm/topic=202)

509 See Renewable Energy: Market and Policy Trends in IEA Countries, International Energy Agency, 2003 for a detailed look at policy support in OECD countries for renewable energy. See also the renewable energy policies and measures database at http://repolicies.iea.org.

United States: Internal Revenue Code of 1986, 26 U.S.C.S. § 45 (a), (c)

(a) The renewable electricity production credit for any taxable year is an amount equal to the product of:

(1) 1.5 cents, multiplied by

(2) the kilowatt hours of electricity–

(A) produced by the taxpayer–

(i) from qualified energy resources, and

(ii) at a qualified facility during the 10-year period beginning on the date the facility was originally placed in service, and

(B) sold by the taxpayer to an unrelated person during the taxable year.

(c) Closed-loop biomass means any organic material from a plant, which is planted exclusively for purposes of being used at a qualified facility to produce electricity. Open-loop biomass means: any agricultural livestock waste nutrients, or any solid, non-hazardous, cellulosic waste material that is segregated from other waste materials.

The installation of a biomass boiler has positive environmental benefits. Apart from the reduction in greenhouse gases compared with fossil fuels, there is reduction in local air pollutants. Use of biomass boilers reduces emissions by substituting fossil fuels with wood as a fuel for power and heat generation and by depleting stockpiles of wood residues. Composting of residues releases methane, a greenhouse gas 27 times more potent than CO_2[510].

The paper and pulp and sugar industries offer excellent opportunities to use biomass resources efficiently and competitively worldwide. In many countries, these sectors use wood waste and bagasse (a byproduct of the sugar cane process) for their internal energy needs, usually inefficient conversions to low-pressure steam and some power. The absence of regulation to ensure reasonable electricity tariffs for independent power producers make it unattractive for industries to invest in more efficient power generation. But the liberalization of energy markets in many countries is removing this barrier, opening a window to reduce production costs and modernize production capacity. Efficient boilers have been installed in many production facilities. Gasification technology could offer even further efficiency gains and lower costs, particularly when applied for converting black liquor, a byproduct of the pulp and paper manufacturing process.[511] The power generated is generally competitive with grid prices.

In Nicaragua, legislation has been adopted that supports electricity production from bagasse using improved boilers to meet demand for electricity.

510 For environmental consequences of composting residues in Asia, see http://www.rwedp.org/acrobat/p_prospects.pdf.
511 See The US initiative, Agenda 2020: Pulp and Paper Industry Roadmap that supports research and development efforts to increase the efficiency of the pulp and paper industry, http://www.aceee.org/pubs/ie962.htm.

In Mauritius, the 1985 Sugar Sector Package Deal Act aimed at increasing the production of bagasse for the generation of electricity and the 1988 Sugar Industry Efficiency Act that provides tax incentives towards investment in the generation of electricity and encourages small planters to provide bagasse for this purpose.

Biomass schemes can also offer the possibility of electrification of rural areas not reached by a grid system at lower cost than grid extensions. In remote areas, where the distance from the grid renders it too costly to connect communities to the national or regional grid, decentralised micro-projects are an option. Small biomass plants can offer refrigeration, water pumping, lighting, and communication services.

Brazil: Brazil's Electricity Law (Law 10.438), passed in April 2002, created incentives for supplying electricity to rural areas. The Law provides for the reduction of tariffs to low-income consumers, the establishment of targets for concessionaires and the granting of permission to permit-holders to provide full coverage. http://www.ieiglobal.org/ESDVol8No4/brazil.pdf

3. Building and Operating Biogas Facilities

Legislation needs to address the potential environmental impacts, both positive and negative, from the four main ways of obtaining biogas: gas obtained from the anaerobic digestion of municipal solid waste; anaerobic fermentation of manure from animals; sewage treatment with anaerobic digestion; and capture of methane from landfill sites. The impacts include citing of biogas plants and the quantity and quality of substances used for production. For biogas installations, such as large livestock farms, with a major spatial impact, laws must take into account local or regional legislation. Heat and electricity from biogas is environmentally friendly and economically feasible for many applications. Soil improvement can also result from the biogas process when the liquid manure after treatment or the compost is used as a fertiliser. Compost produced as part of the biogas process is a good quality fertiliser. Negative effects from landfills arise mainly from uncontrolled emissions of landfill gas and leachate to the surrounding environment. Leachate is a high strength, aqueous solution and is formed when water introduced with the solid waste or from external sources percolates through the landfill, contacting the waste.[512]

4. Gas Obtained From the Anaerobic Digestion

a. Anaerobic Digestion of the Organic Fraction of Municipal Solid Waste

European Union: The Communication from the Commission "EU Policies and Measures to Reduce Greenhouse Gas Emissions: Towards a European Climate Change Programme (ECCP)," COM(2000) 88 final, states that one of the proposed measures in the area of waste is the promotion of the biological treatment of biodegradable waste. Regarding landfill gas, the Community Strategy on Waste states that measures should be taken to enhance prevention and recycling, so that the amount of waste that is sent to the landfills, will be reduced: land-filling of waste being the last option in the hierarchy of waste management. Accordingly, the Directive on the landfill of waste that came into force on 16

512 For a guide to environmental monitoring of municipal solid waste facilities, see http://wlapwww.gov.bc.ca/epd/epdpa/mpp/gfemamsw.html#5.

July 1999 and was transposed into national law on 16 July 2001, lays down specific requirements on the construction, operation and after-care of landfills. http:// europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=32000L0076&model=guicheti.

b. *Anaerobic Fermentation of Manure from Animals*

Livestock slurries represent a major potential source of pollution, especially of water sources. Anaerobic digestion of these slurries is therefore an attractive option. Biogas plants can become centres for the management of agricultural manure in rural areas. The plants can be generated from cattle dung and animal wastes. Biogas systems offer multiple benefits. The digester-effluent is usually a good fertiliser, and, if connected to latrines, biogas plants can provide valuable sanitation services. Also, biogas plants can play a role in the recycling of organic waste products from households in cities.

Nepal: The Biogas Support Programme in Nepal promoted the wide-scale use of biogas as a substitute for other less efficient fuels used for cooking and lighting. Since its inception, the programme has installed more than 40,000 family-size biogas units benefiting more than 200,000 members of rural households. A critical element in developing the commercial market for these plants has been the programme's innovative financial engineering and consumer subsidies. The subsidy, fixed at three levels, accounted for 35% of the total cost of biogas plants in 1998. At the start of the programme, there was only one local manufacturer of biogas plants. Market development increased the number of suppliers to 38 by 1996. As a result of growing competition, technical design modifications, and better quality control measures, the overall cost of biogas plants in Nepal declined by more than 30% from 1992 to 2002. In addition to the institutional improvements, employment for skilled as well as unskilled labour in rural areas was generated.[513]

c. *Sewage Treatment With Anaerobic Digestion*

In China, anaerobic digesters producing combustible biogas have been in use since the 1960s. Today, the majority of digesters supply single households. Building on the initial household applications, China has successfully developed digester technology for use with large and medium-sized domestic livestock and industrial and organic waste disposal facilities. There are currently about 6.4 million household-scale biogas systems producing some 1.6 billion m^3 per year of gas and over 600 industrial-scale systems processing 40 million tonnes of waste annually to make 110 million m^3 of biogas. The industrial systems meet their host factory needs and also supply about 56,000 households with biogas for cooking. The projects are mostly located in the eastern part of the country and in the suburbs of large cities. Their location coincides with areas where there is rapid growth in concentrated animal breeding industries.[514]

At present, there are two technological approaches being pursued in China for utilisation of municipal solid waste – incineration and landfill gas extraction. A few MSW incineration demonstration projects have been built, with a total installed capacity of 15 MW in 2000. Utilisation of biogas from landfills is still in the early stages of demonstration in China.[515]

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513 *World Energy Assessment: Energy and the Challenge of Sustainability,* UNDP, UNDESA and World Energy Council, 2002, www.undp.org/seed/eap/activities/wea.

514 Li Jingjing, Zhuang Xing, Pat DeLaquil and Eric Larson, "Biomass Energy in China and Its Potential", *Energy for Sustainable Development,* Vol V, no. 4, December 2001, http://www.ieiglobal.org/ESDVol5No4/biomass.pdf

515 *Ibid.*

China: Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste, effective from January 1996.

CHAPTER I GENERAL PROVISIONS

Article 1 This Law is enacted for the purpose of preventing and controlling environmental pollution by solid waste, safeguarding human health and promoting the development of socialist modernization drive. Article 2 This Law shall apply to the prevention and control of environmental pollution by solid waste within the territory of the People's Republic of China. This Law shall not apply to the prevention and control of marine environmental pollution by solid waste or of environmental pollution by radioactive solid waste. Article 3 The State shall, in preventing and controlling environmental pollution by solid waste, implement the principles of reducing the discharge of solid waste, fully and rationally utilizing solid waste, and making it hazardless through treatment. Article 4 The State encourages and supports clean production and reduced discharge of solid waste. Full text available at http://www.zhb.gov.cn/english/law_detail.php3?id=7.

5. Capture of Methane from Landfill Sites (Normally Named Landfill Gas).

For biogas installations in Germany, the criteria to be considered are the output of the firing installation or the nature and quantity of the substances to be fermented. Typical biogas installations with combustion engines should be examined for approval under emission protection law in the simplified procedure if 1) either the threshold of 1 MW firing heat output (if technologies other than combustion engines are used from 10 MW) is reached for the incineration installation or 2) the associated fermentation installation is an installation for biological processing of waste, with a minimum daily throughput of 10 tonnes. If one of these criteria is met, a site-related preliminary enquiry into the need for an environmental impact assessment should also be carried out, and from 50 tonnes daily fermentation throughput a general preliminary enquiry into the EIA requirement. An authorisation procedure with public participation and EIA obligation under emission protection law is necessary only for large installations with at least 50 MW firing heat output.[516]

European Union: European Union Directive 99/31/EC, OJ L 182, 16.7.1999, p. 1-19, Corrigendum OJ L 282, 5.11.1999, p. 16.

The overall objective of the Directive is to prevent or reduce as far as possible negative effects on human health or the environment from landfills. The Directive provides as one of its main objectives that member states draw up strategies to reduce the amount of biodegradable waste going to landfills; it also sets precise targets for the reduction of the amount of biodegradable municipal waste going to landfills. To achieve these targets Member States will have to increase in particular the recycling, the composting of biodegradable waste, the production of biogas and other forms of recovery. http://europa.eu.int/eur-lex/en/consleg/pdf/1999/en_1999L0031_do_001.pdf.

516 http://europa.eu.int/comm/energy/res/legislation/country_profiles/2004_0547_sec_country_profiles_en.pdf .

D. What Are The Impacts on Health Related to Biomass Energy Use and What Legislation Has Been Used to Counter These Impacts?

Biomass that is directly combusted in an inefficient cookstove produces pollutants, leading to severe health and environmental consequences. Legislation that focuses on setting standards for emission reduction is important to mitigating the negative impacts. Over the past 20 years, some 90% of improved cookstoves were disseminated in China. Other successful dissemination programmes took place in India, Kenya, Tanzania and Uganda. But even the best biomass stoves available today do not greatly reduce the health-damaging effect of biomass combustion.[517] Poor people in the developing world are constantly exposed to indoor particulate and carbon monoxide concentrations many times higher than World Health Organization standards. Traditional stoves using dung and charcoal emit large amounts of carbon monoxide and other noxious gases. Women and children suffer most, because they are exposed for the longest periods of time. Acute respiratory illness affects as much as 6% of the world population. The World Health Organization estimates that 2.5 million women and young children in developing countries die prematurely each year from breathing the fumes from indoor biomass stoves.[518]

Many OECD countries have set standards for pollutant emissions from wood stoves. Since 1994, British Colombia has prohibited the sale of wood stoves that do not meet EPA standards. Nova Scotia's legislature is reviewing a similar regulation. Other provinces and territories are considering following suit, so that only high efficiency, low emission stoves will be available for sale. High-efficiency wood-burning appliances are certified by the Environmental Protection Agency to meet stringent smoke emission limits.

See: Canada: Burn-It-Smart legislation sets standards for emissions from wood stoves. http://www.burnitsmart.org/english/faq/campaign_answer.html

Austria: A first law on the efficiency of woodstoves in Austria was implemented in Styrian State in 1992. Today, all Austrian states have the same legislation as agreed in a contract in 2001 between the states and the Austrian Federal Government. The Federal Institute of Agricultural Engineering provides for the installation of certified furnaces that comply with strict emission limits for rated load and part load in newly constructed plants. These requirements were discussed with the producer and have not stunted but rather have stimulated the development of efficient woodstoves.

See the Austrian legislation Feuerungsanlagengesetz, LGBl. Nr. 73/2001 at http://www.ris.bka.gv.at/lr-steiermark/ (the text is only available in German).

517 *World Energy Assessment: Energy and the Challenge of Sustainability,* UNDP, UNDESA and World Energy Council, 2002.

518 http://lnweb18.worldbank.org/sar/sa.nsf/0/95ee1c18873abcef852569d0004f83c2?OpenDocument.

See also:

New Zealand: Resource Management Act 1991

National Environmental Standards relating to wood stoves are regulated under the Resource Management Regulations 2004, pursuant to section 43 of the Resource Management Act 1991:

Discharge from wood stoves installed on certain properties after 1 September 2005 prohibited

(1) The discharge of particles to air from a wood stove installed after 1 September 2005 in a building on a property with an allotment size of less than 2 hectares is prohibited.

(2) Subclause (1) does not apply if the discharge from the wood stove complies with–

(a) the design standard in regulation 23; and

(b) the thermal efficiency standard in regulation 24.

Design standard

(1) The design standard for a wood stove is a discharge of less than 1.5 gram of particles for each kilogram of dry wood burnt.

(2) The discharge must be measured in accordance with the method specified in Australian/ New Zealand Standard AS/NZS 4013:1999, Domestic solid fuel burning appliances– Method for determination of flue gas emissions.

Thermal efficiency standard

(1) The thermal efficiency standard for a wood stove–

(a) is the ratio of useable heat energy output to energy input (thermal efficiency); and

(b) must be not less than 65%.

(2) The thermal efficiency must be calculated in accordance with the method specified inAustralian/New Zealand Standard AS/NZS 4012:1999, Domestic solid fuel burningappliances–Method for determination of power output and efficiency.

Text available at http://gpacts.knowledge-basket.co.nz/regs/regs/text/2004/2004309.txt.

E. What Are The Environmental Impacts of Liquid Biofuels and Legislative Support for Transport Biofuels?

1. The Negative Environmental Impacts of Biofuels

Ethanol-blended gasoline produces evaporative hydrocarbons. Impacts of both ethanol and biodiesel on oxides of nitrogen are generally minor and depend on climatic and technical conditions. Biofuels also can have impacts on toxic air emissions. While emissions of most toxic air pollutants, such

as benzene, 1.3-butadiene, toluene and xylene, decrease when ethanol is added to gasoline, emissions of acetaldehyde, formaldehyde and peroxyacetyl nitrate increase. Formaldehyde and acetaldehyde are by-products of incomplete combustion. Since these are currently uncontrolled emissions, in the future they can be much lower if appropriate emissions controls are applied.[519]

The impacts of biofuels on soils and habitats from growing bioenergy crops, on removing crop and forest residues and using these to produce biofuels, on water quality from bioenergy crop production and biofuels use, and on disposing of various solid wastes are analogous to the impacts examined in section two. The net effect of these factors varies and depends on how the fuels are produced and used, and on the systems and methods applied. In the extreme, such as if a rainforest is replaced by bioenergy crop plantations, the impacts could be strongly negative. In many cases, however, growing bioenergy crops on vacant land, producing biofuels and using these fuels in vehicles provide net environmental benefits.

2. Legislative Support for Vehicle Biofuels

Many governments explicitly recognize the environmental advantages of vehicle biofuels as compared with fossil fuels and seek to expand their production and use. Biofuels can reduce many of the vehicle pollutant emissions that exacerbate air quality problems, particularly in urban areas. Biofuels generally produce lower tailpipe emissions of carbon monoxide, hydrocarbons, sulphur dioxide and particulate matter than gasoline or conventional diesel fuel, and blending biofuels can help lower these emissions. See for example:

Italy: Financial Law of 2001 supports biofuels production through an excise tax exemption. http://europa.eu.int/comm/energy/res/legislation/country_profiles/2004_0547_sec_country_profiles_en.pdf

Spain: Law 53 of 30 Dec. 2002 on Measure of a Fiscal, Administrative and Social Order Nature sets a hydrocarbon tax level of zero percent for biofuels until 2012. http://europa.eu.int/comm/energy/res/legislation/country_profiles/2004_0547_sec_country_profiles_en.pdf

519 *Biofuels for Transport: An International Perspective,* International Energy Agency, 2004, http://www.iea.org.

United States: Internal Revenue Code of 1986, 26 U.S.C.S. § 40, 40A

The Alcohol Fuels Credit in the United States encourages the production of gasohol and ethanol through a credit to taxpayers for alcohol or biodiesel used as fuel.

I.R.C. §40 Alcohol used as fuel 26 USCS§ 40 (2004)

I.R.C. §40A Biodiesel used as fuel 26 USCS§ 40A (2004)

… (b) (1)(A) In general. The biodiesel mixture credit of any taxpayer for any taxable year is 50 cents for each gallon of biodiesel used by the taxpayer in the production of a qualified biodiesel mixture …

(3) Credit for agri-biodiesel. In the case of any biodiesel that is agri-biodiesel, paragraphs (1)(A) and (2)(A) shall be applied by substituting «$ 1.00» for «50 cents».

(4) Certification for biodiesel. No credit shall be allowed under this section unless the taxpayer obtains a certification (in such form and manner as prescribed by the Secretary) from the producer or importer of the biodiesel, which identifies the product produced, and the percentage of biodiesel and agri-biodiesel in the product …

(d) Definitions and special rules. For purposes of this section–

(1) Biodiesel. The term "biodiesel" means the monoalkyl esters of long chain fatty acids derived from plant or animal matter which meet–

(A) The registration requirements for fuels and fuel additives established by the Environmental Protection Agency under section 211 of the Clean Air Act (42 U.S.C. 7545), and

(B) The requirements of the American Society of Testing and Materials D6751.

(2) Agri-biodiesel. The term "agri-biodiesel" means biodiesel derived solely from virgin oils, including esters derived from virgin vegetable oils from corn, soybeans, sunflower seeds, cottonseeds, canola, crambe, rapeseeds, safflowers, flaxseeds, rice bran, and mustard seeds, and from animal fats.

In many non-OECD countries, emissions control standards are less strict, and biofuels are likely to have a larger impact on emissions. In many countries, however, new vehicles are increasingly being required to meet basic emissions standards. Worldwide, older vehicles with little or poor quality emissions control equipment can certainly benefit from the use of biofuels.

Brazil: The Brazilian Pro-Alcohol programme, launched in the 1970s, is a unique example of a major biofuels program. It is the largest programme of commercial biomass utilisation in the world. The programme demonstrates the technical feasibility of large-scale production of ethanol as a transport fuel, and its use in high-level blends as well as in dedicated ethanol vehicles. Sugar cane plants in Brazil make excellent use of biomass as process energy. Emission reductions from sugar cane-derived fuels are greater than from ethanol from grains because nearly all conversion plant process energy is provided by the remains of the crushed cane after the sugar has been extracted,

i.e. the bagasse. After the second oil crisis, steps were taken to use hydrated ethanol. The Brazilian car industry agreed to implement the technical changes necessary for vehicles to safely operate on the neat fuel. The investment required for this phase of the programme was funded through soft loans by the government. Tax reduction made the ethanol option highly attractive to consumers.

When Pro-Alcohol was established, several negative environmental impacts were expected: the exacerbation of historical labour problems, water contamination by the stillage, air pollution from traditional burning of field residues and competition with other agricultural products. Many of these problems have been overcome with technological advances. The main remaining problem is the burning of residues that pollute the air with ashes. Federal law requires this practice to end in the near future). Today, ethanol is sold competitively in Brazil because the sugar cane industry has been able to increase productivity over the past three decades.

On October 30, 2002, Brazil launched the Probiodiesel Program, with Portaria MCT Number 702, Directive #702 of the Ministry of Science and Technology. The program aims to develop technology for the production, industrialisation, and use of biodiesel. According to the legislation, Brazil wants to reduce its dependence on diesel imports. President Lula's administration views biodiesel as a program for social inclusion and job creation, with hopes that it will generate up to 200,000 jobs. See http://www.udop.com.br/ (law in Portuguese but with links in English)

Other countries with biofuels programs include:

Paraguay: A group of legislators in Paraguay has filed a draft bill for discussion in the Congress on supporting the purchase of renewable bio-fuels. The draft bill promises stable taxes for companies producing bio-fuels for at least 15 years. Bio-fuels will be increasingly needed as the government intends that all fuels to be sold in the country contain as minimum as 20% of any bio-fuel and as maximum as 80% of the same product. http://www.ultimahora.com/template.asp?notic=85647 (in Spanish)

India: See Ministry of Petroleum and Natural Gas Resolution, New Delhi, 3 September, 2002, No. P-45018/28/2000-C. C., effective from January 2003, that decrees that 5% ethanol-doped-petrol will be supplied in the following nine States and four contiguous Union Territories: States & Union Territories 1. Andhra Pradesh 1. Damman and Diu 2. Goa 2. Dadra and Nagar Haveli 3. Gujrat 3. Chandigarh 4. Haryana 4. Pondicherry 5. Karnataka 6. Maharashtra 7. Punjab 8. Tamilnadu 9. Uttar Pradesh.

Colombia: Colombia's congress has approved a bill that permits mixing a 10% ethanol mixture in gasoline beginning on 25 September 2005 and another that promotes the production, consumption and commercialization of biofuels. The bill stipulates a 10-year grace period from paying income taxes on crops and a tax exemption on biodiesel. Development of its biofuels program is expected to generate 150,000 new jobs.

III. CONCLUSION

Biomass has tremendous potential in developing countries. It is plentiful in supply and its use maximizes local labour minimizes the need for imported equipment. If environmental safeguards are observed, it can provide a significant energy resource to assist in development efforts. This chapter describes some of the legislation that has been used both to promote and safeguard the use of biomass as an energy resource.

CHAPTER 5E. GEOTHERMAL ENERGY

Adrian J Bradbrook*

I. THE NATURE OF THE RESOURCE

Geothermal energy is most commonly associated with large-scale plants relying on underground heated water or volcanic activity. From a legal standpoint all developments to date have focused on this aspect of the energy resource.

It should be noted, however, that geothermal energy can also be used for heating and cooling at the small scale by individual households. This is by the use of heat pumps. The contractor can drill several well holes down to the level where the temperature is a constant 15C, and a non-freezing fluid is circulated from the wells to the house by heat pumps. This obviates the need for air conditioning and for heating requires only boosting the winter temperature from 15C to 21C. The challenge for the widespread use of heat pumps is to finance the initial cost, which will be addressed in the Financing Renewable Energy, Section Three of this Guide. From a legal perspective the technology can be encouraged by tax incentives along the same lines as used to promote small-scale solar and wind energy (discussed in the Renewable Energy section of this Guide).

The remainder of this chapter will consider legal means of promoting large-scale geothermal power plants.

The potential of large-scale geothermal energy for satisfying the world's growing energy requirements is enormous. For example, it has been estimated that the total heat available within the upper 5 kilometres of the Earth's surface is about 140x106 EJ. If only 1% of this could be used at the current rate of world energy consumption of about 500 EJ/year, this would provide the world with all its energy for 2,800 years.[520]

In 2008 the US Geological Survey conducted an updated assessment of the United States' geothermal resources, concluding that identified geothermal systems within just the US had a combined power generation potential of 9,057 megawatts, while the average estimate of the potential power generating ability of undiscovered geothermal resources was 30,033 megawatts.[521]

Scientifically, there are three fundamentally different types of geothermal energy:

- In areas of geological instability and volcanic activity, such as the Philippines and New Zealand, there are volcanic or magmatic reserves and vapour-dominated systems. These resources rely on natural systems where water is heated and comes to the surface as steam. This steam is used to generate electricity through the use of conventional turbines.

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520 I Johnston, G Narsilio and S Colls, "Emerging Geothermal Technologies" (2011) 15(4) *KCSE Journal of Civil Engineering* 643 at 643.

521 C Williams et al, "Assessment of moderate- and high-temperature geothermal resources of the United States: U.S. Geological Survey Fact Sheet 2008-3082" (2008) *United States Geothermal Survey.*

- In many areas of the world, such as Australia, substantial reserves of hot groundwater exist, which can be used for heating purposes, although not for the generation of electricity as no steam is generated.
- Research has shown the widespread existence of hot dry rocks (HDR). This resource can exploited by the injection into the earth through drilled holes of cold water that becomes superheated on contact with underground heated rock and is discharged at the surface in the form of steam. HDR technology is still at the experimental stage, but is regarded as very promising. Various exploratory work has already been undertaken around the world.[522]

Despite the fundamental differences between these different types of geothermal resources, it appears from a legislative standpoint that they can be treated together. This is the experience of countries that have legislated in this field, which include 12 States of the United States, Queensland (Australia), British Colombia (Canada), New Zealand, Chile, Iceland, Vanuatu and the Philippines.

In general terms, this legislation seeks to establish a legal management regime in respect of the resource, much of which appears to be a modified version of legislation established many decades before to regulate and promote the exploration and production of petroleum and natural gas. The fact that the oil and gas legislation has been used as a close model for geothermal legislation is recognition of the fact that the processes of exploration and production of geothermal energy closely resemble that in operation in the oil and gas industry. The legislation already in effect in some countries also controls particular environmental problems associated with the geothermal energy industry; in some cases these environmental controls are contained in the country's environmental laws of general application, and in other cases the environmental controls are contained in the specific geothermal legislation (and sometimes a mixture of the two).

A. Can the Allocation and Management of Geothermal Resources be Effectively Conducted by Amendments to Legislation Controlling Other Natural Resources or Is New Legislation Specifically Controlling Geothermal Resources Required?

The first issue confronting legislative drafters is whether completely new legislation is required for geothermal energy or whether the existing mining or oil and gas legislation can be amended to achieve the same result.

If the amendment approach is adopted, geothermal water or steam could be deemed by legislation to be a "mineral", "gas" or "groundwater" so as to attract the operation of the legislation regulating minerals, oil and gas or groundwater (respectively). Precedents exist for all these alternative approaches. In the United States, for example, some States declare the resource to be "water",[523] some declare it to be a "mineral",[524] while the United States Court of Appeals, Ninth Circuit, held in *Reich v Commissioner of Internal Revenue*[525] that the resource is "gas" for the purpose of securing entitlement to the depletion allowance in the US Internal Revenue Code.[526] This approach

32 In Australia, for example, see http://arena.gov.au/files/2014/07/Geothermal-Energy-in-Australia.pdf.
523 See e.g. Wyoming: Wyo Stat. s 41-121(b); Nevada Rev Stat s 534A.040.
524 See e.g. Hawaii Rev Stat. s 182-1(1); Texas Rev Civ Stat Ann, art 1435a, s 4(2).
525 (1972) 454 F 2d 1157. Cf. US v Union Oil Co (1971) 549 F 2d 1271.
526 See P McDevitt and D Wells, "Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States" (1982) 22 Nat Res J 391 at 392ff.

is fundamentally appealing, as it would only require a simple amendment to the statutory definition of "mineral", "gas" or "groundwater" for geothermal resources to be included within the existing legislation. This approach may be appropriate in jurisdictions where only one of the different types of geothermal resources identified earlier is known to exist. Thus, for example, there is sufficient in common between the HDR resource and minerals generally possibly to justify a legislative declaration that the minerals legislation is deemed to include the HDR resource. Similarly, the obvious similarities between hot groundwater and groundwater reserves used for irrigation purposes may lead to a legislative declaration including this geothermal resource within the existing groundwater statutory regime.

Even in these situations, however, the notion of adapting existing legislation to include geothermal resources can be attacked, as on close analysis the similarities between geothermal resources and minerals, gas and groundwater break down. Geothermal resources are fundamentally different from groundwater as it is the heat energy, rather than the liquid content, which constitutes the resource. Fundamental differences also exist between geothermal resources, on the one hand, and minerals, oil and gas, on the other hand, as the latter must be burned or processed in order to produce heat energy, while the former is heat energy and requires no such processing. An additional factor is that minerals, oil and gas can be utilised directly, while the geothermal resource can only be exploited indirectly by means of steam or water that conveys the heat energy to the land surface.[527]

Thus, even in jurisdictions where only one of the various types of geothermal resources is known to exist, it is submitted that the preferred approach is to enact legislation specifically designed for geothermal energy rather than to enact amendments to existing legislation designed for other purposes. This conclusion applies a fortiori where two or more different types of geothermal resources are known to exist. The only way of adapting existing legislation in this situation would involve either grossly misclassifying one or more types of resource (for example, to declare hot groundwater to be a "mineral" or the HDR resource to be "groundwater") so as to ensure that all types of geothermal resource fall within the same legislation or to classify the various types of resources differently (for example, to treat the HDR resource as a mineral and hot groundwater as groundwater). Neither of these approaches would appear to be desirable on any analysis.

The conclusion that geothermal resources require separate legislation accords with the general experience in jurisdictions where the resource has been significantly exploited in the past.

II. THE FORMAT OF THE LEGISLATION

Although, as discussed above, certain geothermal resources share much in common with minerals and/or groundwater and could be regulated by a statutory regime similar to that established for either of these two types of natural resources, it is submitted that the preferred approach is to copy the format of the legislation established for petroleum exploration and production.

Difficulties arise in the context of production because of different environmental concerns affecting the development of hot groundwater as opposed to the HDR or geopressured types of geothermal resources. One method of tackling this problem would be to have one part of the new legislation devoted specifically to the production of the hot groundwater resource and a separate Part dealing

527 J W Aidlin, "Representing the Geothermal Resources Client" (1974) 19 Rocky Mt M L Inst 27 at 30-31.

with the production of all other types of geothermal resources. While this would be effective, it would be a cumbersome procedure and would significantly lengthen the statute. It is submitted that the preferred approach is to define hot groundwater as a low-temperature geothermal resource and to apply separate provisions as to this type of resource where required by the nature of the resource in the appropriate Part of the statute imposing environmental safeguards.

The new provisions regulating the exploration and production of geothermal resources could be included in two separate Parts of the Act and would form the bulk of the legislation. The statute also requires a Part relating to environmental safeguards. To be consistent with normal drafting techniques, any new geothermal legislation would also need a preliminary Part containing an interpretation section and provisions concerning the ownership of the resource, and a final Part dealing with miscellaneous matters such as the creation of offences and penalties, and the establishment of regulation-making powers.

Thus, the suggested format of the legislation is as follows:

Part I: General

Division 1: Interpretation

Division 2: Ownership of Resources

Part II: Exploration Permits

Part III: Production Leases

Part IV: Environmental Protection

Part V: Miscellaneous

A. Part I: General

1. Division 1: Interpretation

The legislation must define at the outset the types of resource intended to be included within its scope. The most appropriate method of achieving this is to include an exhaustive definition of "geothermal resources" within the interpretation section. In order to include the HDR resource, the definition must be stated to include water introduced underground (that is, injected water) as well as water occurring naturally underground. In addition, the definition must be stated to exclude resources included within the petroleum and minerals legislation.

As explained earlier, since it is necessary for the hot groundwater resource to be subject to some different provisions in the Part of the Act relating to environmental safeguards, it is also necessary to include a definition of "low-temperature geothermal resources" and to ensure that hot groundwater is excluded from the definition of "geothermal resources". The definition of "low-temperature geothermal resources" could be defined so as to include both a minimum temperature. The minimum temperature should be designed to ensure that normal groundwater reserves used for irrigation

purposes are not caught by the legislation. The minimum would ideally be the lowest figure at which the heated water is commercially exploitable. Scientific evidence suggests that this figure is in the range of 35ºC to 40ºC. See:

Alaska, USA, Drilling Regulations (AS 41.06.060) http://touchngo.com/lglcntr/akstats/Statutes/Title41/Chapter06/Section060.htm

The definition has been recently amended to the following:

(4) "geothermal fluid" means liquids and steam at temperatures greater than 120 degrees Celsius or any commercial use of liquids and steam naturally present in a geothermal system at temperatures less than 120 degrees Celsius;

(5) "geothermal resources"

(A) means the natural heat of the earth at temperatures greater than 120 degrees Celsius, or any use of that heat for commercial purposes, measured at the point where the highest-temperature resources encountered enter or contact a well or other resource extraction device or any commercial use of the natural heat of the earth;

(B) includes:

(i) the energy, including pressure, in whatever form present in, resulting from, created by, or that may be extracted from that natural heat;

(ii) the material medium, including steam and other gases, hot water, and hot brines constituting the geothermal fluid naturally present, as well as substances artificially introduced to serve as a heat transfer medium; and

(iii) all dissolved or entrained minerals and gases that may be obtained from the material medium, but excluding hydrocarbon substances and helium;"

British Colombia, Canada (Geothermal Resources Act 1996, c 171, § 1) http://www.bclaws.ca/civix/document/id/complete/statreg/96171_01#section1

*"geothermal resource" means the natural heat of the earth and all substances that derive an added value from it, including steam, water and water vapour heated by the natural heat of the earth and all substances dissolved in the steam, water or water vapour obtained from a well, but does not include

(a) water that has a temperature less than 80oC at the point where it reaches the surface, or

(b) hydrocarbons;..."

United States (30 USC § 1001(c)) https://www.law.cornell.edu/uscode/text/30/1001

Philippines (Presidential Decree No. 1442 (1978), § 1) http://www.lawphil.net/statutes/presdecs/pd1978/pd_1442_1978.html

Vanuatu (Geothermal Energy Act, c 197 (1988), § 1) http://www.paclii.org/cgi-bin/sinodisp/vu/legis/consol_act1988/gea183/gea183.html?stem=&synonyms=&query=geothermal%20and%20energy%20and%20act

California and New Mexico

Both jurisdictions have definitions using 'a temperature less than boiling point at the altitude of occurrence' rather than a reference to a specific temperature.

California: Public Resources Code Section 3703.1 http://codes.findlaw.com/ca/public-resources-code/prc-sect-3703-1.html

> Low-temperature geothermal resources: "fluids that have value by virtue of the heat contained therein and have a temperature that is not more than the boiling point of water at the altitude of occurrence."

New Mexico: Geothermal Resources Convention 75-1-3 http://law.justia.com/codes/new-mexico/2009/chapter-71/article-5/section-71-5-3/

> Low temperature geothermal resource: "a geothermal reservoir containing low temperature thermal water, which is defined as naturally heated water, the temperature of which is less than boiling at the altitude of occurrence, which has additional value by virtue of the heat contained therein and is found below the surface of the earth or in warm springs at the surface."

European Union

EU Directive 2009/28/EC, article 2(c) defines 'geothermal energy' as meaning energy stored in the form of heat beneath the surface of solid earth;

Based on the above, the author suggests legislation in which the following definitions might be used:

"Geothermal resources" means substances derived or derivable from the earth that are produced by natural phenomena, and include:

(a) all steam, water and water vapour or mixture thereof, that has been produced naturally or artificially by the injection of fluids to the source of energy; and

(b) all minerals naturally occurring in or derived or derivable from any steam, water or water vapour or mixture thereof, but does not include:

(c) petroleum, natural gas or helium; or

(d) water which constitutes low-temperature geothermal resources; or

(e) minerals which are extracted from the earth by the use directly or indirectly of geothermal resources".

"'Low-temperature geothermal resources' means water derived from the earth and produced naturally within the earth which has a temperature which does not exceed 100 degrees Celsius at the point at which it reaches the earth's surface and which is less than 40 degrees Celsius at the point at which it reaches the earth's surface".

2. Division 2: Ownership of Resource

The issue of ownership of the resource is a major policy issue that each legislature must address. This is not an issue where geothermal resources are developed on public land, as on any legal analysis the ownership rights will vest in the State. However, the issue will arise in respect of private lands. If the ownership issue is not resolved by legislation, claims to ownership may be lodged by both the surface landowner and by the State.

Except in the United States, other legislatures have vested ownership rights of geothermal resources in the State.

Thus, in British Colombia (Canada), the Geothermal Resources Act 1996, c 171, § 2 states:

"The right, title and interest in all geothermal resources in British Colombia are vested in and reserved to the government". http://www.bclaws.ca/civix/document/id/complete/statreg/96171_01

See also: Chile: Law on Geothermal Energy Concessions, Law No 19.657 (2000), Art. 4

http://www.leychile.cl/Navegar?idNorma=150669

Queensland, Australia: Geothermal Energy Act 2010

Section 28 defines the State ownership of geothermal energy as "(1) All geothermal energy on or below the surface of any land in the State is, and is taken always to have been, the property of the State. (2) To remove any doubt, it is declared that— (a) a person does not acquire any property in geothermal energy merely because the person discovers it or discovers geothermal resources from which geothermal energy may be extracted; and (b) subsection (1) applies whether or not the land is freehold or other land. (3) This section applies despite any other Act, grant, title or other document." https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/G/GeoEnA10.pdf

Vanuatu: Geothermal Energy Act, c 197 (1988), § 2 http://www.paclii.org/cgi-bin/sinodisp/vu/legis/consol_act/gea183/gea183.html?stem=&synonyms=&query=geothermal%20and%20energy%20and%20act

The Netherlands: Mining Act 2003

Includes geothermal energy (geothermal heat low 500m) in definition of subsoils – ownership vested in the state.

http://docplayer.net/12609755-Mining-act-of-the-netherlands-mijnbouwwet.html

Denmark: Danish Subsoil Act 2007

All Danish subsoils belong to Danish state, including geothermal resources http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=104299&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL (in Danish)

B. Part II: Exploration Permits[528]

Consistent with existing legislation, this Part of the legislation could contain provisions relating to the making of applications for exploration permits, the power to refuse or grant applications, the area for which a permit may be granted, the term of the permit, the permit fee, the duties of permit holders, the restrictions on drilling operations, and rules relating to the cancellation of permits. From a drafting standpoint, many of these issues present no difficulties. However, the following points should be noted:

1. The Area For Which the Permit May be Granted

The size of the block for which individual permits are issued must be specified. This could be left to the relevant Minister, in which case no specifying provision would be needed in the legislation. Alternatively, the maximum and minimum size of the block could be prescribed. See:

In Alaska, the minimum size is 40 acres and the maximum size is 2,560 acres (Alaska Stats. Ann., § 38.05.181(e)). http://law.justia.com/codes/alaska/2013/title-38/chapter-38.05/article-07/section-38.05.181

In California, the minimum and maximum is 640 acres and 5,760 acres (Public Resources Code, § 6922), http://codes.findlaw.com/ca/public-resources-code/prc-sect-6922.html

In Chile and Vanuatu, the maximum is 100,000 hectares and 100 km2 (respectively), but no minimum is specified (Law on Geothermal Energy Concessions, Law No. 19.657 (2000), Art. 7 (Chile) and Geothermal Energy Act, c 197 (1988), §11(4) (Vanuatu)). http://www.leychile.cl/Navegar?idNorma=150669 (Chile)

http://www.paclii.org/vu/legis/consol_act/gea183/index.html#p5 (Vanuatu).

In Queensland and the Northern Territory, Australia, the Geothermal Energy Act 2009 (NT) and the Geothermal Energy Act 2010 (Qld) split the Earth's surface of the Territory/State into 'Graticular Blocks'. Applications and grants are then made with reference to those blocks. Section 5 of NT Act states:

(1) For this Act, the land of the Territory is taken to be divided into graticular sections by the following lines:

  (a) the meridian of longitude 129 degrees east and each meridian of longitude east of it, with a distance of 1 minute between each of the meridians;

  (b) the parallel of latitude 26 degrees south and each parallel of latitude north of it, with a distance of 1 minute between each of the parallels.

(2) The geographical coordinates of the graticular sections are determined on the basis of GDA 94.

528 Sometimes referred to as "exploration leases", "prospecting licences", "prospecting permits", "exploration permit", "exploration concessions" or "service contracts".

(3) *A block* is so much of a graticular section that is within the land of the Territory.

(4) A reference in this Act to a block includes a reference to part of the block.

In the NT, application can only be made for one discrete area of blocks, that is, the blocks must be touching.

Qld: http://www5.austlii.edu.au/au/legis/qld/consol_act/gea2010183/NT: http://www.austlii.edu.au/au/legis/nt/consol_act/gea183/

A compromise form of legislation suggested by the author is as follows:

> "The area in respect of which an exploration permit is granted shall not be less than X hectares nor shall it exceed Y hectares, but if the Minister is satisfied that because of the unusual nature of the method of exploration to be undertaken or the kind of land applied for a greater area is necessary, the Minister may in his absolute discretion grant the permit in respect of a larger area than Y hectares".

2. Term of the permit

It is important for the term of the permit to be specified in a separate section of the legislation. The length of the term of the permit is a matter of judgment for the legislature. The length specified in existing geothermal statutes ranges from two years in Alaska (Alaska Stats Ann § 38.05.181) to two years plus a possible extension of two years in California (California: Public Resources Code, § 6910(b)).

See http://law.justia.com/codes/alaska/2013/title-38/chapter-38.05/article-07/section-38.05.181 for Alaska statutes and www.leginfo.ca.gov for California code.

In Queensland, Australia, s 40 of the Geothermal Energy Act 2010 states: "Provisions and granting of geothermal permit (1) If the Minister decides to grant the applicant a geothermal permit, the Minister must decide its provisions and grant the applicant the permit. (2) The permit must state its term and area. (3) The term must end no later than 5 years after the permit takes effect."

3. Duties of permit holder

As in petroleum exploration, the government has an interest in obtaining geological, surveying and other scientific and technical information that may be learned in the course of geothermal exploration. The government is also concerned to ensure that the permit holder conducts exploration with due diligence. These valid concerns can be appropriately be satisfied by a separate section of the legislation making certain requirements of the permit holder. See:

Geothermal Energy Act 2010 (Queensland, Australia) ss 109-121. https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/G/GeoEnA10.pdf

Geothermal Energy Act, c 197 (1988) (Vanuatu), §§ 15-18

http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=041740&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL See also: Geothermal Energy Act 1988 (Vanuatu), § 16

"16. Obligations of holder of prospecting licence

(1) The holder of a prospecting licence shall keep, to the satisfaction of the Director, full and accurate records of his prospecting operations which shall show –

(a) boreholes drilled, with detailed logs of strata penetrated;

(b) the results of any geochemical or geophysical analysis;

(c) the geological interpretation of the records maintained under paragraphs (a) and (b);

(d) other work done in connection with the prospecting licence; and

(e) such other matters as may be prescribed;

and shall supply, at least once every 3 months, copies of such records to the Director, together with any reports prepared as a result of such records.

(2) The holder of a prospecting licence shall, within 3 months after the expiration thereof, submit a report to the Minister setting forth all results of his prospecting operations in the area of the licence; such report shall be accompanied by –

(a) all geological, geochemical and geophysical maps, profiles, and diagram charts made by such holder;

(b) copies of all tests and analyses made by such holder;

(c) copies of all reports made by such holder;

(d) a statement of direct costs incurred by the holder in the prospecting programme."

Alternatively, the duties of the permit holder can be specified in the geothermal lease. In this case, the duties do not need to be specified in the legislation. See: Geothermal Energy Act 2010 (Queensland, Australia) s 11.

4. Selection criteria for the granting of licences

The Consolidated Act on the Use of Danish Subsoil (Denmark, 2011), s 18b sets out selection criteria for the granting of licences in order to aid the Minister in his or her discretion.

"Obligations of holder of prospecting licence

(1) The holder of a prospecting licence shall keep, to the satisfaction of the Director, full and accurate records of his prospecting operations which shall show –

(a) boreholes drilled, with detailed logs of strata penetrated;

(b) the results of any geochemical or geophysical analysis;

(c) the geological interpretation of the records maintained under paragraphs (a) and (b);

(d) other work done in connection with the prospecting licence; and

(e) such other matters as may be prescribed;

and shall supply, at least once every 3 months, copies of such records to the Director, together with any reports prepared as a result of such records.

(2) The holder of a prospecting licence shall, within 3 months after the expiration thereof, submit a report to the Minister setting forth all results of his prospecting operations in the area of the licence; such report shall be accompanied by –

(a) all geological, geochemical and geophysical maps, profiles, and diagram charts made by such holder;

(b) copies of all tests and analyses made by such holder;

(c) copies of all reports made by such holder;

(d) a statement of direct costs incurred by the holder in the prospecting programme.

C. Production Leases[529]

Based on existing geothermal legislation, this part of the legislation could contain provisions relating to the following matters:

1. The Size of the Leased Area

This issue is the parallel issue to the size of the area over which an exploration permit may be granted. The maximum and minimum sizes of the leased area specified in the Alaskan and Californian legislation are the same as those specified in respect of exploration permits by their statutes but add the statement that a person may not own, or hold an interest in, geothermal leases covering more than 51,200 acres and 25,600 acres, respectively.

The US Code Ch 30 s 1006, which applies in respect of federal lands in the United States, imposes a maximum limitation of 5,120 acres (previously 10,240 acres). https://www.law.cornell.edu/uscode/text/30/1006

529 Sometimes referred to as "production licences" or "exploitation concessions".

In Chile, the maximum area is 20,000 hectares (Law on Geothermal Energy

Concessions, Law No 19.657 (2000), Art. 7. http://www.leychile.cl/Navegar?idNorma=150669

It is a policy decision for the legislature whether to impose a similar limitation or whether to leave the size of individual leased areas to the discretion of the Minister. If it is thought desirable to specify maximum and/or minimum sizes, the form of legislation referred to in the context of exploration permits could be adapted for use in Part III of the Act.

2. The Rights Conferred By A Lease

The Act could specify the nature of the mining rights and the rights to the use of the land surface granted by the lease. A useful precedent is:

Victoria, Australia: Petroleum Act 1998, s 46

"A production licence authorises the holder of the licence, subject to and in accordance with the conditions of the licence—

(a) to carry out petroleum production in the licence area; and

(b) to carry out petroleum exploration in the licence area; and

(c) to do anything in the licence area that is necessary for, or incidental to, those purposes."

www.austlii.edu.au/au/legis/vic/consol_act/pa1998137/.

3. The Statutory Covenants And Conditions Of The Lease

The relevant Minister could be authorised to impose such covenants and conditions into a production lease as appear to him to be appropriate.

Vanuatu: Geothermal Energy Act, c 197 (1988), § 23

http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=041740&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

In addition to this general discretionary power, consistent with production leases of other types of natural resources, the geothermal legislation could specify a number of basic covenants and conditions that would be common to all geothermal leases. This, based on existing precedents, the legislation, as suggested by the author, could read:

"A lease shall contain the following covenants and conditions in addition to any other covenants and conditions which are prescribed by regulations, namely –

(a) A covenant by the lessee to pay royalty upon geothermal resources produced or obtained from the land at the rate of and in accordance with the scale prescribed by the regulations;

(b) in the case of a lease authorizing the injection of water into and its recovery from a natural reservoir – a covenant by the lessee to do all such acts and things as are prescribed or as the Minister may from time to time direct in writing to be done in relation to that injection or recovery;

(c) A covenant by the lessee to pay rent in the amount in the manner and at the times provided in this Act;

(d) A covenant by the lessee to use the land continuously and bona fide exclusively for the purpose for which it is demised and in accordance with this Act;

(e) A covenant by the lessee not to assign or let or part with the possession of the land or any part thereof without the previous consent in writing of the Minister;

(f) A covenant by the lessee to carry on all his operations in a good and workmanlike manner in accordance with recognised and approved methods and practice to the satisfaction of the Minister and to take all reasonable precautions to prevent waste of geothermal resources developed in the leased land;

(g) A covenant by the lessee to furnish to the Minister such reports as may be prescribed containing such particulars as may be prescribed relating to development works and structures in connection with the production of geothermal resources;

(h) Such other covenants and conditions as the Minister may think fit and specify".

The covenant to use the land continuously and in accordance with the Act mirrors a statutory term commonly included in petroleum production and mineral leases. Essentially it requires the lessee to exploit the leased land in a diligent manner and allows the lease to be terminated by forfeiture if the leased area is not worked expeditiously. Such a term is traditionally justified both on the public policy ground that it is in the public interest that the natural resources should be exploited efficiently, effectively and without unnecessary delay, and on the ground that in light of the competition for mineral or petroleum leases, if a lessee does not work the leased area expeditiously another lessee should be given the opportunity to do so.

Covenant (h), vesting a wide discretionary power in the Minister, may seem to be unnecessarily broad. However, such a clause is designed to cover unforeseen eventualities and/or special problems and issues that may arise concerning the exploitation of particular geothermal fields. An illustration of this might be the need for special measures concerning the support of buildings where geothermal development occurs close to urban or suburban areas. As will be shown later, a broadly drafted clause of this nature would also be useful in the environmental context.

4. Drilling Operations.

Existing geothermal statutes contain a number of provisions relating to the drilling of wells. See for example:

California Public Resources Code, §§ 3724-3726

www.leginfo.ca.gov.

One common requirement is to restrict the situation of the drill and to require that drilling does not take place too close to the outer boundaries of the leased area. This could be achieved by stating in the legislation that drilling shall not commence within a specified number of metres of the outer boundaries of the land demised:

California Public Resources Code, § 3757

www.leginfo.ca.gov.

Alternatively, the exact distance could be left in the discretion of the relevant government authority.

Consideration could also be given to the inclusion of a section requiring the lessee to drill at least one well within a specified period and to drill further wells within a reasonable period of time. Such a section has the same public policy justification as the covenant to use the land continuously and in accordance with the Act. The following is a precedent:

"(1) Each year in accordance with the regulations, a permittee must

(a) carry out in respect of the permittee's location geothermal exploration of a prescribed value, or

(b) make payments instead of the work.

(2) A permittee must record all work, including road construction giving access to the location, with the commissioner in the permit year in which it is done."

Source: British Colombia, Canada: Geothermal Resources Act 1996, c 171, § 7,

www.qp.gov.bc.ca/statreg/stat/G/96171_01.htm.

Finally, the legislation could require that a drilling log and core record be made.

California Public Resources Code §§ 3730-3732:

3730. The owner or operator of any well shall keep, or cause to be kept, a careful and accurate log, core record, and history of the drilling of the well.

3731. The log shall show the character and depth of the formation passed through or encountered in the drilling of the well, the amount, size and weight of casing used, and particularly the location, depth and temperature of water bearing strata, together with the temperature, chemical composition, and other chemical and physical characteristics of fluid encountered from time to time, so far as ascertained.

3731. The core record shall show the depth, character, and fluid content of the cores obtained, so far as determined."

Source: www.leginfo.ca.gov.

5. Access and Inspection

The majority of existing geothermal statutes contain a provision entitling the Minister or governmental official responsible for the operation of the legislation to enter geothermal fields at any time and to inspect the workings, plant and records. Such a right would appear to be essential to ensure that the terms of the legislation are complied with. See:

British Colombia, Canada: Geothermal Resources Act 1996, c 171, § 14 states:

"(1) At any reasonable time, persons authorised in writing by the division head have the right, with respect to a geothermal resource,

(a) to enter on and inspect any well or place at which geothermal resources are handled, processed or treated, and any place used or occupied for those purposes,

(b) to inspect all equipment, plant and records relating to the resource, and

(c) to take samples or particulars or carry out tests or examinations.

(2) If records required by the regulations to be kept are kept at a place other than a place referred to in subsection (1)(a), persons employed in the division and authorized in writing by the division head have the right, during normal business hours and after giving reasonable notice to the persons affected, to inspect the records, and for that purpose to enter the place where the records are kept.

(3) Persons authorized by the division head to exercise any of the powers in subsection (1) or (2) must produce on demand their authorization signed by the division head and their identification card signed by the Minister."

Source: www.qp.gov.bc.ca/statreg/stat/G/96171_01.htm

See : Chile: Law on Geothermal Energy Concessions, Law No 19.657 (2000), Art. 26http://www.leychile.cl/Navegar?idNorma=150669

6. Assignment of Leases

Under the normal law of leases in most countries, unless there is an express term in a lease to the contrary, a lessee may assign the premises without the consent of the lessor. Where there is an express term requiring the lessee to obtain the consent of the lessor to an assignment, in most jurisdictions statutory law requires that the consent shall not be unreasonably withheld. These rules will apply in the present context unless contrary statutory provision is made in the geothermal legislation. It may be thought appropriate to add such a contrary provision in light of the desirability of harnessing the resource in the public interest. In this regard, the interests of the State cannot realistically be equated with those of a private landlord. The author suggests that the following precedent could be used:

"(1) No lease or any land demised thereby or any interest in such lease or land shall be directly or indirectly assigned, transferred, sub-let, or be made the subject of any trust, except with the consent of the Minister first had and obtained, and any such dealing with such lease, or land made without such consent shall be void.

(2) The Minister may require to be furnished to him such information concerning any proposed transfer, assignment, or sub-letting, as he considers necessary or advisable.

(3) The Minister shall not be bound to consent to any such assignment, transfer or sub-letting.

(4) If any lease or any land demised thereby is assigned, transferred or sub-let, or made the subject of a trust, except with the consent of the Minister first had and obtained, the lease shall be forfeited to the State."

In Chile, there is a statutory right to assign production leases.

Article 24 of the Law on Geothermal Energy Concessions, Law No 19.657 (2000) states:

"Geothermal energy concessions may be assigned to third parties, in whole or in part. Such transfer shall be made through public deed. Upon execution of such public deed of assignment, the new holder of a concession shall surrogate the previous holder thereof, solely by operation of law, in the liabilities and rights under the concession." http://www.leychile.cl/Navegar?idNorma=150669&tipoVersion=0

In contrast, in Vanuatu the Geothermal Energy (Prospecting Licences) Regulations, c 197 (1988), reg. 5 provides that:

"a licence is not transferable except with the consent in writing of the Minister, who shall only grant such consent if he is satisfied as to the status of the new licensees as he would be for the grant of a new licence."

http://www.paclii.org/cgi-bin/sinodisp/vu/legis/consol_sub/gelr485/gelr485.html?stem=&synonyms=&query=geothermal%20and%20energy%20and%20prospecting%20and%20licences#disp10

7. Termination of Leases

Termination of leases may occur by forfeiture or by surrender. A separate provision in the legislation would be required for each eventuality.

a. Forfeiture

The legislature will presumably wish to retain discretion to exercise a right of forfeiture of a production lease wherever the lessee fails to comply with the terms of the lease or breaches the requirements of the Act. A suitable precedent would read:

"If the lessee fails to comply with the provisions of this Act or makes default in the performance or observance of any of the covenants and conditions of the lease, the lease shall for any such failure or default be voidable at the will of the Minister".

British Colombia, Canada: Geothermal Resources Act 1996, c 171, §§ 10-11www.qp.gov.bc.ca/statreg/stat/G/96171_01.htm

b. Surrender

Statutes relating to the exploitation of natural resources commonly include a provision entitling the production lessee to surrender the lease prior to its expiration through the effluxion of time. In order to avoid doubt, the legislation usually states that surrender does not affect any existing liability or obligation that arose during the term of the lease. The legislation also usually requires the lessee to make suitable provision for the conservation and protection of the property either prior to or after the surrender: See:

Geothermal Energy Act 2010, ss 301-304 (Queensland, Australia) www.legislation.qld.gov.au

Geothermal Energy Act, c 197 (1988), § 25 (Vanuatu)

www.paclii.org

The author suggests that a suitable precedent could read:

"(1) The lessee may with the written consent of the Minister surrender and terminate the lease upon the payment of all rents royalties and other obligations due and payable to the State.

(2) The surrender of a lease shall not release the lessee from any liability that arose during the term of the lease or on the surrender thereof, or from liability to comply with all the obligations under this Act.

(3) On the surrender of a lease the lessee shall immediately take all necessary steps to make the geothermal work to which the lease relates secure and safe in accordance with the regulations."

8. Unitilization Agreements and Orders

A commonly found provision in existing geothermal legislation is one or more requirements relating to unitisation agreements and orders: See:

British Colombia, Canada: Geothermal Resources Act 1996, c 171, §§ 18-19 www.qp.gov.bc.ca/statreg/stat/G/96171_01.htm;

USA: Geothermal Steam Act 1970, 30 USC, § 1017 https://www.law.cornell.edu/uscode/text/30/1017

Such agreements and orders require the production field to be treated as one field for the purposes of production. Unitisation enables the production by each lessee to be controlled by a certain formula. The advantages of unitisation are fourfold: it may prevent damage to the reservoir; it prevents unnecessary capital expenditures for drilling, casing and the completion of wells; it promotes conservation of the resource; and it entitles each developer to a fair share of production.[530]

The author suggests that a suitable precedent could read:

Compensation To Private Landowners

Considerable, but unavoidable, inconvenience and financial loss will inevitably occur to the surface landowner wherever geothermal exploration and production takes place on his land. The loss may range from crop loss or damage, and/or damage to the surface and deprivation of possession over certain parts of the land. Existing geothermal statutes entitle the surface owner to full compensation for all losses, subject to the qualification that no compensation is payable in respect of geothermal energy beneath the land. See:

Geothermal Energy Act 2010, ss 247-249 (Queensland, Australia).

www.legislation.qld.gov.au

Geothermal Energy Act, c 197 (1988), § 33 (Vanuatu)

www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation.

530 For a discussion of unitization, see G J Kitchen, "Geothermal Leasing Practices" (1977) 13 Land and Water L Rev 25 at 56.

The author suggests as an illustrative example:

"(1) Every person who –

(a) Has any estate or interest in any land injuriously affected by the exercise of any powers conferred by this Act or conferred by any exploration licence or production lease granted under this Act; or

(b) Suffers any damage from the exercise of any powers so conferred – shall be entitled to full compensation for all such loss, injury and damage suffered by him.

(2) The compensation to be made under this section shall be compensation for –

(a) deprivation of the possession of the surface or of any part of the surface;

(b) damage to the surface or any part thereof, and to any improvements thereon, which may arise from the carrying on operations by the Minister or the lessee thereon or thereunder;

(c) severance of the land from other land of the owner or occupier;

(d) surface rights of way; and

(e) all consequential damages: Provided that in determining the amount of compensation no allowance shall be made for any geothermal resources known or supposed to be in or under the land."

D. Part IV: Environmental Protection

Six environmental problems associated with the development and exploitation of geothermal resources exist: blowouts; atmospheric pollution; land subsidence; water pollution; noise; and well abandonment.

The first issue is the relationship between the general environmental legislation, which most countries now possess, and the specific environmental provisions to be included within the geothermal statute. Should the geothermal statute contain all the legislative measures necessary to control the various environmental problems associated with geothermal energy, or should the statute merely contain provisions relating to environmental problems that are not encompassed within the general environmental legislation? Existing geothermal legislation adopts the latter approach.

The second issue is that the different types of geothermal resources do not all share the same environmental problems. All types of geothermal resources may cause problems of land subsidence, water pollution and well abandonment. The other problems of noise, air pollution and blowouts may be caused by the HDR resource and geopressured systems, but not the hot groundwater resource. The problem could be resolved if the distinction between a "geothermal resource" and a "low-temperature geothermal resource" referred to above is accepted and added into the definition section of the Act. If this legislative framework is adopted, the various environmental provisions relating to blowouts, atmospheric pollution and noise can be stated in a separate subsection of the

relevant sections to be inapplicable to low-temperature geothermal resources, while the provisions relating to land subsidence, water pollution and well would be applicable to both geothermal resources and low-temperature geothermal resources.

Any comprehensive environmental legislation is likely to include measures designed to safeguard against atmospheric pollution, water pollution and noise. Unless otherwise stated in the legislation, these measures would automatically apply to geothermal operations. For this reason, assuming the existence of comprehensive environmental legislation, no specific provision relating to any of these matters would appear to be required in any new geothermal legislation. The problems of blowouts, land subsidence and well abandonment are unlikely to be encompassed by the general environmental legislation. Specific provisions dealing with each of these matters could be inserted in the geothermal statute:

1. Blowouts

A common approach is to impose a general duty of care on the geothermal operator. See for example:

> California Public Resources Code, § 3739
>
> "Any person engaged in operating any wells wherein high pressure are known to exist, and any person drilling for geothermal resources in any district where the pressures are unknown shall equip the well with casings of sufficient strength, and with such other safety devices as may be necessary, and shall use every reasonable effort and endeavour effectually to prevent blowouts, explosions, and fires."
>
> www.leginfo.ca.gov.

2. Land Subsidence

This problem can be dealt with administratively by the Minister if the geothermal statute gives the Minister the power to issue the lease subject to such conditions and covenants as he thinks fit, as referred to earlier.

3. Well Abandonment

A good example of legislation dealing with well abandonment is the following:

The Geothermal Energy Regulation 2012, reg 9, in Queensland, Australia states:

Section 9 Notice of completion, alteration or abandonment of geothermal well

(1) This section applies if—

(a) drilling of a geothermal well is completed; or

(b) the completion configuration of a geothermal well changes; or

(c) a geothermal well is abandoned.

(2) The geothermal tenure holder for the geothermal well must, within 10 business days after an event mentioned in subsection (1) happens, give the chief executive a notice stating that the event has happened.

Schedule 1, Part 1: Requirements for all geothermal wells

1. Abandonment to be consistent with good industry practice A geothermal well must be abandoned in compliance with good industry practice, to the extent that the practice is consistent with this regulation.

2. Capping of well A geothermal well must be capped with a metal plate inscribed with the following information—

(a) the identifying name of the well;

(b) the total depth in metres of the well;

(c) the date the well was abandoned.

3. Casing to be sealed

(1) The casing of a geothermal well must be sealed below ground level.

(2) The stub of the casing must be buried below the surface at a depth that—

(a) allows for efficient later re-entry to the well; and (b) will not adversely interfere with the normal activities of the owner of the land on which the well is located.

Source: https://www.legislation.qld.gov.au/legislatn/current/G/GeoEnR12.pdf

See also: California: Public Resources Code, §§ 3746-3750

www.leginfo.ca.gov

E. Part V: Miscellaneous

This part could contain the offences and penalties for breach of the legislation, as decided upon by the local legislature. This Part can also contain any regulations made under the legislation.

For offences and penalties, See: Chile: Law on Geothermal Energy Concessions, Law No 19.657 (2000), Arts. 43-44, http://www.leychile.cl/Navegar?idNorma=150669&tipoVersion=0

Vanuatu: Geothermal Energy Act, c 197 (1988), Part XII

www.paclii.org

British Colombia, Canada: Geothermal Resources Act 1996, c 171, § 22

www.qp.gov.bc.ca/statreg/stat/G/96171_01.htm.

III. CONCLUSION

Geothermal energy has many useful applications and is now being used to a considerable extent around the world. The chapter seeks to give the drafter of geothermal legislation guidance on the issues presented with this energy medium, from drilling, leasing and property rights provision through environmental protection and abandonment of geothermal properties.

SECTION SIX – RURAL APPLICATIONS

Ibibia Lucky Worika*

I. INTRODUCTION

In many developing countries, a large percentage of the population are poor and live in rural areas where basic amenities are lacking, electricity being one of these. Yet, many parts of the developing world are energy-resource rich. However, energy prices are often too high with poor delivery even in the few cases where it is accessible. This poses a great challenge to achieving sustainable development. Apart from exhaustibility, the extraction, transportation and use of fossil fuels have deleterious impact on man and the environment, thus raising questions on their long-term sustainability.[531]

Energy production, transmission and consumption are essential ingredients to the development process. If developing countries are to transform from predominantly rural to industrial economies, they must necessarily choose a more sustainable energy path,[532] one that is environmentally benign in the short, medium and long run. Concerned about, and importantly to improve the standard of living of the world's poor – many of whom are rural dwellers in developing countries – the United Nations General Assembly in 2015 adopted Sustainable Development Goals, of which SDG 7 declares:

"Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all," and stating: "Energy is central to nearly every major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, access to energy for all is essential."[533]

Moreover, studies have shown that there is a high correlation between the level of electricity consumption and human development index.[534] Indeed, this expressed goal, rather than an implied one as in the case of the previously adopted Millennium Development Goals, raises the profile of the need to ensure access to clean and affordable energy especially for rural dwellers in developing countries.

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41 Regarding the environmental impacts of energy production and consumption, see "A Second Asia –Pacific Expert Meeting on Promoting Sustainable Consumption and Production: A Background Paper", Seoul, Republic of Korea, 6th – 7th November 2003. Organized by the Government of Korea, UN Department of Economic and Social Affairs (UNDESA), United Nations Environment Programme (UNEP), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), available at: *http://esa.un.org/marrakechprocess/pdf/korea_report.pdf*

532 On the linkages between energy, poverty and economic growth, see D. Lallement, "Delivering Sustainable Energy Services for Poverty Reduction and Economic Growth", available at: *http://www.worldbank.org/html/fpd/esmap/pdfs/wec_dl.pdf.*

533 http://www.un.org/sustainabledevelopment/energy/.

534 See P. Meisen and I. Akin, "The Case for Meeting the Millennium Development Goals through Access to Clean Electricity" (2008), available at: http://www.geni.org/globalenergy/research/meeting-mdgs-through-access-toelectricity/MDG_Final_1208.pdf.

Rural electrification is especially significant in developing regions of the world where about one-and-one-half billion people lack access to modern energy services.[535] While rural electrification per se cannot ensure economic development, it is, however, a necessary condition to economic development. Rural electrification works best when overall conditions are right for rural income growth and when it is complemented by social and economic infrastructure development – such as rural water supplies, regional and feeder roads, health programs, and primary, secondary and college or technical education.[536] Rural electrification is, therefore, a sine qua non for rural economic development as it catalyses these complimentary programs.

That said, the challenge is to effectively provide affordable and clean energy services to large populations in rural areas and to reduce greenhouse gas emissions and other pollutants, without impeding development. This challenge, it is widely acknowledged, can be effectively met with adequate exploitation of renewable energy sources for rural electrification purposes and progressively ensuring energy efficiency. In support, the stated 'target' for achieving SDG 7 (on affordable, clean and sustainable energy for all) all depends on renewable energy development and as well improving energy efficiency.[537]

It is in this light that this chapter sets out to discuss the policy, legislative and regulatory framework for promoting energy efficiency and renewable energy for rural electrification and development, particularly in select developing countries in Asia (India and China as examples) and Africa (Nigeria and Ghana as examples), without precluding reference to other countries where lessons could be learned. Before this main aspect, the next section will provide a brief overview of the theme of the chapter.

A. Brief Overview of Rural Applications of Efficiency and Renewable Energy

Some who currently lack access to modern electricity in developing countries will be served by central grid connections, connecting villages and remote areas to a national grid often owned and operated by a public utility. This tendency to incrementally extend a grid to remote communities, however, is very costly, particularly for those areas that are farther from the national grid. Predictably, remote areas with small populations may remain unconnected.

Due to a lack of access to modern electricity, rural populations resort to burning large quantities of wood, agricultural residues, and dung to satisfy their everyday energy needs. For example, much of the cooking and home heating in developing countries is done using wood or coal burning stoves. Use of wood requires women and children to spend much of their time and energy collecting firewood. Using either wood or coal in enclosed buildings also exposes occupants, particularly women and children, to very concentrated health-damaging emissions and contributes considerably to carbon dioxide and other pollutants. Wood burning also causes other severe environmental hazards, including deforestation, followed by irreversible biodiversity loss.

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535 E. Martinot and K. Reiche, "Regulatory Approaches to Rural Electrification and Renewable Energy: Case Studies from Six Developing Countries", A Working Paper, June 2000, p. 1 quoting the World Bank see *http://www.martinot.info/Martinot_Reiche_WB.pdf.* See also "Renewable Power Policy/Regulatory Approaches Worldwide: An Overview." Available at: *http://www.worldenergy.org/wec-geis/global/downloads/accelerating/p3a_p_p.pdf.*

536 J. Goldemberg, "Rural Energy in Developing Countries", UNDP, *World Energy Assessment* (New York: UNDP, 2000) available at: http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/sustainable-energy/world-energy-assessment-energy-and-the-challenge-of-sustainability/World%20Energy%20Assessment-2000.pdf.

537 UN, 'Sustainable Development Goals', available at: https://sustainabledevelopment.un.org/?menu=1300.

Rural off-grid renewable energy electrification can provide a viable alternative to grid electrification as the cost of off-grid technologies continues to rapidly decline. Costs are declining because of proven and improved technologies, and increased demand and production. There are examples of both public and private-sector-led markets for off-grid electrification in rural areas of developing countries. These decentralized off-grid generation technologies have been demonstrated, especially in the field of renewable energy, for example using small-scale hydropower, photovoltaic, wind, and geothermal and small-scale bio power and producer gas electrification projects. There are confirmed experiences, for instance, in China, India, Kenya and Nigeria and many other developing countries.[538]

Even with respect to the particular issue of wood burning for cooking referred to earlier, a number of relatively cleaner alternatives that also help reduce the consumption of wood and coal exist, such as: fuel-efficient stoves and micro-hydropower and other renewable energy generators that provide clean electricity to rural off-grid communities.[539]

For a concrete example, Kenya has an outstanding cooking stove program, having adapted a Thai bucket ceramic-lined charcoal-burning stove that saves between 20% and 50% of the fuel otherwise used and now costs only a $1-3 U.S. dollar (USD) equivalent. There are now about 900,000 of these "Jiko" stoves in Kenya, reaching about 60% of urban households and 20% of rural homes. About 200 local firms produce the stoves. The Kenya program has been adopted in Tanzania, Uganda and Rwanda. Also, China established a "National Improved Stove Program" in 1992, which has provided over half of China's rural households with improved Chinese-manufactured stoves at a $9 USD equivalent per unit.[540] Inexpensive efficient stoves are available and in use in many places around the world now, which both reduce the amount of fuel needed and pollutant emissions.

II. POLICY GOALS FOR EFFICIENCY AND RENEWABLE ENERGY DECISION-MAKING

What policy goals can guide rural applications of efficiency and renewable energy decision-making in developing countries?

Sustainable development in developing countries can hardly be achieved without rural applications of efficiency and renewable energy, thus underscoring the necessity for a dynamic and efficient legislative and regulatory system. All such regulatory systems must require a number of tasks to be performed: as an exercise of policy-making. The goals of rural applications of efficiency and renewable energy regimes must be established; those goals must then be translated into the principles and rules that control behaviour of the principal actors; and there must be procedures

538 For case studies around the world on micro financing of rural energy enterprise employing renewable energy resources and technologies, see E+Co, an independent company that began as a Ford Foundation Program. *http://www.energyhouse.com/casestudy_world.htm*

539 E.g. hybrid fuels that incorporate biomass waste; biogas units that yield gas from waste agricultural materials; use of improved building materials and passive solar construction that reduce heating needs.

540 See "Chinese National Improved Stove Programme" available at http://www.bigee.net/en/policy/guide/appliances/policy_examples/12/. The first phase, from 1983 to 1992, focused on rapid dissemination with major subsidies to counties, households, and technical institutions in order to meet the challenges of energy shortages in rural areas as quickly as possible. The second phase, from about 1990 to 1995, was characterised by the reduction of subsidies to households and a push to increased commercialisation. In the third phase, after 1995, policy engagement was restricted to extension efforts such as advice and demonstration together with certifications for energy-saving devices.

adopted for explicating and enforcing the principles and rules and for the adjudication of disputes arising from them, all supported by facilitating legislation.[541]

While there is no single algorithm for determining universally applicable policy goals and legislation that can guide rural applications of efficiency and renewable energy decision-making, they can amongst others stress the need to:

- Promote rural applications of efficiency and renewable energy in all its ramifications;
- Maintain fair, just and reasonable rates for rural electricity consumption;
- Ensure uninterrupted electricity to rural areas;
- Promote rural energy efficiency;
- Promote technological innovations and transfer of renewable energy technologies to rural communities (and to the people who would directly benefit from their use);
- Facilitate and encourage effective competition, education, training and public participation;
- Improve people's lives and livelihoods; and
- Meet goals of sustainable development, including obligations and norms established in multilateral environmental agreements such as those for greenhouse gas emission reductions.

A. India Policy Goals

In India, the Central Government takes the lead in the formulation of renewable energy and energy efficiency policies, which commonly relate to rural electrification. Under its guidance and within its policy frameworks, State governments in India have also formulated laws and policies on the subject matters to further realize the national goals within their domain.

Some of such State Government policies, include: the 2012 Wind Power Project Policy of Madhya Pradesh (as amended in 2013);[542] the 2012 Policy for Power Generation through New and Renewable Energy Sources in Andaman and Nicobar Island;[543] the 2012 Andhra Pradesh Solar Power Policy;[544] the 2012 Kerala Small Hydro Power Policy; the 2009 Karnataka Renewable Energy Policy (as amended in 2010);[545] and the 2008 Maharashtra Policy for Power Generation from Non-Conventional Source of Energy,[546] among many others.[547]

541 See A. Ogus, *Regulation: Legal Form and Economic Theory* (Oxford: Oxford University Press, 1994), p. 99.
542 Compendium of State Government Policies on Renewable Energy Sector in India, GOVERNMENT OF MADHYA PRADESH, Wind Power Project Policy of Madhya Pradesh, 2012 (As Amended on 21st February 2013) Available at: http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/P%20Original/MP3.pdf.
543 GOVERNMENT OF ANDAMAN AND NICOBAR ISLAND Policy for Power Generation Through New and Renewable Energy Sources in Andaman and Nicobar Island- May 2012 Available at: http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/P%20Original/A&N.pdf.
544 GOVERNMENT OF ANDHRA PRADESH ABSTRACT Clean and Green Energy – Development of Solar Power in Andhra Pradesh – Andhra Pradesh Solar Power Policy – Amendment - Order – Issued. Available at: http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/P%20Original/AP3.pdf.
545 Government of Karnataka, KARNATAKA RENEWABLE ENERGY POLICY 2009-14 available at: http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/P%20Original/Kerala%203.pdf.
546 NEW POLICY FOR POWER GENERATION FROM NON-CONVENTIONAL SOURCES OF ENERGY -2008 Government of Maharashtra, available at: http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/P%20Original/MH%202.pdf.
547 For copies of other Indian State Government Policies on renewable energy and energy efficiency, see: http://www.ireda.gov.in/writereaddata/CompendiumStatePolicyRE/Program.htm.

These State policies have been largely inspired, as earlier alluded to, by the national laws and policies on renewable energy and energy efficiency with rural application, which contribute in providing direction for the nation in this regard. The major policies have interestingly been formulated and adopted in compliance with express provisions of a national Act, unlike what obtains in most jurisdictions where policies either metamorphose into or engender an Act on the subject matter. Perhaps, this Indian approach may have helped to raise the status of these policies from just being political instruments guiding State actions, to ones that actually require certain State action with some form of quasi-legal force.

One of such major policy – which is on energy in general – is the 2005 National Electricity Policy[548] (NEP) that was formulated pursuant to section 3(1) of the 2003 Electricity Act[549] which provides that:

"The Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments … based on optimal utilisation of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy."

Based on this provision, NEP aims to achieve certain objectives which include: access to electricity for all households in the next five years; the supply of reliable and quality power of specified standards in an efficient manner and at reasonable rates; and the protection of consumers' interests.

NEP contains a specific section on 'rural electrification' with provisions aimed at ensuring rural electrification in an efficient and affordable manner, including through off-grid renewable energy means, in the next five years. While there are other specific ambitious timelines concerning rural electrification that have been missed due to several challenges,[550] the NEP has certainly made progress in rural electrification and continues to provide guidance in this respect. However, the specific targets should be 'reviewed or revised' as provided in 3(3) of the Electricity Act.

Coming close behind the NEP is the general 2006 Tariff Policy[551] (TP) (with a 2008 amendment/addition[552]), developed pursuant to section 3(1) of the 2003 Electricity Act as quoted above. Its objectives include: ensuring availability of electricity to consumers at reasonable and competitive rates; ensuring financial viability of the sector and attracting investments; and promoting competition, efficiency in operations and improvements in quality of supply. In this context, the TP promotes 'subsidised electricity' for the poor and those in rural areas in order to improve their access to power. It discourages the provision of free electricity to this category of consumers on the ground that free electricity would encourage wasteful consumption of electricity.

A big push for rural electrification through renewables came later in 2006 with the adoption of the Rural Electrification Policy (REP).[553] The REP was formulated in compliance with sections 4 and 5 of the 2003 Electricity Act which together provide that Central Government shall, after consultation

548 Ministry of Power, Government of India "National Electricity Policy", available at: http://powermin.nic.in/National-Electricity-Policy-0.
549 Indian Electricity Act 2003, available at http://www.aegcl.co.in/INDIAN%20ELECTRICITY%20ACT%202003.pdf
550 S. Garud, "Rural Electrification: Challenges and the Way Ahead", *Power Watch, 17 April, 2015,* available at: http://powerwatchindia.com/rural-electrification-challenges-and-the-way-ahead/.
551 Ministry of Power, Government of India Tariff Policy available at: http://powermin.nic.in/upload/pdf/Tariff_Policy.pdf.
552 See Amendment to Tariff Policy, available at: http://www.aegcl.co.in/Amendment_Tariff_Policy%2031_03_2008.pdf
553 The Gazette of India, Rural Electrification Policy (No.44/26/05-RE (Vol-II), available at: http://www.aegcl.co.in/RE%20Policy%2023_08_2006.pdf.

with the State Governments, prepare a (detailed and specific) national policy on rural electrification and one 'permitting stand-alone systems (including those based on renewable sources of energy and other nonconventional sources of energy) for rural areas'. The REP goals are: provision of access to electricity to all households by year 2009; quality and reliable power supply at reasonable rates; and provision of a minimum lifeline consumption of 1 unit of electricity per household per day as a merit good (i.e. a free social good) by the year 2012. To achieve these goals, the REP contains diverse provisions for incorporating renewable energy and promoting energy efficiency by means that include local community participation and public awareness campaign. Although these goals are yet to be met, the REP has and continues to guide progress in this direction.

More recently, however, the India government would seem to be focusing on the formulation of policies specifically targeted at furthering the development of general application of renewable energy sources, which would indirectly lead to progress on the implementation of earlier policies as it relates to rural electrification. In 2008 for example, the Central Government adopted the Hydro Power Policy (HPP).[554] Considering India's need for clean energy to electrify power deficient regions especially the rural areas, and the fact that hydro power is its richest renewable resource – having a potential of about 150,000 MW of which only about 35,222 MW has been harnessed[555] the HPP was developed with the goals of: inducing private sector investment in hydro power development; harnessing the balance of hydro power potential; improving resettlement and rehabilitation of the affected population, especially rural dwellers; and facilitating financial viability.

On biofuels, the India government has adopted a 2008 National Policy on Biofuels (NPB)[556] with the goal of 'mainstreaming of biofuels; it envisions a central role for biofuels in the energy and transportation sectors of the country in coming decades' and '[a]n indicative target of 20% blending of biofuels, both for bio-diesel and bio-ethanol, by 2017 is proposed'. This policy is made, among others, with the objective that the development of biofuel production from renewable bio-mass resources will help 'meeting the energy needs of India's vast rural population' as well as 'stimulate rural development and create employment opportunities'. It is instructive to note that the Indian strategy and approach to biofuels under the policy is somewhat different from the current international approaches, which could lead to conflict with food security; it is based solely on non-food feedstocks to be raised on degraded or wastelands that are not suited to agriculture, thus largely avoiding a possible conflict of fuel vs. food security.

Most recently, the Indian government has produced the 2015 National Offshore Wind Energy Policy (NOWEP).[557] The government aims to replicate the success of onshore wind power development in India (with about 24 GW of wind energy capacity already installed and generating power) in the largely under-exploited offshore wind power development, especially as research has shown that India possesses the potential to establish at least a 1 GW offshore wind farm.[558] By the NOWEP, it aims to ensure the electrification, with clean and affordable energy, of regions that lack adequate power, and to achieve the objectives of: promoting spatial planning and management of maritime renewable energy resources in the exclusive economic zone (EEZ) of the country; achieving energy

554 India Hydro Power Policy available at: http://powermin.nic.in/upload/pdf/new_hydro_policy.pdf.
555 Ibid, i and ii (forewords).
556 India National Policy on Biofuels 2008 available on: http://mnre.gov.in/file- manager/UserFiles/biofuel_policy.pdf.
557 2015 National Offshore Wind Energy Policy available at http://mnre.gov.in/file-manager/UserFiles/National-Offshore-Wind-Energy-Policy.pdf.
558 Ibid, 9-10.

security; reducing carbon emissions; and encouraging indigenization of the offshore wind energy technology, among others.

A number of other policy-like measures exist in India with positive implications for rural electrification through renewable energy and energy efficiency. In this regard, the 2010 National Solar Mission[559] (NSM) and the 2010 National Mission on Enhanced Energy Efficiency[560] (NMEEE) are two of the eight key National Missions which comprise India's National Action Plan on Climate Change (aimed at climate change mitigation) launched in 2008. While the overall goal of NMEEE is to ensure that in the context of providing increasing energy to areas lacking (adequate) power, energy efficiency is promoted using various approaches and incentives, NSM aims to create an enabling policy framework for deploying 20,000 MW of solar power by 2022, and 20 million solar lighting systems for rural areas by 2022, among other measures.

B. China Policy Goals

China's policies on energy efficiency and renewable energy development fall into three categories. Its central government establishes the first two levels of policy. Local governments, including provincial, municipal, and county governments, establish the third level of policy with overall direction from the central government.

The first-level policies provide general direction and guidance, and include speeches of state leaders about development of renewable energy and the Chinese government's standpoint on the global environment. The second-level policies specify goals/objectives and development plans, focusing on rural electrification, renewable energy-based generation technologies and improved fuel wood facilities. These policies attempt to standardize the directions, focal points, and objectives of renewable energy development from different standpoints. Third-level policies consist of practical and specific incentives and managerial guidelines. These prescribe specific supporting measures for developing and using renewable energy.[561]

China regards the development of renewable energy as an important means to reduce the power sector's heavy reliance on coal, replacement of which is essential to reducing greenhouse gas (GHG) emissions, other pollutants and debilitating smog. Reducing local environmental damage is important as annual health and agricultural losses associated with coal-related air pollution in China are estimated to be as high as 6 percent of GDP. Hence China's most recent 12th Five-Year Plan (2011-2015) contains the following ambitious objectives on the development of renewable energy and improvement of energy efficient throughout the country: increasing non-fossil (primarily, renewable) energy to 11.4% of total energy use; achieving a 16% reduction in energy consumption per unit of GDP; and achieving a 17% reduction in carbon emissions per unit of GDP.[562]

559 Ministry of New and Renewable Energy, Indian National Solar Mission available at: http://indianpowersector.com/electricity-regulation/national-solar-mission/. See also http://www.mnre.gov.in/solar-mission/jnnsm/introduction-2/

560 See the National Mission on Enhanced Energy Efficiency available at https://beeindia.gov.in/content/nmeee-1

561 National Renewable Energy Laboratory (NRL), "Renewable Energy Policy in China: An Overview" (2004), available at: http://www.nrel.gov/docs/fy04osti/35786.pdf.

562 J Lewis, 'Energy and Climate Goals of China's 12th Five-Year Plan' (Centre for Climate and Energy Solutions, 2015), available at: http://www.c2es.org/international/key-country-policies/china/energy-climate-goals-twelfth-five-year-plan#_edn2.

Renewable energy also is a critical component of China's long-term energy strategy for rural development. With tens of millions of its citizens lacking electricity – primarily those living in isolated rural areas away from the power grid – the Chinese government has over the years steadily employed a number of policy initiatives aimed at providing rural electrification. Ostensibly, the ultimate Chinese policy goal in this regards is to fully electrify rural China, especially through the development and deployment of decentralised renewable energy systems, while ensuring efficiency, in a phased manner.[563] This much, for instance, can be gleaned from its 2005 Renewable Energy Law (as amended in 2009)[564] – designed to accelerate development of renewables in China – which mandates relevant authorities to develop further measures to realise this goal. It reads in part:

The Renewable Energy Law - The People's Republic of China

Chapter 4 Popularization and Application.

Article 18— The state shall encourage the development and utilization of renewable energies in rural areas.

The departments in charge of the energy work of the local people's governments at and above the county level shall, in conjunction with other relevant departments and in light of the need of the local economic and social development, ecological protection and comprehensive control of hygiene conditions, formulate renewable energy resource development planning for rural areas and, in light of the local conditions, popularize the use of marsh gas and other conversion of biomass resources, domestic solar energy, small-scale wind energy and small-scale hydro energy techniques.

The local people's governments at and above the county level shall provide financial support for renewable energy utilization projects in rural areas.

Source: http://english.mofcom.gov.cn/article/policyrelease/Businessregulations/201312/20131200432160.shtml

In light of the above thinking, China has since 1995 voiced new commitment to renewable energy, as outlined in the New and Renewable Energy Development Program (1996-2010) developed by the State Planning Commission (SPC), the State Science and Technology Commission (SSTC), and the State Economic and Trade Commission (SETC). This program is aimed at improving the efficiency of renewable energy technology applications, lowering production costs and enlarging the contribution of renewable energy to overall energy supply.[565]

Furthermore, the then State Development Planning Commission (renamed in 2003 as the National Development and Reform Commission (NDRC)) in 1996 launched the Brightness Programme (BP), the goal of which was to supply about 23 million people living in remote rural areas with electricity

563 National Renewable Energy Laboratory, 'Renewable Energy in China: Township Electrification Programme', available at: http://www.nrel.gov/docs/fy04osti/35788.pdf.

564 Renewable Energy Law, 2005 (as amended in 2009), available at: http://english.mofcom.gov.cn/article/policyrelease/Businessregulations/201312/20131200432160.shtml.

565 R.P. Taylor and V.S. Bogach, *China: A Strategy for International Assistance to Accelerate Renewable Energy Development* (World Bank Discussion Paper No. 388, Washington: World Bank, 1998) *iv.*

via decentralized energy systems based on renewable energy resources such as hydropower, solar and wind by 2010. Under the Brightness Programme, the Township Electrification Programme (2001-2005) (TEP), which focused among others on electrifying the remote Chinese villages with energy generated from renewable sources, was established; 1,065 villages were selected for the programme. Through the TEP, hundreds of PV/wind hybrid systems and small hydropower stations were built, supplying electricity to 989 rural townships and villages, thus providing electricity for 1.3 million people.[566]

Subsequently, the Village Electrification Programme (VEP) formulated in 2005, aimed to expand on the TEP's success by electrifying 20,000 villages in China's off-grid western regions with renewable sources by 2010.[567] Other such programmes include the County Hydropower Construction of National Rural Electrification Programme of the Ministry of Water Resources that aimed to build a total of 400 high-standard rural hydropower electrification systems in 400 counties by 2010. This aligns with the responsibility of water authorities to building small hydropower stations to replace conventional energy sources for cooking and heating, especially in the rural areas. Thus, by 2008, years of concerted effort in this regard meant that 45,000 small hydropower stations were installed with a combined capacity of 51 GW, supplying electricity to 300 million people living in rural areas with hydropower sources. In this context, the electrification rate in rural hydropower areas has been noted to have increased from 40% in 1980 to 99.96% in 2008.[568]

C. Nigeria Policy Goals

In Nigeria, policies on energy efficiency and renewable energy development have been mostly developed by the federal government. However, there has been no national policy dedicated specifically to energy efficiency and renewable energy or its applications to rural areas until recently. There are, however, other policy instruments on the environment and energy that are relevant to supporting such applications. Perhaps, the earliest of such instrument is the 1999 Nigerian National Policy on the Environment[569] which provides that the goal of the National Policy on the Environment is to achieve sustainable development in Nigeria, with partly sketchy strategies that include:

> '… developing a rational National Energy Utilization Master-Plan[491] that balances the need for conservation with the utilization of premium energy resources for premium socio-economic needs; encouraging the use of energy forms that are environmentally safe and sustainable, particularly solar energy; promoting and encouraging research for the development and use of various locally available energy sources especially non-conventional resources such as geothermal, solar, wind and other complex forms of hydrocarbons other than oil and coal'.[492]
>
> 491 Till date there is no such National Energy Utilization Master-Plan.
> 492 These form part of the mandate of the Energy Commission Act 1979 (as amended in 1988 and 1989) see http://www.energy.gov.ng/index.php?option=com_content&view=article&id=79

566 A Niez, *Comparative Study on Rural Electrification Policies in Emerging Economies: Keys to Successful Policies* (Paris: International Energy Agency and OECD, 2010) 45, available at: http://www.iea.org/publications/freepublications/publication/rural_elect.pdf.
567 UNESCAP, "Lighting up Remote Corners China's: Mini-grids for Rural Electrification", available at: http://www.unescap.org/sites/default/files/9.%20CS-China-mini-grids-for-rural-electrification.pdf
568 Niez, supra note 38 at p. 47.
569 National Policy on the Environment, 1999, available at: http://environment.gov.ng/index.php/downloads/6-national-policy-on-environment.

In 2001, the National Electric Power Policy[570] (NEPP) was adopted and approved by the relevant federal government authorities. Its overwhelming objective is to ensure that Nigeria has an electricity supply industry that can meet the needs of its citizens in the 21st Century. On rural electrification, the primary objective of NEPP is to expand access as rapidly as can be afforded in a cost-effective manner; in addition to implementation strategies; it also includes a full menu of options – grid and off-grid, mini-grid, non-thermal and renewables, etc., while ensuring close co-ordination of rural electrification expansion with economic development objectives and encouraging states, local communities as well as the private sector to develop and contribute financially to rural electrification.[571]

Considering that energy policies in Nigeria were hitherto fragmented, relating only to individual energy sub-sectors (e.g. electricity, oil and gas, solid minerals, renewables,) which in some cases resulted in conflicting policies and programmes, a multidimensional and integrated National Energy Policy[572] (NEP) was developed and adopted in 2003 to provide a much more comprehensive direction to the development of the entire energy sector.[573] Amongst others, it provides extensively for rural electrification through diverse renewable energy sources, and, unlike the NEPP 2001, it stresses the need to improve energy efficiency especially (but not exclusively) in rural areas, providing strategies for efficient energy technology development and use, in many points of the instrument. This tallies with one of its major goals: '[t]o ensure the development of the nation's energy resources, with diversified energy resources option, for the achievement of national energy security and an efficient energy delivery system with an optimal energy resource mix'.[574] And even though the NEP may require an update on a number of new issues, some of which have been covered by subsequent instruments, it remains a major catalyst for reform in the sector.

To increase the penetration of renewable energy use in the country, the government in 2006 formulated specifically a more elaborate overarching policy on all electricity derived from renewable energy sources, which is styled Renewable Electricity Policy Guidelines (REPG).[575] While the overall objective of the REPG is to expand the role of renewable electricity in sustainable development, a primary motivation for its adoption is that 'rural electricity access in Nigeria is less than 20%. … renewable electricity technologies are generally modular and are ideal candidates for improving rural electricity access.'[576] Among others, it contains the following rural-relevant policy goals along with relevant strategies to implement them: To expand the market for renewable electricity to at least five percent of total electricity generating capacity and a minimum of 5TWh of electric power production, excluding large hydropower by 2016; Construction of independent renewable electricity systems in areas not covered by the electricity grid; Development of innovative, cost-effective and practical measures to accelerate access to electricity services in rural areas through renewable sources; and Setting up of a Renewable Electricity Trust Fund to be governed by the Rural Electrification Fund.[577]

570 See Presidential Task Force on Power, "A New Policy and Regulatory Framework" available at http://www.nigeriapowerreform.org/index.php?option=com_content&view=article&id=79:policy-framework&catid=41&Itemid=304
571 See Banwo and Ighodalo, "A Succinct Guide to Investing in Nigeria's Renewable Energy Sector" available at http://www.banwo-ighodalo.com/assets/resources/6cbd0c5b298daf9fe0754887c856e429.pdf
572 See Energy Commission of Nigeria (ECN), "National Energy Policy 2003" available at http://www.energy.gov.ng/index.php?option=com_docman&task=cat_view&gid=34&Itemid=49
573 A 2013 Draft National Energy Policy incorporating elements of the 2003 policy document is still in the works.
574 Supra, note 46 at p. 8.
575 Nigeria Renewable Policy Guidelines available at: http://iceednigeria.org/backup/workspace/uploads/dec.-2006.pdf
576 Ibid, pp. 3 and 13.
577 Ibid, pp. 14-19.

At the peak of global promotion of the development and use of biofuel, the National Biofuel Policy and Incentive[578] (NBPI) was issued in 2007 for that purpose. The NBPI was formulated to link the agricultural sector with the energy sector, with the aim of promoting 'rural and agricultural development and technology acquisition and transfer'[579] among others. For the purpose of the policy, biofuel refers to "fuel ethanol and bio-diesel and other fuels made from biomass and primarily used for automotive, thermal and power generation, according to quality specifications stipulated by' relevant government agencies."[580] While biofuel is often regarded as clean energy, the furtherance of the aim of the policy would seem to have waned over the years, perhaps considering the criticism of this source of energy for its conflicting use of large amounts of food stocks and agricultural land for the 'cultivation' of energy.

Most importantly, the National Renewable Energy and Energy Efficiency Policy[581] (NREEEP) was recently approved by the Federal Executive Council in April 2015 to provide adequate guidance to policy makers and investors in this sector. The overall aim of this policy is 'the optimal utilization of the nation's energy resources for sustainable development' by exploiting renewable energy resources and ensuring energy efficiency.[582] The NREEEP remedies the lack of coherence, inadequate consideration of current electricity market reforms and privatization moves, as well as the narrowness of scope that bedevils earlier policies in the sector, by providing a coordinated, coherent and comprehensive framework that promotes renewable energy and energy efficiency, with rural electrification featuring prominently in several aspects of the instrument. It can be regarded as an umbrella document that largely harmonized and expounded on the aforementioned policies and strategies, as well as combining similar measures on renewable energy and energy efficiency in one document.

D. Ghana Policy Goals

In Ghana, the evolution of national energy policies can be traced to the enactment of the Provisional National Defence Council (PNDC) Law 62 in 1983, which provided the statutory foundations for the establishment and operations of a board known as the National Energy Board (NEB) that was responsible for formulating recommendations on energy policy and submitting it to the PNDC.[583] The current policy document guiding the development of the energy sector is the Energy Sector Development Programme (ESDP). According to Part II of the ESDP document, Ghana energy sector policies are shaped by the following needs amongst others, to:[584]

- plan for the sustained provision and security of energy supplies;

578 Official Gazette of the Nigerian Bio-fuel Policy and Incentives available at: http://www.sunbirdbioenergy.com/docs/Nigeria_E10_POLICY_GAZETTED.pdf
579 Ibid, p. 7.
580 Ibid, p. 4.
581 National Renewable Energy And Energy Efficiency Policy (NREEP) Approved by the Federal Executive Council For The Electricity Sector available at: http://www.power.gov.ng/download/NREEE%20POLICY%202015-%20FEC%20APPROVED%20COPY.pdf
582 Ibid, p. 1.
583 Ghana Provisional National Defense Council Law (PNDC) Law 62 of 1983. See J. P. Painuly and J. V. Fenhann, Implementation of Renewable Energy Technologies – Opportunities and Barriers: Ghana Country Study (Denmark: UNEP Collaborating Centre on Energy and Environment, 2001) p. 22: http://uneprisoe.org/RETs/Summ aryCountryStudies.pdf.
584 Ibid at p. 25.

- increase the reach of energy resources to all sections of the country to facilitate their socioeconomic improvements, especially the majority rural people;
- enhance private sector investment in the development of the energy sector; within the framework of meeting the country's energy requirements for sustained growth and development.

The energy sector's goals include:[585]

- restore improved productivity and efficiency in the procurement, transformation, distribution and use of all energy resources;
- reduce the country's vulnerability to short-term disruptions in energy resources and supply availabilities; and
- consolidate and further accelerate the development and use of the country's indigenous energy sources, especially wood fuels, hydropower, petroleum and solar energy.

Amongst the action programs developed by the Ministry of Mines and Energy for the energy sector for the short, medium and long-terms are: The Renewable Energy Development Programme (REDP); The Power (Electricity) sub-sector; and The Energy Efficiency & Conservation Programme.[586]

The implementation strategy for all renewable energy projects is on a demand-driven basis within the following criteria: sustainability, payment for service and cost recovery, full involvement of potential users, environmental considerations and the basic needs of the community or users. Also considering that most of the renewable energy technologies are still at their infancy, the Ministry of Mines and Energy proposed to subsidize the sector for interested investors in order to encourage accelerated penetration of renewable energy technologies in the market.[587]

There is also a power sector development program (PSDP), which strategy and action plan are aimed at achieving the following objectives amongst others:[588]

- Extension of reach of electricity to all parts of the country, especially to the rural areas, under a National Electrification Scheme (NES) by the year 2020; and
- Assuring future supply of power by developing new hydro resources as well as complementing the predominantly hydropower generation capacity with other energy sources such as thermal generation.[589]

In 2010, the Ghanaian government adopted an holistic National Energy Policy[590] (NEP) for the country following its discovery of petroleum resources in commercial quantities in 2007. The NEP outlines the goals, challenges and actions as related to diverse energy sub-sectors and issues including the power subsector, the renewable energy subsector and the issue of energy efficiency and conservation. The NEP aims to provide affordable access to electricity to all communities by

585 Ibid at p. 26.
586 Ibid.
587 I. Edjekumhene *et al,* "Implementation of Renewable Energy Technology: Opportunities and Barriers – Ghana Country Study" (UNEP Collaborating Centre on Energy and Environment, Denmark, 2001) at pp. 28-29, available at: http://gold.unepdtu.org/RETs/GhanaCountryStudy.pdf.
588 Ibid at p. 30.
589 The implementing legislation and regulations will be examined in the next subsection dealing with regulations.
590 Ministry of Energy, National Energy Policy (February 10, 2010) available at: http://ghanaoilwatch.org/images/laws/national_energy_policy.pdf.

2020 and becoming a net exporter of electricity to neighbouring countries by 2015. To achieve this objective, the government commits under the NEP to pursuing, among others, the following policy actions:

- Establishment of a sustainable internally generated funding mechanism for rural electrification;
- Support of new service connections for electricity in rural areas;
- Addressing institutional and market constraints that hamper increasing electricity access to the poor; and

promoting productive uses of electricity as an integral part of the Rural Electrification Programme.

Furthermore, the NEP aims to increase the proportion of renewable energy – particularly solar, wind, mini hydro and waste-to-energy – in the national energy supply mix to 10% by 2020. Also, the policy aims to ensure efficient production and transportation as well as end-use efficiency and conservation of energy, and the policy measures required to promote energy efficiency and conservation include fiscal incentives, public awareness creation, institutional and human resource capacity development (including the establishment of a Centre for Energy Efficiency), and legislation against the local production, importation and use high energy consuming vehicles and inefficient electricity consuming equipment.

The fact that the implementation of NEP will require putting in place new legislation for renewable energy resources development was acknowledged by the Energy Minister in the foreword to the policy. Such a legislation, which also touches on issue of energy efficiency, was indeed put in place in 2011 and will be discussed subsequently.

III. LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

What legislative measures can best advance rural applications of energy efficiency and renewable energy in developing countries?

In most jurisdictions, principal legislation in the power sector usually establishes an electricity regulatory board or regulatory agencies with powers to process and recommend applications for licenses, set, review and adjust transmission and distribution tariffs, enforce environmental and safety regulations, investigate complaints, ensure there is competition, and approve power purchase contracts and transmission and distribution contracts. The provisions are usually broad and permissive, with the enactment of subsidiary legislation or regulations to deal with specific aspects of electricity regulation. Since the bulk of regulatory matters are usually addressed through subsidiary legislation or regulations in order to maintain a fair degree of flexibility in dealing with ever-changing and fluid power sector needs, an opportunity exists for regulating off-grid electrification in rural areas not easily accessible by the grid network. Additionally, other statutes may complement the electric power legislation in the regulation of the power sub-sector by paying specific attention to rural applications of efficiency and renewable energy.

Regulations and energy policies have a direct impact on the success of energy markets generally, market participants and stakeholders, as well as products and services. However, the exact nature and scope of this impact will depend on the effectiveness of the implementing agencies

or institutions. Regulatory institutions can either promote or defeat the goals of regulatory policy captured in legislation or regulations. Every regulatory institution needs at least to have:

- A clearly defined organizational structure;
- A hierarchical relationship within its structure;
- Sufficient qualified staffing and financing;
- Strategic policy goals;
- Internal and external reporting requirements;
- Licensing provisions; and
- Consultation, hearing and expeditious approval processes; and
- Strong Enforcement measures with stiff penalties and citizen suit provisions.

The legislative and regulatory provisions for promotion and regulation of energy efficiency and renewable energy are addressed below for India, China, Nigeria, Ghana and Kenya as typical of countries in transition and developing countries. In some cases the laws of other countries are discussed, including some comparisons to the laws of developed countries.

A. India

In India, the Electricity Act of 2003 seeks to create a liberal framework of development for the power sector by distancing the Government from regulation, while promoting efficient and environmentally benign policies.[591] Despite this fact, and apart from environmental laws, there is no countrywide renewable energy legislation specifically applicable to rural areas in India.[592] It is, however, noteworthy that sections 3, 4 and 5 of the Electricity Act 2003 makes it imperative on the Central Government, after consultation with the State Governments, to prepare and publicise national policies that support energy efficiency and rural electrification through renewables as earlier discussed.

With respect to energy efficiency, the Energy Conservation Act[593] was enacted in 2001. It addresses the use and conservation of energy in an attempt to reduce the amount of new generating capacity needed. The Act applies to the whole of India except the state of Jammu and Kashmir.[594] One of the distinctive features of this Act is the incorporation and establishment of a Bureau of Energy Efficiency (BEE) in Chapter II to assist in making policies and regulations concerning energy efficiency and

591 The Electricity Act 2003 (No. 36 of 2003), available at: http://powermin.nic.in/The%20Electricity%20Act_2003.pdf... A review of India's old electricity laws beginning with the Indian Electricity Act of 1910, the Electricity (Supply) Act of 1948 and Electricity Regulatory Commission Act 1998 (all now superseded by the 2003 Act) indicates that these pieces of legislations were not actually directed at efficiency and renewable energy applications for rural electrification. See Government of India, Ministry of Power, "Historical Background of Legislative Initiatives", available at: http://powermin.nic.in/upload/pdf/Historical_Back_Ground.pdf.

592 For Environmental law resources including specific legislation on the Indian Environment see, http://www.moef.gov.in/.

593 No. 52 of 2001, available at: http://powermin.nic.in/upload/pdf/ecact2001.pdf. Article 2 of the Energy Conservation Act 2001 defines "energy" as "any form of energy derived from fossil fuels, nuclear substance or materials, hydro-electricity and includes electrical energy or electricity generated from renewable sources of energy, or biomass connected to the grid."

594 See Article 1(2). The Act does not apply to the state of Jammu and Kashmir as the power of the Indian Parliament to make laws for the said state is limited by section 370 of the Constitution of India, available at: http://www.constitution.org/cons/india/const.html.

conservation.[595] Further, its functions amongst others are to formulate and facilitate implementation of pilot projects and demonstration projects for promotion of efficient use of energy and its conservation; and promote the use of energy efficient processes, equipment, devices and systems. So far, the BEE has been quite active in executing its function: it has introduced and is advancing energy-labelling requirements and standards, building codes, and certification programmes, among other initiatives, to reduce the energy intensity of India's GDP growth.[596]

India's current regulatory framework for efficiency and renewable energy applications of rural electrification oscillates somewhere between the Electricity Act of 2003 and the Energy Conservation Act of 2001. However, the absence of legislation for the mandatory purchase of renewable power, absence of a green power market, and financially weak utilities are some of the barriers facing the State Electricity Regulatory Commissions in promoting renewable power.[597] India is direly in need of a renewable energy electricity law that will set the stage for rural applications of renewable energy.

However India is the only country that has a cabinet level office just for renewable energy, the Ministry of New and Renewable Energy[598] (MNRE) created in 2006. It is the administrative ministry for policies and programs in all matters related to the development and deployment of new and renewable energy in India. The Ministry is organized into several divisions, each dealing with a separate set of technologies and applications. The extension programs of the Ministry are largely implemented through State "Nodal" Agencies. These agencies in turn mobilize participation of local institutions, non-governmental organizations (NGOs) and village level organizations for implementation of programs. R&D programs also are sponsored by the Ministry, mainly in educational institutions, national laboratories and to some extent, in industries, in the public and private sectors.[599]

The 25 year old Solar Energy Centre under MNRE was converted in 2013 to an autonomous institution – the National Institute of Solar Energy (NISE) – to assist the Ministry in implementing the National Solar Mission; the institute is involved in development, demonstration, standardization, interactive research, and training and testing of solar technologies and systems.[600] In India, there has been a long-standing program of financial incentives for solar photovoltaic electricity, however it has only resulted in 50,000 solar home systems and 30,000 solar streetlights.[601]

Another institution, the National Institute of Wind Energy (NIWE) (formally Centre for Wind Energy Technology) has been created to provide technical support to MNRE in the implementation of wind energy programs.[602] Besides, a National Institute of Renewable Energy (NIRE) has been set up at Punjab to cater to research and developmental activities in the area of bio-energy, as well as the commercialization of renewable technologies in this regard, all in a manner that supports the 'rural energy sector' among others[603]

595 Department of Energy, U.S., "An Energy Overview of India" http://www.fe.doe.gov/international/South_and_Southwest_Asia/indiover.html, p. 6 of 37.
596 See https://beeindia.gov.in/.
597 "Renewable Energy Power: An Indian Perspective", Issue 6 & 7, Energy Technology News, January and April 2002, available at: http://www.teriin.org/opet/articles/art10.htm.
598 See, http://mnre.gov.in/
599 See ibid.
600 See NISE: http://nise.res.in/.
601 See E. Martinot and K. Reiche, supra at note 7. See also A. Barnett, "The Diffusion of Energy Technology in Rural Areas of Developing Countries: A Synthesis of Recent Experience" 18(4) World Development 539-53 (1990).
602 See NIWE: http://niwe.res.in.
603 See NIRE: http://www.nire.res.in/. http://www.worldenergy.org/wec-geis/publications/reports/renewable/country_reports/chap_2_3_3.asp.

Furthermore, the India Renewable Energy Development Agency (IREDA) promotes, develops and extends financial assistance for renewable energy and energy efficiency/conservation projects.[604] Established in 1987 as a Public Sector Enterprise, under the administrative control of MNRE, IREDA has been spearheading the mission to ensure "Energy for All". IREDA has over the years evolved into a unique development and financial institution in the renewable energy sector, reaching out to the individual user and providing micro-credit through financial intermediaries.

It can be said that India considers new and renewable energy development and deployment to be of great importance for long-term energy supply security, decentralization of energy supply (particularly for the benefit of the rural population), and environmental benefits and sustainability. In this context, the Indian renewable energy program is a goal-oriented effort to meet the country's energy needs in an environmentally sound way.[605] Even at that, there appears to be an urgent need for promotional and regulatory measures that can widen the role of and demand for renewable energy generation and use, particularly in rural communities. Although a few of the states have begun legislative reforms in the electricity sector – Orissa, Haryana and Andhra Pradesh – more still needs to be done in the form of a country-wide integrated legislative program. Most of the existing reforms are aimed at extending existing grid-networks. In many instances extension of the national grid does not meet the needs of unserved rural communities because extension of the grid is expensive and not likely to happen in communities with small populations. Community solar energy is usually more suitable and economic for these areas.[606]

B. China

China has put top priority on developing renewable energy because of the devastating pollution in all of its cities derived primarily from the burning of coal for electricity, industry and even residential heating and cooking. In just a dozen years, China went from having virtually no renewable energy to become today the world leader in solar thermal, solar photovoltaic, wind, and hydroelectric energy, both in domestic installations and, for solar panels and wind machines, in exports.

This progress has largely been aided by a number of laws promulgated by the Chinese Central Government which contain provisions that address and have positive implications for the development of renewable energy and improvement of energy efficiency for the advancement of rural areas in China. One of such is the 1993 Agriculture Law of the Peoples Republic of China (as revised in 2002 and became effective in 2003).[607] It aims, as revealed in its Article 1, to 'deepening the reform in rural areas' and promote 'sustained, steady and sound growth of agriculture and the rural economy', among others. To achieve this, Article 57 of the law provides that '[i]n the development of agriculture and the rural economy, attention shall be paid… to the rational development and use of renewable and clean sources of energy such as hydro-energy, marsh gas, solar energy and wind energy'.

Mainly to enhance energy utilization efficiency and, partially, to further promote renewables, China

604 See IREDA: http://www.ireda.gov.in/...
605 See generally MNRE, "About Us", available at: http://mnre.gov.in/mission-and-vision-2/mission-and-vision/.
606 For more on India, renewable energy and energy efficiency, see: Reegle, 'India', available at: http://www.reegle.info/policy-and-regulatory-overviews/IN.
607 Order of the President of the People's Republic of China (No. 81), available at: http://www.wipo.int/edocs/lexdocs/laws/en/cn/cn157en.pdf.

promulgated the 1997 Energy Conservation Law of the People's Republic of China (as revised in 2007 and became effective in 2008).[608] As part of its strategies for improving energy efficiency in China, it provides for the restriction of development of high-energy-consumption and high-pollution industries; the development of energy-saving and environmentally friendly industries; incorporation of energy conservation knowledge into national education and training systems; and the institution of energy efficiency labelling system, among others. Article 59 of the law focuses on rural areas as follows:

> *People's governments at or above the county level shall… [provide for] multiple forms of energy to complement each other,… strengthen the energy conservation work in agriculture and rural areas, and increase the capital investment into popularization and application of energy conservation technologies and products in agricultural and rural areas… The State encourages and supports vigorous development of marsh gas, and popularizes biomass, solar power, wind power and other renewable energy in rural areas, develops small-scale water power generation, popularizes energy saving rural houses and stoves, etc.*

China's Electricity Law of 1995 went into effect April 1, 1996.[609] Several articles of the law encourage the use of cleaner fuels, such as natural gas and liquefied petroleum gas, and require environmental facilities to be built in tandem with new power generation facilities.[610]

China: The Electricity Law of 1995

The 1995 Electricity Law also extends support to solar, wind, geothermal and biomass energy for power. It provides that:

"The construction, production, supply and utilization of electric power shall protect the environment according to law, adopt new technologies, minimize discharge of poisonous waste, and prevent pollution and other public hazards. The State encourages and supports electricity generation by using renewable and clean energy resources."[491]

491 Article 5.

Chapter VI deals with the subject of "Rural Electric Power Construction and Agricultural Utilization of Electricity".[611] Article 48 provides that:

"The State advocates the exploitation of rural hydropower resources, the construction of medium size hydropower stations to promote rural electrification. The State encourages and supports rural areas to utilize solar energy, wind energy, geothermal energy, biomass energy, and other energy resources to develop rural electric power sources and to increase the rural power supply."

608 Order of the President of the People's Republic of China (No. 77), available at: faolex.fao.org/docs/texts/chn76322E.doc.
609 Order of the President of the People's Republic of China (No. 60), available at: http://www.asianlii.org/cn/legis/cen/laws/eplotproc429/.).
610 Ibid.
611 Article 48.

Full text available at: http://www.asianlii.org/cn/legis/cen/laws/eplotproc429/

In 2005, China passed a new Renewable Energy Law to go into effect in January 31, 2006, designed to further promote and regulate renewable energy, providing inter alia:

China: The Renewable Energy Law of 2005

Article 4—The Government lists the development of utilization of renewable energy as the preferential area for energy development and promotes the construction and development of the renewable energy market by establishing total volume for the development of renewable energy and taking corresponding measures.

The Government encourages economic entities of all ownerships to participate in the development and utilization of renewable energy and protects legal rights and interests of the developers and users of renewable energy on the basis of law.

Article 8—Energy authorities of the State Council shall, on the basis of the middle and long-term total volume target of renewable energy throughout the country, prepare national renewable energy development and utilization plan, which is to be implemented after being approved by the State Council.[491]

491 Available at: http://english.mofcom.gov.cn/article/policyreleaseBusinessregulations/201312/20131200432160.shtml.

Amongst others, the law would enforce such coercive measures as the prescribed proportion of renewable energy in the total electricity output, so as to expand the market share of renewable energy.[612] The law provides a legal framework for the implementation of incentives aimed at encouraging the development of renewable technologies and provides market opportunities for renewable energy companies so that local governments, energy enterprises and the public can themselves promote and utilize renewable energy.[613] The overall objective of the law is to meet short-term energy needs while strengthening long-term sustainable development objectives. Amongst others, the law aims to reduce air pollution, safeguard human health and the environment, provide power to off-grid rural areas as well as contribute to mitigating climate change. It will blend the basic principles of the market economy with the political objectives of energy security.[614]

The fourth session of the Standing Committee of the 11th National People's Congress passed the Circular Economy Promotion Law of the People's Republic of China[615] on August 29, 2008, to take effect from January 1, 2009. This law is closely correlated to the Renewable Energy Law, and aims to facilitate recycling, raise resource utilization efficiency, protect and improve the environment and realise sustainable development in both urban and rural areas.

612 See Article 14.
613 See Chapter IV.
614 National Renewable Energy Laboratory (NREL), "Renewable Energy Policy in China: Overview" (2004), available at: http://www.nrel.gov/docs/fy04osti/35786.pdf.
615 Order of the President of the People's Republic of China (No. 4), available at: http://www.fdi.gov cn/1800000121_39_597_0_7.html.

Importantly, on 24 April, 2014, the Chinese government promulgated the Environmental Protection Law of the People's Republic of China (ELP),[616] a substantial revision of China's 1989 Environmental Protection Law. This new law which came into force on 1 January, 2015, is aimed, as provided in Article 1, at protecting and improving the environment, preventing and controlling pollution, promoting ecological civilization improvement and facilitating sustainable development. To achieve these goals, the ELP contains provisions on renewable energy and efficiency development applicable and potentially beneficial to rural dwellers. It provides, in section 40, that relevant departments of the State Council and local people's governments shall adopt measures to promote the production and use of clean energy, and therein mandates enterprises to give priority to the introduction and adoption of clean energy, as well as processes and facilities with higher resource efficiency.

In addition, the ELP obliges citizens in Article 6 to adopt a low-carbon and energy-saving lifestyle. State authorities and other institutions financed by fiscal funds are also required under Article 35 to, among others, give priority to the purchase and use of energy-efficient facilities that support environmental protection. And to avoid the situation under the 1989 EPL where NGO and individuals were severely limited in their ability to sue for environmental degradation, section 58 of the 2014 EPL tries to remedy this by authorizing relevant NGOs to bring suits against polluters on behalf of the public; in addition, the provisions like Articles 59 and 68 stipulate for increased penalties and accountability for violation on the part of polluters and government bodies and officials. Although this new section 58 provision arguably has some potential limitation to its impact,[617] it is acknowledged as a significant step forward. This is especially so in light of the more than one hundred environmental tribunals established at local courts in China and the latest Environmental and Resources Tribunal of the Supreme People's Court, set up in 2014 by China's Supreme Court to better implement the revised ELP,[618] all of which will hopefully constitute a viable fora for giving effect to section 58.

In China, several institutions are involved in rural applications of efficiency and renewable energy. Currently, five major government institutions have different functions and responsibilities in this regard. There is the State Electricity Regulatory Commission (SERC), the State Grid Corporation of China (SGCC), the Ministry of Water Resources (MWR), the Ministry of Agriculture (MOA) and, over all of these, the National Development and Reform Commission (NDRC) – all considered to be influential in the field of rural electrification,[619] together with other relatively minor but specialized bodies.

Such bodies include the Energy Research Institute (ERI) of the NDRC which is the only energy, economy and policy research institute at the national level in China.[620] Its scope of research covers the fields of energy production, distribution, consumption and efficiency. The main focus is on scientific studies in the fields of energy economy, improvement of energy efficiency, energy

616 Available at: https://www.chinadialogue.net/Environmental-Protection-Law-2014-eversion.pdf.
617 See R. L. Falk and J. Wee, 'China's New Environmental Protection Law: Implications for Overseas Investors, Joint Ventures and Trading Partners' (Morrison & Foerster LLP, 2014) 3, available at: http://www.mofo.com/~/media/Files/ClientAlert/2014/09/140930ChinasNewEnvironmentalProtectionLaw.pdf?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original.
618 The BRICS Post, 'China Supreme Court sets up Environment Tribunal', The BRICS Post, 3 July, 2014, available at: http://thebricspost.com/china-supreme-court-sets-up-environment-tribunal/#.VtGm9_krLIU.
619 Niez, supra note 38 at 42.
620 See Energy Research Institute (ERI) of the State Development Planning Commission: http://eng.eri.org.cn/zjnys.php?cid=6.

and the environment, and renewable and alternative energy development.[621] The ERI consists of four professional research centres through which it operates to carry out its functions: the Energy Economics and Strategy Research Centre; the Energy Environment and Climate Change Research Centre; the Centre for Renewable Energy Development; and the Beijing Energy Efficiency Centre.[622]

Furthermore, the Energy Foundation China, formerly known as China Sustainable Energy Program, supports China's policy efforts to increase energy efficiency and renewable energy. The program aims to build capacity in China to analyse energy savings and renewable energy opportunities as well as developing policies to capture those opportunities. The program has provided assistance to Chinese agencies, experts, and entrepreneurs in solving energy challenges for themselves and their country. At the request of Chinese non-governmental organizations (NGOs), the program lends support to capacity building and technology policy transfer through linking Chinese experts with "best practices" expertise from around the world. When it determines there is an unmet need in the field, the program may convene workshops, commission papers, or take other direct initiatives, in addition to its primary role as a grant-maker.[623]

In China, small hydropower is considered a potential foundation of rural economic development. The areas supplied with electricity from small hydropower are mostly mountainous areas, which are hard to reach with large national grids and which have suffered from the lack of or shortage of electricity. This has severely restrained the economic development in these areas. In these situations, small hydropower plants have supplied enough electricity to provide lighting, television, refrigeration and cooking heat to homes in rural areas, thus becoming one of the foundations of the economic vitalization process for mountainous areas.[624]

In the field of legislation, the 1995 Electricity Law, the 2005 Renewable Energy Law as well as the 2014 Environmental Protection Law will together primarily chart the trajectory for a regulatory framework for rural applications of renewable energy in China.[625]

C. Nigeria

The 1999 Constitution of Nigeria provides the general legal basis for off-grid electrification in rural areas falling within each state in the form of renewable energy by empowering the House of Assembly of each state to establish electric power stations within their respective states and to generate, and transmit and distribute electricity to areas not covered by the national grid system within that state.[626]

621 Ibid.
622 For details on the various centres, see: http://eng.eri.org.cn/jgsza.php.
623 Energy Foundation China: http://www.efchina.org/About-Us-en/Introduction-en.
624 See generally G. Shuhua, L. Wenqiang and Z. Xiaohua "Development of Small Hydropower (SHP) in China" (1996) 3 (3) Energy for Sustainable Development 46-49.
625 For more on China, renewable energy and energy efficiency, see: Reegle, 'China', available at: http://www.reegle.info/policy-and-regulatory-overviews/CN.
626 See Section 14 to Part II of the Second Schedule to the 1999 Constitution of Nigeria, available at: http://www.icnl.org/research/library/files/Nigeria/constitution2.pdf. .

Specifically, for many years, it was the Nigerian Electricity Act,[627] – which provided 'for the regulation and control of electricity installations, and of the generation, supply and use of electricity energy'[628] – and the National Electricity Power Authority Act (NEPA Act) which provided the regulatory and institutional framework for nation's power sector. However, 2005 witnessed a major change and advancement in the regulation of the energy sector in Nigeria with the enactment of the Electricity Power Sector Reform Act[629] (EPSR Act) 2005, which is a consequence of the 2001 NEPP. This Act, which repeals the Electricity Act and the NEPA Act,[630] is now considered the most important legislation in the sector as it resets the future direction of the Nigerian power market.

The fundamental changes, among others, which the EPSR Act entailed was the liberalization of the power sector and the unbundling and privatization of the government-owned electricity company (NEPA), thus introducing new and independent players into the sector.[631] Within this context, the EPSR Act promotes the generation of electricity from all sources of energy, including renewable energy sources and mandates that such is efficiently sources and delivered to the consumers, especially those in the rural areas.

To realize such goals, the EPSR Act, 2005 introduced some regulatory reforms. One of these is the development of a competitive electricity market – which if properly managed may see a scramble to electrify rural communities, mainly through off-grid renewable sources. Others include the foundation of the Nigerian Electricity Regulatory Commission[632] (NERC) as national regulatory body to oversee the market and administer licenses (based on prescribed requirements) for new generation, distribution and transmission companies; implementation of consumer rights and consumer protection including the Power Consumer Assistance Fund to subsidize the tariff for less-privileged consumers – most of which are rural dwellers; and establishment of a Rural Electrification Agency[633] (REA) to expand access to electricity to the rural areas – especially through off-grid renewable energy sources – and the financing of its activities.s

With respect to hydroelectric power, the 1993 Water Resources Act[634] establishes the legal framework for the development of water resources in Nigeria. The Act vests rights to the use and control of water resources in the state,[635] and places ultimate responsibility for the proper development of the nation's water resources on the Federal Ministry of Water Resources (MWR). This does not preclude the rights of individuals to reasonably take and use water for domestic, fishing, live-stock watering and navigation purposes.[636] Nevertheless, a license from the MWR

627 Cap. 106 Laws of the Federation of Nigeria 1990. See generally http://www.nigeria-law.org/LFN-1990.html. See also http://lawnigeria.com/LawsoftheFederation/NATIONAL-ELECTRIC-POWER-AUTHORITY-ACT.html

628 The preamble to the Act provides that it is 'An Act to establish the National Electric Power Authority to develop and maintain an efficient, co-ordinated and economical system of electric supply for all parts of the Federation and other matters incidental thereto.'

629 See Federal Republic of Nigeria Official Gazette available at http://www.power.gov.ng/download/Electric%20Power%20Sector%20Reform%20Act%202005.pdf

630 See EPSR Act, sections 98 and 99.

631 See Bureau of Public Enterprises (BPE), http://www.bpeng.org/10/addsector.asp?DocID=43&MenuID=38. USEIA, "Independent Power Projects in Nigeria: March 2003", URL: http://www.eia.doe.gov/emeu/cabs/nigeria-ipp.html.

632 For more on NERC, see: http://www.nercng.org/.

633 For more on REA, see: http://www.rea.gov.ng/.

634 Decree No. 101 of 1993. See generally http://www.nigeria-law.org/LFN-1993.html. See author for actual Decree.

635 Section 1(1) provide of the Water Resources Act provides: "The right to the use and control of all surface and groundwater and of all water in any water course affecting more than one state as described in the schedule to this Decree together with the bed and banks thereof, are by virtue of the Decree and without further assurance vested in the Government of the federation."

636 See S. 2 of the Water Resources Act.

is required for any person to operate any hydraulic work, which may include the generation of hydroelectric energy, on the waterways or underground.[637]

The above responsibilities of the MWR provide it with the opportunity to be involved in hydropower generation activities, in partnership with other government ministries or agencies concerned with energy. In fact, the MWR through its Department of Dams and Reservoir Operations has been involved in numerous renewable energy and rural electrification activities. It is in collaboration, for instance, with the Ministry in charge of Power in respect of all dam projects with hydropower potential. And small hydropower schemes – a source of renewable energy that would greatly benefit rural communities – have been integrated into some dam projects across the country as a way of increasing the energy supply of the nation.[638]

Bio-fuels in the form of wood, charcoal, and biomass constitute at least 70% of the energy consumed all over Nigeria. The demand for wood fuels is expected to rise by about 350% by 2030 and beyond, while urban consumption is expected to grow by 250% within the same period.[639] The requirement for an environmental impact assessment in respect of any project embarked upon by any private or public authority with likely environmental impact under the Environmental Impact Assessment Act No. 86 1992 all combine to reduce the trend towards massive deforestation in Nigeria.[640] Prior to this Act, logging of wood for fuel was carried out at random and without hindrance. A requirement for an EIA slowed down logging activities.

Other renewable energy resources that could in principle meet almost all Nigeria's needs, such as solar power, wind power, geothermal energy and wave power are not given any specific regulatory prominence. The Jigawa Alternative Energy Trust fund, with the United States Department of Energy, is constructing a solar electric project in Jigawa State. The project is a result of a $600,000 solar rural electrification and water-pumping project for 3 villages in Jigawa State.[641]

In Nigeria, another important regulatory institution as it concerns energy efficiency and renewable energy is the Energy Commission of Nigeria[642] (ECN), which was established by the ECN Act[643] (as amended) of 1979. As provided in the Act, the agency is responsible for the co-ordination and general surveillance over the systematic development of energy resources of Nigeria, including new and renewable energy sources.[644] Section 1(2) of the ECN Act also provides for the composition of the Commission. The Departments of the Commission include that of Energy Planning and Analysis (including energy efficiency demand management and conservation, rural energy, and alternative

637 Section 9(1) ibid.
638 Rural Nigeria report…
639 See Adesanya Olugbenga M. "Elysian Energy for a Sustainable Nigeria", available at: http://www.worldenergy.org/wec-geis/publications/default/tech_papers/17th_congress/2_3_03.asp. Regulations to stem the tide of dwindling forest resources in size and volume can be traced to the 1999 Constitution of Nigeria, which provides in Section 20 that: "It is an obligation of the state to protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria." Under Article 24 of the African Charter on Human and Peoples' Rights (Ratification and Enforcement) Act, Cap. 10 L.F.N. 1990, "All people shall have the right to a general satisfactory environment favourable to their development", available at: http://www.nigeria-law.org/African%20Charter%20on%20Human%20and%20Peoples'%20Rights.htm.
640 For Nigeria's EIA Act No. 86 of 1992, available at: http://www.nigeria-law.org/Environmental%20Impact%20Assessment%20Decree%20No.%2086%201992.htm.
641 T. Okoli, "Nigeria: Jigawa Gets Solar Electrification Project", This Day, 23 April, 2004, available at: http://allafrica.com/stories/200404230290.html.
642 For more, see the ECN website: http://www.energy.gov.ng/.
643 No. 109, Laws of the Federation of Nigeria, 1990, available at: http://www.energy.gov.ng/index.php?option=com_content&view=article&id=79&Itemid=90.
644 See S. 1(2).

and new and renewable energy sources).[645] The ECN is charged with responsibility for the strategic planning and co-ordination of national policies in the field of energy in all its ramifications and includes, amongst others: preparation, after consultation with relevant energy-related agencies of government, of periodic master plans and guidelines for the balanced and coordinated development and utilization of energy.

D. Ghana

In Ghana, following a 1983 drought that reduced the Volta Lake to very low levels and resulted in drastic curtailment of electricity production and supply to all sectors of the country, the government was prompted to pursue a program of expanding the power generation base. Even effective generation, transmission and distribution could pose formidable challenges that, if not carefully handled within an enabling regulatory framework, could jeopardize all efforts to make electricity more easily available and affordable. It is within this context that the Energy Commission Act, 1997,[646] (EC Act) should be appreciated. Some of the functions and objects of the Commission under section 2 of the Act are: to assess application and grant licenses to public utilities for the transmission, distribution and sale of electricity and natural gas; establish and enforce, in consultation with the Public Utilities Regulatory Commission, standards of performance for such public utilities; and promote and ensure uniform rule of practice for the transmission, distribution and sale of electricity and natural gas.

As it relates to renewables and energy efficiency with positive implications for rural electrification, other functions of the Energy Commission are to: "recommend national policies for the development and utilization of indigenous energy resources"[647] – the phrase "indigenous energy resources" includes renewable energy resources that can be found in Ghana, including wind, solar energy, hydropower, geothermal energy and biomass;[648] 'advise the Minister on national policies for the efficient, economical, and safe supply of electricity… having due regard to the national economy'[649]; and "secure a comprehensive data base for national decision making on the extent of development and utilization of energy resources available to the nation."[650]

An important provision under the EC Act is the establishment of the Energy Fund in section 41. The monies generated through the Fund shall be applied amongst others, for promotion of projects for the development and utilization of renewable energy resources including solar energy. The sources of monies for the Energy Fund, as stipulated in the EC Act, are primarily through a proportion of the government levy on petroleum products, electricity and natural gas.[651] Since, according to the Act, the Commission also is empowered to "determine allocations to be made towards the objectives of the Fund",[652] and one of the objectives is the "promotion of projects for the development and utilization of renewable energy resources, including solar energy;" more funds could be allocated towards realizing its renewable energy objective under the Act.

645 S. 1(2)(b).
646 Act 541, available at: http://energycom.gov.gh/files/ACT.pdf.
647 S. 2(a).
648 See S. 57, the interpretation section.
649 S. 2(b).
650 S. 2(d).
651 See s. 41(2) (a).
652 S. 44(1) (b).

In addition to the EC Act, there is the Public Utilities Regulatory Commission Act of 1997[653] that established the Public Utilities Regulatory Commission (PURC) to regulate and oversee the provision of utility services by the public sector to all consumers. Since this Act makes no distinction between consumers in rural as against those in urban areas, it is to be assumed that it has general application. The PURC's functions under section 3 of the Act include protecting the interests of providers and consumers, approval of rates, monitoring performance standards, promoting competition among service providers and, importantly, conducting studies relating to economy and efficiency of public utilities.

Considering that the aforementioned laws apply generally to all energy, and incidentally to efficiency and renewable energy, and given the need to boost the development and deployment of renewable energy and improve energy efficiency, the Ghanaian government recently passed the Renewable Energy Act, 2011.[654] The Act aims to promote, develop, manage, utilize, sustain and ensure an adequate supply of renewable energy resources for power and heat in an efficient and environmentally sustainable manner. Renewable energy as defined by the Act includes wind, solar, hydro, biomass, biofuel, landfill gas, sewage gas, geothermal energy and ocean energy.

For the implementation of the Act, the Minister in charge of energy is charged with providing policy direction for the achievement of the objective of the Act, while the EC and PURC are charged with detailed implementation responsibilities under the Act. By implication, the Ministry in charge of energy, the EC and the PURC are the principal regulatory institutions in Ghana's energy sector and renewable energy sub-sector. The Act also establishes a Renewable Energy Fund with the objective of providing financial resources to meet the aim of the Act. And to achieve this objective, the Fund is required to be applied primarily to the provision of financial incentives, feed-in-tariffs, capital subsidies, production based subsidies and equity participation for mini-grid and off-grid power systems for remote areas and islands, among others.[655]

IV. CONCLUSION

This paper attempts to examine rural applications of energy efficiency and renewable energy in developing countries. It emphasizes the importance of energy efficiency and renewable energy as essential components for meeting the SDGs as well as accelerating economic development in developing countries. The introductory segment, Part 1, sets the agenda for discourse and includes a brief overview of rural applications of energy efficiency and renewable energy decision-making. Part II examines the policy goals for efficiency and renewable energy generally, and more particularly, in India, China, Nigeria and Ghana. The legislative and regulatory framework for rural applications of energy efficiency and renewable energy were then examined in these same case study countries.

The findings are quite instructive. Whereas in China and India, the central governments take the lead in the initiation of policies on efficiency and renewable energy, regional and local governments actually follow in the footsteps of central governments in actually initiating policies at the regional, or

653 Act 538, available at: http://www.purc.com.gh/purc/purc/Legislation/PURCAct538.
654 Act 832, available at: http://energycom.gov.gh/files/RENEWABLE%20ENERGY%20ACT%202011%20(ACT%20832).pdf.
655 For more on Ghana, renewable energy and energy efficiency, see: Reegle, 'Ghana', available at: http://www.reegle.info/policy-and-regulatory-overviews/GH.

local government levels. On the other hand, in Nigeria and Ghana, there is a dearth of regional, state, or local government policy initiatives as all the policies have been initiated by the central governments.

In China, three levels of policy beginning with the Central government for the first two levels, and later dovetailing to the local governments, including provincial, municipal, and county governments, establish the third level of policy with overall direction from the central government. Despite the clear and unambiguous provisions of the Constitution in Nigeria[656] there appears to be a 'disconnect' between Federal/State/Local governments in policy formulation and implementation. In Ghana, Article 181(5) of the Ghanaian Constitution provides that any international business or economic transaction to which the State is a party requires parliamentary approval before it can become effective.[657] This possibly accounts for the wide-spread articulation and implementation of policies in India and China as against their West African counterparts.

Furthermore, while policy generally precedes the law, in India and China, the law sometimes provides a basis for an expansion of policy and sometimes precedes it. The implication of this is that there are no hard and fast rules regarding which comes first. What is important is the sincerity and determination of government to implement its policies. Lack of political will is possibly one of the factors militating against the wide-spread initiation and implementation of rural applications of efficiency and renewable energy in Africa.

The legislative and regulatory framework for rural applications of efficiency and renewable energy is a combination of policy instruments seeking to set clear goals, legislative requirements and subsidiary instruments that provide legal bases for policy perspectives as well as institutional mechanisms for policy implementation in all four case study countries. Again, India and China are ahead. The de facto, not necessarily de jure centralization of policy instruments, legislative and regulatory power as well as institutional mechanisms for efficiency and renewable energy applications in Nigeria are a draw-back to effective and wide-spread application of efficiency and renewable energy in Nigeria. In Ghana, the challenge is over-centralisation of power in the national government. Both countries are direly in need of decentralization and reform.

Renewable energy has a large and geographically widely spread resource base. However, its major obstacles include the general lack of or inadequate awareness of alternative energy options; the lack of reliable data to undertake specific projects; poor or no research and development base or even commercial business models. These considerations contribute to the difficulty of accessing the latest renewable energy technology, as well as limited financial resources; insufficient number of personnel qualified to administer energy efficiency and renewable energy programs; the lack of supporting policies, up-to-date and comprehensive regulations, inefficient infrastructure and equipment for their use; and other constraints such as competition from other energy resources,

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656 See Sections 13 and 14 of the Second Schedule, Part II of the 1999 Constitution of Nigeria, wherein electricity is placed on the Concurrent legislative list, meaning both Federal and State Governments can legislate on the subject matter, generally.

657 However, in the case of Balkan Energy Co. LLC (a project company supplying power generated by a power barge to the Government under a PPA), the Supreme Court of Ghana found that the PPA constituted an international business transaction for which Parliamentary approval was required but had not been obtained. "Investing in the African electricity sector Ghana Ten things to know" available at http://www.nortonrosefulbright.com/files/investing-in-power-in-ghana-100588.pdf.

mainly fossil fuels.[658] An adequate regulatory framework must, therefore, specifically address these issues in order to put renewable energy squarely on the national agendas.

Additionally, a law on renewable energy must contain provisions on qualifications, application for and conditions of licenses, and incentives to harness any form of renewable energy including procedures for facilitating renewable energy technologies through effective implementing institutions. Such a law must provide for the rights and obligations of the host country and its rural communities, and private investors, and it must impose standards.[659] The vague, aspirational quality of statutory language; a weak judiciary stemming from a lack of independence; the poorly trained, ill-equipped and unmotivated workforce in implementing institutions, all combine in varying degrees to deflect regulatory will.[660] Developing countries must guard against these in regulating the renewable energy sector.

An example of the regulatory needs to promote renewable energy may be found in the treatment of small hydro projects. Hydropower for rural electrification can help minimize local, regional and global environmental impacts in the long run, while ensuring people's livelihoods.[661] It is an important pillar of economic development in hilly areas, an important source of a country's fiscal revenues, and an important way for local people to shake off poverty and set out on a road to prosperity. It promotes structural readjustment of the economy, which is beneficial in resolving deep-rooted structural contradictions, which constrain the economic development of poverty-stricken areas. It improves agriculture and rural production conditions and brings about advances in agriculture as well as promotes the comprehensive utilization of renewable energy resources – wind, water, solar, geothermal and biomass energy just to mention these.

These benefits, not just of hydropower, but for all renewable energy resources, can hardly be realized without a coherent and adequate legislative and regulatory framework that sets out the policy, laws as well as institutional mechanisms for concretizing the gains that will flow from rural applications of renewable energy.[662]

658 J. Bischoff, "Renewable Energy in Asia-Pacific" World Renewable Energy Policy and Strategy Forum (June 13-15, 2002), http://www.world-council-for-renewable-energy.org/downloads/WCRE-Bischoff.pdf.

659 See for example, Rikke Munk Hanwen, "Legislative Measures for Promotion of Renewable Energy: Wind Energy Development in Denmark as a Case Study", in A. J. Bradbrook and R. L. Ottinger eds., Energy Law and Sustainable Development, http://www.iucn.org/themes/law/pdfdocuments/Energy-Law/ENERGY-PUB-prelims.pdf pp. 115-137.

660 Alex Wang, "The Downside of Growth: Law, Policy and China's Environmental Crisis" http://www.oycf.org/Perspectives/8_103100/downside_of_growth.htm. pp. 5-6.

661 World Energy Council Committee on Renewables, http://www.worldenergy.org/wec-geis/wec_info/work_programme2004/tech/renew/renewables.asp. p. 1 of 2.

662 Hangzhou Regional Center (Asia-Pacific) for Small Hydropower, "SHP-based Rural Electrification in China" SHP NEWS Autumn 2004 www.hrcshp.org/shp/en/pdf/2004/autumnoverview.pdf pp. 5-8 of 24.

SECTION SEVEN – CASE STUDIES

CHAPTER 7A. CASE STUDY OF COLOMBIA

Victor M. Tafur*

I. INTRODUCTION

In 2001, Colombia adopted legislation for the promotion of "non-conventional renewable energy sources" and energy efficiency, and created a national program to that end — termed Efficient Use of Energy and Non-Conventional Energy Sources Program (PROURE).[663] The Ministry of Mines and Energy was charged with developing the program.[664] Non-conventional renewable energy sources (NRES) are defined as biomass, small-scale hydro — less than 10 Megawatts (MW) —, wind, geothermal, solar and ocean energy.[665] Despite Congress' declaration that this program has top national interest,[666] it has remained unfunded, thus not fully implemented. As a result, the program has had little impact on Colombia's mix and use of energy. In brief, some of the weaknesses of this original legislation were the lack of specific policies to promote NRES and energy efficiency; the failure to set quantitative targets for the share of renewable energy to be incorporated; the absence of specific mechanisms for the development of the program; and, most notably, the lack of economic or fiscal incentives to encourage investments in these areas.

It was not until 2010 that the Ministry — through a resolution — adopted an Action Plan to develop PROURE for the period 2010-2020.[667] The Action Plan set specific goals regarding the requirement for participation in NRES electric generation by 2015 and 2020. At the national level, NRES generation was expected to reach 3.5% and 6.5% of total output, respectively, but it only reached about 2% by 2015.[668] For off-grid areas — termed zones-not-interconnected —NRES output was expected to reach 20% of total generation by 2015 and 30% by 2020, but it only reached 10% by 2015.[669] Not surprisingly, the adoption of the resolution alone, without additional incentives and mechanisms or adequate funding has not yielded the aspired goals.

By 2014, it was clear that the country lacked the regulatory framework, as well as the economic incentives, needed to make significant progress increasing NRES and energy efficiency. In August of 2014, Congress revamped legislation to encourage NRES development and facilitate their

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173 Law 697 of 2001 (Col.); see also República de Colombia, Ministerio de Minas y Energía, Unidad de Planeación Minero Energética, Integración de las Energías Renovables No Convencionales en Colombia (2015), http://www.upme.gov.co/Estudios/2015/Integracion_Energias_Renovables/INTEGRACION_ENERGIAS_RENOVANLES_WEB.pdf (herein NRES Study) (last accessed January 15, 2016).

664 Law 697 of 2001, at Art. 4.

665 *Id.*, at Art. 3.

666 *Id.*, at Art. 1.

667 Resolution No. 18-0919 of June 1, 2010 (Col.).

668 NRES Study, supra n. 1, p. 26.

669 Id., p. 27.

integration into the national energy grid, improve energy efficiency, and encourage the substitution of diesel generators for NRES in off-grid areas.[670]

The NRES Law is based on six pillars. First, the Law authorizes small self-generators using NRES to deliver any excess electricity to the grid under net metering.[671] The regulatory agency — the Electricity and Gas Regulation Commission (CREG) — may also, or instead, adopt a Renewable Energy Credits regulatory scheme. Net metering may be extended to residential customers with solar systems delivering excess electricity into the grid. Second, the Law creates a public-private fund for the promotion of NRES and energy efficiency programs.[672] Third, it provides four permanent fiscal incentives: tax deductions, exclusion of a Value Added Tax, elimination of import duties, and accelerated tax depreciation for NRES projects.[673] Fourth, it sets general guidelines for the promotion of biomass, small-scale hydro, wind, geothermal, solar, and ocean energy.[674] Fifth, regarding energy efficiency, the Law adopts features of the Action Plan of PROURE — previously issued by ministerial resolution — to set forth goals, based on sectoral voluntary programs and good practices, and, importantly, authorizes the implementation of demand response programs.[675] Finally, it encourages the development of NRES in non-grid areas.[676]

With these measures, the Colombian Government estimates that NRES generation capacity could increase from 420 MW in 2015 to 932 MW by 2020, to 2,077 MW by 2025, and to 2,507 MW by 2030.[677] Under more favourable scenarios, NRES generation capacity could increase to 1,293 MW by 2020, to 2,981 MW by 2025, and to 3,622 MW, by 2030.[678] This chapter will explore how these instruments have been tailored, and the reasons given by Colombian authorities for rejecting the adoption of other mechanisms at this juncture, such as national auctions for renewable energy, a Renewable Portfolio Standard, or a Feed-in-Tariff.

II. OVERVIEW OF COLOMBIA'S ELECTRIC SECTOR

Colombia's total installed electricity capacity with grid intertie in 2015 totalled 15,645 MW of which 66.5% are large-scale hydroelectric power stations (of more than 20 MW), and 28.5% are fossil fuel generating plants — roughly 80% natural gas-fired and 20% coal-powered —representing 95% of the total capacity.[679] In 2015, hydroelectric stations of more than 10 MW, but less than 20 MW, represented 2.5% of the total installed electricity capacity, while small hydroelectric of less than 10 MW represented 1.3%. As noted earlier, only small hydroelectric units less than 10 MW are regarded as non-conventional renewable energy. Small-scale fossil fuel cogeneration (less than 20 MW) comprised 0.6%. The remainder was biomass cogeneration (0.5%), and wind energy (0.1%).[680] Thus, NRES was only about 2% of the energy mix in 2015.

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670 Law 1715 of 2014 (Col.) (herein "NRES Law") (available at http://wsp.presidencia.gov.co/Normativa/Leyes/Documents/LEY%201715%20DEL%2013%20DE%20MAYO%20DE%202014.pdf); see also NRES Study, supra n. 1. The Law also seeks to encourage nuclear energy although Colombia does not have a legal framework to ensure the safe operation nuclear reactors or to assess and their environmental impacts.
671 2014 NRES Law, Art. 8.
672 *Id.*, at Art. 10.
673 *Id.*, at Arts. 11-14.
674 *Id.*, at Arts. 15-23.
675 *Id.*, at Arts. 16-33.
676 *Id.*, at Arts. 34-40.
677 NRES Study, supra n. 1, pp. 194-196.
678 *Id.*, pp. 197-198.
679 *Id.*, p. 26.
680 *Id.*

Specifically, Colombia's installed NRES capacity — both with and without grid intertie — in 2015 was 420 MW. NRES capacity is composed, as follows: 206 MW of biomass, 194 MW of small hydroelectric stations less than 10 MW, 19.5 MW of wind (a wind farm in La Guajira on the Caribbean coast provides its electricity to the national grid), and 2 MW of solar.[681] An additional 7.5 MW wind project in San Andres Island, in the Caribbean Sea, is under construction.[682]

The share of fossil fuel used in generation has increased since the mid-1990s. This has happened in response to the reliability issues caused by El Niño's associated droughts and the high reliance on hydroelectric installations for power generation.[683] As a result of the policies adopted by the country, the dominance of hydropower in the generation portfolio has been reduced from 80% in the early 1990s to less than 70% today. Nonetheless, "[i]n dry years, such as during El Niño periods, the split between hydro and fossil fuel generation is about 50-50."[684]

The energy consumption in Colombia, in 2015, was approximately 1,070 Petajoules (PJ).[685] Transportation (45%), industry (22%) and households (19%) dominate consumption, followed by agriculture and mining (7%) and the commercial and public sectors (7%). Energy demand is supported by an energy mix comprised of oil and gas (43%), natural gas (25%), hydroelectricity (13%), coke (10%) and bioenergy (5%).[686]

Colombia's electricity sector was restructured in the early 90s with the adoption of Law 143 of 1994.[687] Government-owned electricity companies were privatized, resulting in a series of private electricity generation companies, private distribution companies, and a single public-private transmission company, which provides grid-connected electricity.[688] Currently, both generation and commercialization are competitive activities, while transmission and distribution are regulated as natural monopolies.[689] The Ministry of Mines and Energy, oversees the energy sector.[690] The Mining-Energy Planning Unit (UPME), an affiliate of the Ministry, does capacity planning. UPME's plans are indicative, not mandatory. The CREG regulator agency determines tariffs and issues other regulations for the sector.

As summarized in a report prepared for the Inter-American Development Bank and the Ministry, (IADB Report), the electricity market operates as follows:

> Electricity from large hydro and thermal power plants is purchased directly in the electricity market by two means - either the spot market or by long term financial contracts. The buyers can be 'commercializers' that are agents that buy large amounts of electricity and sell it to the users, regional distribution companies, and large industrial users. Electricity from plants smaller than 20 MW is purchased by 'commercializers' who in turn sell it to users. The sale of electricity by large power plants to the distribution companies is governed by an auction process overseen by the

681 *Id.*, p. 195.
682 *Id.*
683 See Inter-American Development Bank, Ministry of Mines and Energy Government of Colombia, Sustainable Energy and Biofuels Strategies for Colombia (Preliminary Report I, 2010) (herein IADB Report), p. 4-5.
684 *Id.*, p. 4.
685 NRES Study, supra n. 1, p. 25.
686 *Id.*
687 IADB Report, supra n. 21, p. 4.
688 *Id.*
689 *Id.*
690 See Decree 1073 of 2015 (Col.), available at http://decreto1073.co (last accessed March 18, 2016)

> regulator, the CREG … Large industrial users negotiate directly with generation companies plus pay a regulated rate for transmission and distribution.[691]
>
> Except for the rate negotiated by large industrial users, all retail rates are regulated by CREG. There are six residential classes based on income. The first, lowest-income class pays a tariff set at 40% of the average cost. The second class pays 60 percent, the third pays 85 percent, and the fourth pays at the average cost. Class five and six pay 20 percent over average cost, as does a commercial class and an industrial class. Thus, the industrial, commercial, and top two residential classes cross subsidize the bottom three residential classes.[692]

Although the Ministry has been considering a requirement for utilities to purchase a certain amount of electricity from NRES for several years, the government has been so far reluctant to create such a mechanism for Colombia. Nonetheless, "Colombia has adopted a national electricity auction process for conventional electricity resources that may serve as a precedent for the sale of electricity from renewable sources as well."[693] Under the current process, the planning agency, UPME, determines new demand that must be met, while the regulating agency, CREG, adds a reserve margin and determines the overall size of the auction, which is administered by the system operator.[694] The process can be summarized as follows:

> Only firm power resources participate in the auction – that is, only power sources that can assure availability at all times regardless of climatic conditions. CREG developed a mechanism called a 'reliability charge' in order [to] prevent future shortages of energy. Under this scheme there is a figure called firm energy obligation (OEF), which is the energy that the backup plants can assure, through generation assets, under critical conditions. These obligations are offered and bought by distribution utilities and large industrial consumers in [the] auction process. For the buyers, the process provides a guaranteed certain known price for a pre-determined period of time. With this scheme, when the dry season approaches and the spot price of electricity rises, reaching a pre-established price (called [the] shortage price).[695]

The main advantages of this scheme are that it provides economic signals to invest in new generation projects, provides for the long-term stability of the electricity system, places a legal obligation on the generators to provide the energy they are being paid for, increases system reliability over the long term, and, since the firm energy obligation is determined by auction, it guarantees a competitive scheme and more efficient prices.[696] The main disadvantages of the scheme are that reliability may be problem in the short term, there is no opportunity to select which energy source to buy from, the "shortage price" can be manipulated by agents, since only a few of them own most of the generation assets that have a dominate position in the market, and only firm sources can participate, so intermittent renewable energy sources such as wind and solar are excluded.[697]

The Institute of Planning and Promotion of Energy Solutions (IPSE), a Ministry affiliate, is charged with oversight of the non-interconnected zones, including the development of an expansion plan for these zones. The IPSE's mandate is "to identify, promote, develop and implement energy solutions that are

691 IADB Report, supra n. 21, p. 5.
692 *Id.*, p. 6.
693 *Id.*, p. 8.
694 *Id.*
695 *Id.*, pp. 8-10.
696 *Id.*, p. 9.
697 *Id.*

economically feasible in the long term and supply the needs of the non-interconnected-zones while being environmentally sustainable."[698] Over 2 million people—about 4% of the country's population—live in the non-connected areas. In these zones, mini-grids consisting of 100 MW of installed capacity (98% diesel and 2% small hydro), operated by different private owners depending on the zone, have been operating for decades.[699] According to the Inter-American Development Bank Report, "[o]n these mini-grids, it costs roughly five times more to provide electricity as on the main grid. The government subsidizes retail prices on the mini-grids. In addition, power suppliers have received a subsidy of one Colombian Peso (COP) for each kilowatt hour generated in the mini-grids."[700]

The Ministry — under its affiliates IPSE and UPME — has prepared information systems to determine the location and quantity of NRES. The Ministry has produced a multi-year average global solar radiation map, a wind energy density map, a multi-year average small hydroelectric potential map, a determination of geothermal energy resources, and an estimation of the country's biomass potential.[701] "The objective of these systems is to support development of renewable energy policies and direct scientific and technological research in the fields of energy efficiency and renewable energy."[702] In particular, the planning agency, UPME, has an on-line information system, termed SI3EA, that contains current information and studies on energy efficiency and NRES.[703]

A. The 2014 NRES Law

Under the pre-2014 legislation, three main barriers to increased investment in NRES were identified. First, with respect to reliance on large hydroelectric stations: "the widespread perception that additional hydro capacity is the best solution, along with some additional fossil fuel capacity for dry years."[704] Second, "although there are defined national goals for the contribution of renewable energy, there is no clear path to achieving those goals. Specifically, there are inadequate incentives and regulatory structures for fostering widespread implementation of renewable energy."[705] And, third, the lack of mechanisms to promote NRES such as, net metering, a separate auction for renewable electricity, a Renewable Portfolio Standard, and a Feed-in-Tariff — which are discussed later in the chapter.

Regarding energy efficiency, five main weaknesses were pointed out: First, the lack of public awareness about the importance of energy efficiency.[706] Second, incentives to promote energy efficiency programs are either insufficient or inadequate.[707] Third, PROURE's resources are not guaranteed."[708] Fourth, information on the efficiency of technologies that arrive to the market is insufficient or non-existent.[709] Fifth, energy efficiency goals have been focused on the commercial and residential sectors "where the benefits in terms of primary energy savings and emissions reductions, although important are limited.[710]

698 *Id.*, p. 5.
699 *Id.*
700 *Id.*
701 *Id.*, p. 7.
702 *Id.*
703 *Id.*; see http://www.si3ea.gov.co.
704 *Id.*, p. 11.
705 *Id.*, p. 12.
706 *Id.*, p. 30.
707 *Id.*
708 *Id.*
709 *Id.*
710 *Id.*

Mindful of these weaknesses and challenges, Congress passed the 2014 NRES Law to revamp PROURE. As noted at the outset, the NRES Law has six fundamental aspects. Under Article 8, it authorizes small self-generators using NRES to deliver any excess electricity to the grid under net metering or Renewable Energy Credits regulatory schemes adopted by the energy regulatory agency, the CREG.[711] As per Article 10, it creates the Fund for Non-conventional Energy and Energy Efficiency, a public-private fund for NRES and energy efficiency.[712] Articles 11 to 14 provide four fiscal incentives: tax deductions, exclusion of a Value Added Tax, elimination of import duties, and accelerated tax depreciation for NRES projects.[713]

General guidelines for the promotion of biomass, small-scale hydro, wind, geothermal, solar, and ocean energy are provided under Articles 15 to 23.[714] In regards to energy efficiency, the Law incorporated the features of the Action Plan of PROURE — previously adopted by ministerial resolution — in Articles 26 through 33.[715] These provisions set forth goals based on sectoral voluntary programs and good practices, and authorize the implementation of demand response programs. Finally, provisions aimed at encouraging the development of NRES in non-grid areas were included in Articles 34 to 40.[716] Some of these aspects are briefly discussed below.

1. NRES Self-Generators Delivering Excess Electricity

Prior to the 2014 NRES Law, cogeneration with sugar cane bagasse was the only form of on-site electricity generation that was allowed to intertie with the grid. However, "this intertie was not considered net metering because the sugar mills were not paid at the same rate per kilowatt/hour as they pay for their electricity."[717] The NRES Law now requires electric utilities to purchase excess electricity generated by small and large NRES self-generators — defined as those who generate primarily to meet their own energy needs — under net metering or Renewable Energy Credits schemes to be developed by the regulator CREG.[718] The CREG is also instructed to "consider" implementing net metering for residential customers with solar systems and other small-scale NRES self-generators.[719]

As a result of net metering regulations, small self-generators and residential solar systems would have electric meters that run in both directions: one direction to measure and charge for the self-generator's or customer's electricity consumption, and the other direction to measure and provide compensation for excess electricity generated by the self-generator or residential system.[720] The small self-generator and solar residential user would pay for the net amount of electricity consumed after subtracting the amount sold to the grid. Small self-generators could earn Renewable Energy Credits as well. The CREG will regulate how these credits are earned and transacted,[721] and it will also determine the

711 2014 NRES Law, Art. 8.
712 *Id.*, at Art. 10.
713 *Id.*, at Arts. 11-14.
714 *Id.*, at Arts. 15-23.
715 *Id.*, at Arts. 16-33.
716 *Id.*, at Arts. 34-40.
717 IADB Report, supra n. 21, p. 15.
718 2014 NRES Law, at Art. 8 (a). See also Decree 2469 of 2014 (Col.), Art. 4.
719 2014 NRES Law, at Art. 19 (7).
720 *Id.*, at Art. 8 (b).
721 *Id.*, at Art. 8 (d).

compensation mechanisms for electricity delivered by distributed generation systems.[722] The CREG is also required to establish simplified procedures for self-generators with systems under 5 MW.[723]

2. New Fund for Non-Conventional Energy and Energy Efficiency

The NRES Law created a public-private fund for NRES and energy efficiency — termed the Fund for Non-Conventional Energy and Energy Efficiency (FENOGE) — pursuant to Article 10.[724] However, the Law does not indicate how the new mechanism will be capitalized or the general funding criteria for NRES, except for the requirement that the programs or projects subject to funding are directed to serve the lower-income classes (first, second, and third classes of residential users), and that a cost-benefit analysis be undertaken.[725]

Prior to the creation of the FENOGE fund, the Colombian government operated two funds, which could be used to develop NRES: the Financial Support Fund for Energy Provision in Non-Interconnected Zones (FAZNI), and the National Royalties Fund. The former is specifically designed to promote renewable energy projects in non-grid areas; the latter is a general fund for infrastructure projects. Both "can be used to develop renewable energy projects, however, FAZNI is the most used for this purpose"[726] These resources are directly allocated state funds, subject to evaluation and allocation criteria from the state. Both provide funds to cover 80 percent of project costs.[727] As noted in the following paragraphs, FAZNI is limited the promotion of NRES in unconnected non-grid areas, while the National Royalties Fund is not NRES-specific. Thus FENOGE must seek to address these shortcomings, particularly to spur financing NRES with grid intertie.

In brief, the FAZNI fund finances plans, programs and investment projects in the non-interconnected ZNI zones for both conventional and renewable energy.[728] It is capitalized by a surcharge on grid-connected electricity sales and is operated by the Ministry of Mines and Energy.[729] Specifically, FAZNI draws on the resources obtained by raising one Colombian peso per kilowatt-hour dispatched to the interconnected system, which is included in the prices charged by the generator to the traders, and therefore paid by end user through fees.[730] The 2014 NRES Law extends this surcharge until 2021.731 The IPSE planning agency, local authorities, and electricity providers are the project developers for upgrading and developing new electrical infrastructure in unconnected ZNI area.

The objective of the FAZNI fund is to finance priority investment plans, programs and/or projects for construction and installation of new electrical infrastructure and replacement or rehabilitation of existing infrastructure, in order to expand coverage and ensure the satisfaction of energy demand in off-grid areas.[732] "As its name implies, this fund focuses on energy expansion and therefore

722 *Id.*, at Art. 8 (c).
723 *Id.*, at Art. 6 (2) (a).
724 *Id.*, at Art. 10.
725 2014 NRES Law, at Art. 19.
726 Rodriguez, Humberto, Observatory of Renewable Energy in Latin America and the Caribbean: Colombia, Financial Mechanisms (2011), sponsored by the Latin American Energy Organization (OLADE) and the United Nations Industrial Development Organization (UNIDO) (herein "Financial Mechanisms Report"), http://www.renenergyobservatory.org/uploads/media/Colombia_Producto_3__Eng__01.pdf (last accessed on February 26, 2016).
727 IADB Report, supra n. 21, p. 8.
728 *Id.*
729 *Id.*
730 Financial Mechanisms Report, supra n. 62, p. 16.
731 2014 NRES Law, at Art. 40.
732 Financial Mechanisms Report, supra n. 62, p. 16.

does not consider only electric power but power in general (local production of biofuels, for example), nor does it consider only renewable energy sources. Renewable energy sources must be viable compared to conventional energy and all projects are subject [to] economic, social and environmental sustainability assessments."[733] During 2010, the planning agency for non-interconnected zones, IPSE, executed US$151 million with FAZNI fund resources.[734]

The National Royalties Fund is endowed mainly with royalties from the exploitation of mining and energy resources in the country. It is managed by the National Planning Department to provide development assistance mainly to regions affected by these industries, but also to other regions as well.[735] The Fund's "[r]esources can be used to improve infrastructure, health, education, and public utilities, including power supply, construction, assembly, installation and commissioning of infrastructure for: i) electric power generation, ii) the street lighting service; iii) the lines of the Regional Transmission System-STR; iv) electrical substations in the Regional Transmission System, v) distribution networks, and vi) standardization of user connections."[736] The guidelines and requirements for the use of these resources are set forth in the laws and regulations for the distribution of royalties, hence the process is subject to intense political pressures.

A third funding mechanism, created in 2011, is Colombia's Development Finance Corporation (Financiera de Desarrollo Nacional), a hybrid private-public national financial institution affiliated with the Ministry of Finance, in charge of supporting the financing of major infrastructure projects.[737] Although, the Corporation's main focus is transportation, actually it replaced Colombia's Energy Finance Corporation (Financiera Eléctrica Nacional), thus there is an expectation that it will undertake energy projects, including NRES-related projects as well. Moreover, the Corporation has been capitalized with the sale of the Colombian government's controlling stake in generator Isagen S.A., in early 2016.[738]

3. NRES Fiscal Incentives

The 2014 NRES Law, under Articles 11 to 14, provides four fiscal incentives.[739] First, Article 11 grants a tax deduction up to 50% of investments during 5 years for all NRES projects. Second, Article 12 authorizes an exclusion of a Value Added Tax for NRES activities. Third, Article 13 eliminates import duties for NRES-related components. Finally, Article 14 provides accelerated tax depreciation for all NRES projects. These measures address one of the key barriers to increased investment in NRES: "[I]nadequate incentives and regulatory structures for fostering widespread implementation of renewable energy."[740] With these incentives, together with the effective funding mechanisms discussed above, the promotion of NRES seems to be entering a new phase with a better chance of success.

733 *Id.*
734 *Id.*
735 IADB Report, supra n. 21, p. 8.
736 Financial Mechanisms Report, supra n. 62, p. 16.
737 See Decree 4174 of 2011 (Col.), at Art. 3, available at http://www.fdn.com.co/pdf/Decreto%204174%20de%202011.pdf (last accessed, March 18, 2016). http://www.fdn.com.co/sites/default/files/images/juridico/FDN_Estatutos_0.pdf (last accessed, March 18, 2016).
738 According to the news agency Reuters, the Colombian government sold its 57.6 percent controlling stake in power generator Isagen to Canada's Brookfield Asset Management Inc. for $1.99 billion. See http://www.reuters.com/article/isagen-ma-brookfield-asset-idUSE3N0WJ04820160113 (last accessed, March 18, 2016).
739 2014 NRES Law, at Arts .11-14.
740 IADB Report, supra n. 21, p. 12.

4. Energy Efficiency

The plan sets forth an overall national goal of 20% energy savings and specific sectoral goals, PROURE can be summarized, as follows:[741]

PROURE establishes potentials and goals for energy savings in different sectors (transport, industry, residential, agriculture and mining, commercial and public) as well as the participation of the nonconventional sources of energy in the national energy matrix. It proposes short-term scenarios, strategies and high-priority actions, which shall be implemented gradually and that must be reviewed and adjusted frequently. PROURE is also oriented towards the consolidation of an energy saving culture, construction of the conditions to promote a market of energy goods and services, strengthening of the institutions, and the promotion of enterprises and investments. The Program identifies as priority programs:

Residential Sector

*Incandescent lamp substitution

*Energy efficient use in refrigeration equipment, coolers and other electrical appliances

*Burners

*Design - Construction of efficient and sustainable buildings

*Liquefied Petroleum Gas - GLP in the rural sector and marginal zones

Industrial Sector

*Improvement of electrical energy use for engines

*Improvement of boilers

*Illumination efficiency

*Integral management of energy with emphasis on cleaner production

*Co-generation and self-generation

*Rational and efficient energy use at small and medium enterprises

*Improvement of combustion processes

Commercial, Public and Services Sector

*Technology diffusion and good practices in illumination systems, refrigeration and coolers

*Characterization, indicators management, and technical assistance

*Street lighting technological updating

Transport Sector

*Technological conversion of the fleet

*Transport options

*Good practices in transport

741 IADB Report, supra n. 21, pp. 25-26.

Notably, the 2014 NRES Law has authorized the establishment of demand response programs. To that effect, Decree 2492 of 2014 was issued, providing general criteria for the programs and enabling the CREG regulator to adopt the necessary regulations to implement them.[742] The Decree also instructs the MME ministry to determine specific "areas of distribution" for demand response programs.[743]

III. CONCLUSION

With the adoption of the 2014 NRES Law, Colombia has comprehensive and coherent legislation to promote non-conventional renewable energy and energy efficiency. But the Law needs to be fully implemented to meet this purpose in any significant way. Importantly, the Law could also help meet the country's urgent need to add reliable sources of electricity, particularly during low hydro capacity El Niño periods—the most serious energy concern in the country—to diversify the energy mix, and to mitigate the environmental impacts of fossil fuel generation.

Colombia's NRES Law tackles the main barriers to increased investment in NRES. First, self-generation projects are now authorized to sell excess electricity to the grid. Second, significant economic incentives and a new funding mechanism — still to be crafted — for promoting widespread implementation of renewable energy and energy efficiency programs were established. Third, in remote non-interconnected areas, new rules for suppliers, fuels, technology transfer, financial instruments, and the extension of the surcharge used to capitalize the FAZNI until 2021, will help replace high-cost, high-pollution diesel generation on these remote mini-grids, and provide access to electricity to the remaining population for whom it is prohibitively expensive or unfeasible to extend the transmission grid.

However, the 2014 NRES Law failed to embrace other policies and instruments, such as a separate auction for renewable electricity, a Renewable Portfolio Standard, and a Feed-in-Tariff. The Ministry in charge claims that these policies and instruments are not optimal for Colombia and that these tools are "complicated" or would increase prices, among the main reasons.[744] Arguments in favour of tailoring a national renewable electricity auction mechanism, a RPS, or even a Feed-in-Tariff for Colombia may be a valid concern.

However, to spur a more consistent and orderly supply, "Colombia's national electricity auction could be supplemented by a separate auction for renewable electricity. The auction could have two components - established sources (geothermal, small hydro, and biomass) and newer sources (wind and solar) or there could be a single auction with two or more renewable energy projects. Renewable energy developers would compete to provide renewable energy to the grid and the system operator would manage the auction just as it manages the conventional energy auction."[745] This mechanism offers several advantages. "The auction process would manage the entry of new resources in order to avoid the boom-and-bust cycle common in other markets. That is, when there are power generation shortages, there can be a scramble to develop new projects, and a number of projects may be built around the same time. Then the development process stops because there is

742 Decree 2492 of 2014 (Col.), at Articles 1-3.
743 *Id.*, at Article 4.
744 NRES Study, supra n. 1, pp. 96-100.
745 IADB Report, supra n. 21, p. 14.

adequate capacity for the near and medium term."[746] Further, the auction would lock in a firm price for the renewable electricity several years in advance.[747] Participants in the auction would include distribution companies that would be required to acquire a certain amount of megawatt-hours, or a certain percentage of their power, from the renewable energy auction or other renewable energy sources.

The Renewable Portfolio Standard — a requirement that a specific an amount or percentage of a distribution utility's electricity that must be supplied by renewable energy sources — should also be seriously considered in Colombia. Moreover, "[t]he advantage of the RPS over the national renewable energy auction approach is that it is done on a utility by utility basis, thereby allowing for consideration of the types and costs of renewable energy sources available in each service territory. This could be the approach used to fund the strategic renewable energy sources – the mini-grids, off-grid, and boosting power at ends of transmission lines."[748] The RPS mechanisms also allow for the creation of Renewable Energy Credits, thereby commoditizing renewable energy generation. Generators, distributors, consumers, and brokers can then buy, sell, and trade RECs among themselves.[749] Actually, "RECs can be the currency for buying and selling renewable energy under an RPS or a renewable energy auction, and for promoting a green image through voluntary purchases."[750]

With respect to a feed-in tariff, such a system — which would allow small renewable solar systems to access the electric grid and would pay the owner for their electricity at a price that allows for full cost recovery and an acceptable rate of return — "can vary according to [the] maximum MW project size allowed, the term of the purchase contract, and the method for determining price. The price can be based on a utility company's marginal cost of new generation; …it can be based on a certain percentage of retail electricity prices; or it can be based on the cost of generating each form of renewable electricity, which means there would be a different feed-in tariff for wind, biomass, solar, etc. as well as for projects of different sizes."[751] Thus, there could be flexibility and opportunities to tailor a feed-in tariff in Colombia.

Another significant feature in Colombia's 2014 NRES Law — making it more comprehensive and coherent than the previous legislation — is a more integrated approach to energy efficiency and renewable energy.[752] As noted in the IADB Report, "[w]hichever policy and regulatory options are selected to spur increased investment in renewable energy, they should be coordinated with an aggressive national energy efficiency policy. The reason is that renewable energy could be more expensive than large hydro plants, and thus the cost of expanded renewable energy implementation could put upward pressure on tariffs. Energy efficiency, on the other hand, will lower consumers' energy bills. So while tariffs could increase in order to pay for renewable energy projects, energy efficiency programs will reduce consumption, and the net effect will be lower energy bills."[753]

Nonetheless, the simple passage of the 2014 NRES Law alone will not change many of the problems

746 *Id.*
747 *Id.*
748 *Id.*
749 *Id.*, p. 15.
750 *Id.*, p. 16.
751 *Id.*, p. 13.
752 2014 NRES Law, at Arts. 26-33.
753 IADB Report, supra n. 21, p. 16.

associated with the slow progress in energy efficiency programs that has occurred to date. To start, "there is still [a] lack of public awareness about the importance of energy efficiency"[754] that needs to be addressed. Despite language in the Law stating that PROURE shall be "adequately funded" to reach its objectives,[755] "the Action Plan is not sufficiently known and the required resources are not guaranteed."[756] Further, monitoring mechanisms to meet the PROURE targets are still missing. "Without appropriate and clear financial support and without an adequate technical and monitoring and verification mechanism, the progress of the programs and its success will be hard to evaluate and sustain."[757]

Another concern is the absence of incentives to promote energy efficiency programs. "The current incentives are inadequate. Previous experiences such as lines of credits haven't had demand by the private sector. "[758] Also, the current programs seem more focused on the residential and commercials sectors where the benefits, although important, are less extensive than industrial efficiency.[759] Finally, the Law fails to recognize problems associated with the lack of information and characterization of energy efficiency in various sectors. To solve these problems, the Ministry must develop programs and energy intensity indicators, as well as tools for monitoring goals, and opportunities for energy saving. However, the Ministry "currently does not have the resources to develop the strategies and successful implementation of appropriate actions."[760] It must be adequately funded to carry out these programs.

To conclude, a few comments on the institutional duties set forth in the 2014 NRES Law are necessary to carry out the Law's mandates. An important accomplishment is the clear definition of roles by the Ministry and its affiliates.[761] The PROURE program has been assigned to the Ministry, but its affiliates for planning UPME, and for non-grid areas IPSE, are key to implement renewable energy and energy efficiency programs. The regulatory agency CREG must play a vital role as it oversees the electricity auction process, and "will need to oversee and set the rules for either a renewable energy auction, a renewable energy portfolio standard, or a feed-in tariff. It will also need to set the rules for net metering and wheeling of renewable electricity. And of course, CREG will need to adjust tariffs, if necessary, to cover the costs of renewable electricity."[762]

Finally, some analysts have proposed increased support for the PROURE program by creating an independent sustainable energy agency affiliated within the Ministry. "If distribution utilities become subject to a regulatory requirement that they acquire renewable energy, then they will need to have the capability to evaluate the reliability and cost of various renewable energy sources, as well as the ability to appraise potential revenues from the sale of RECs or carbon emission reductions."[763] The sustainable energy agency could evaluate, certify, and possibly help finance energy efficiency programs and renewable energy projects. Funding would come from the newly created fund (FENOGE), the fund for non-grid areas (FAZNI), or the National Royalties Fund.

754 *Id.*, p. 16.
755 2014 NRES Law, at Arts. 33.
756 IADB Report, supra n. 21, p. 30.
757 *Id.*, p. 31.
758 *Id.*, p. 30.
759 *Id.*
760 *Id.*, p. 31.
761 2014 NRES Law, at Art. 6.
762 IADB Report, supra n. 21, p. 18.
763 *Id.*

CHAPTER 7B. RENEWABLE ENERGY IN THE PHILIPPINES

Juan Antonio Oposa*

I. INTRODUCTION

On 16 December 2008, the Philippines passed the Renewable Energy Act of 2008 ("PRE Act"). The PRE Act sought to "[a]ccelerate the exploration and development of renewable energy resources [...], to achieve energy self-reliance through the adoption of sustainable energy development strategies to reduce the country's dependence on fossil fuels ..."[764]

With worthy goals such as energy security, and the reduction of harmful emissions, this chapter will now examine the impact of PRE Act over seven years after its passage. It will examine the effects of the PRE Act on the energy sector in the Philippines, as well as possible improvements to the implementation of the PRE Act.

This case study will look at:

- the history of renewable energy laws in the Philippines, as well as the context where the PRE Act was passed;
- the immediate effects of the PRE Act;
- the Feed in Tariff ("FIT") system in the Philippines, which is perhaps the most significant contribution of the PRE Act;
- potential weaknesses in the FIT system that was implemented; and
- A possible way forward to avert the potential weaknesses in the implementation of the FIT system.[765]

The 81 MW Caparispisan Wind Energy Facility, one of the renewable energy projects put up in 2014. Photo courtesy of North Luzon Renewables/AC Energy

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764 Philippine Renewable Energy Act of 2008, Republic Act 9513 (2008) Sec. 2 (a).

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The 81 MW Caparispisan Wind Energy Facility, one of the renewable energy projects put up in 2014. Photo courtesy of North Luzon Renewables/AC Energy

II. HISTORY OF RENEWABLE ENERGY IN THE PHILIPPINES

Since its creation in 1992, the Philippine Department of Energy ("DOE") has kept records of the Philippines' energy generation mix and installed capacity. It reveals that as early as 1991, the Philippines already had already significant renewable energy investments. In that year, the renewable energy generated accounted for 43% of the total energy generated in the Philippines. Stated differently, 10,903 Gigawatt hours ("GWh") out of the 25,649 GWH energy generated in the Philippines came from renewable sources.[766]

In the same year, 45% or 3,043 megawatts ("MW") out of the 6,789 MW of installed capacity were renewable energy facilities.[767] At this time, all of the Philippines renewable energy came from what are classified as older renewable energy technologies ("Old RE"), specifically hydropower and geothermal power. Hydro power accounted for 2,155 MW, and geothermal power provided eight hundred eighty eight (888) MW.[768]

The relatively high amount of renewable energy in the early nineties was due to heavy investments by the government in Old RE in the 1970's. The Energy Development Corporation (EDC), the Philippine's largest renewable energy company, was founded as a government owned and

766 2010 Philippine Power Statistics, Philippine Department of Energy, See https://www.doe.gov.ph/electric-power-statistics/philippine-power-statistics?start=4
767 Ibid.
768 Ibid.

controlled corporation in 1976.[769] From its creation to the present, EDC has continuously developed renewable energy in the Philippines.

However, since then, the growth and development of conventional energy generation (ones that run on fossil fuel) has generally outpaced the development of renewable energy. Conventional generation facilities have grown by over 200%[770] between 1991 and 2014 while renewable energy generation facilities have only expanded by ninety four percent (94%), as shown in Figure 1.[771]

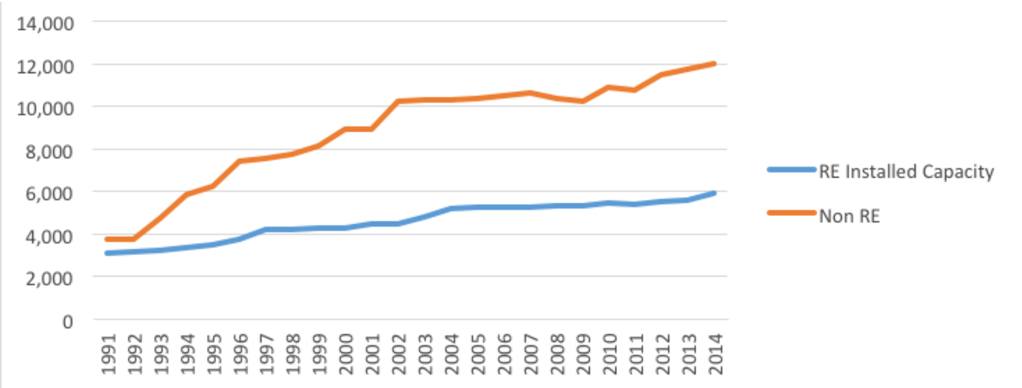

Figure 1: Growth in installed capacity

Furthermore, renewable energy's share in the energy mix has generally dropped since 1991, with renewable energy dropping below thirty percent (30%) in 2010; see Fig. 2.[772]

Figure 2: Share of renewable energy in energy mix 1991–2014

769 "About EDC- Milestones." Energy Development Corporation. N.p., n.d. Web. 31 Dec. 2015.
770 to be more precise there was a 222% growth in conventional energy generation between 1991 and 2014
771 Data from Fig. 1 Extrapolated from 2010 Philippine Power Statistics, Philippine Department of Energy, See https://www.doe.gov.ph/electric-power-statistics/philippine-power-statistics?start=4 and Philippine Power Statistics, Philippine Department of Energy, See https://www.doe.gov.ph/doe_files/pdf/02_Energy_Statistics/power_statistics_2014.pdf
772 Data from Fig. 2 Extrapolated from 2010 Philippine Power Statistics, Philippine Department of Energy, See https://www.doe.gov.ph/electric-power-statistics/philippine-power-statistics?start=4 and 2014 Philippine Power Statistics, Philippine Department of Energy, See https://www.doe.gov.ph/doe_files/pdf/02_Energy_Statistics/power_statistics_2014.pdf

III. RENEWABLE ENERGY LAWS IN THE PHILIPPINES

A. Renewable Energy Act of 2008

In response to the slow growth of renewable energy in the Philippines the Philippines passed the PRE Act on 16 December 2008 with the following objectives:

Section 2. Declaration of Policies. - It is hereby declared the policy of the State to:

(a) Accelerate the exploration and development of renewable energy resources such as, but not limited to, biomass, solar, wind, hydro, geothermal and ocean energy sources, including hybrid systems, to achieve energy self-reliance, through the adoption of sustainable energy development strategies to reduce the country's dependence on fossil fuels and thereby minimize the country's exposure to price fluctuations in the international markets, the effects of which spiral down to almost all sectors of the economy;

(b) Increase the utilization of renewable energy by institutionalizing the development of national and local capabilities in the use of renewable energy systems, and promoting its efficient and cost-effective commercial application by providing fiscal and nonfiscal incentives;

(c) Encourage the development and utilization of renewable energy resources as tools to effectively prevent or reduce harmful emissions and thereby balance the goals of economic growth and development with the protection of health and the environment; and

(d) Establish the necessary infrastructure and mechanism to carry out the mandates specified in this Act and other existing laws.[491]

491 PRE Act, Republic Act 9513 (2008) Sec. 2

The PRE Act also included, among others, the following benefits to accelerate the development of renewable energy:[773]

- Income tax holiday for the first seven years of commercial operations;
- Duty-free importation of renewable machinery, equipment, and materials;
- Special realty tax rates on equipment and machinery;
- Special corporate tax rate of 10% after the income tax holiday; and
- Zero rating on the value-added tax.

Since the passage of the PRE Act in 2008, there were significant increases in what the DOE calls "new renewable energy"[774] ("New RE") technology facilities, specified as solar, wind, biomass, and run-of-river hydro. Between 2008 and 2013, the installed capacity of New RE went from thirty

773 Ibid, Sec. 15
774 2014 Philippine Power Statistics, Philippine Department of Energy, See https://www.doe.gov.ph/doe_files/pdf/02_Energy_Statistics/power_statistics_2014.pdf

four (34) MW to one hundred fifty three (153) MW,[775] an almost fivefold increase in capacity in five years. Though this is relatively small on a megawatt per megawatt basis compared to conventional generation, the growth of New RE appears promising.

The most significant feature of the PRE Act was the introduction of the Feed-in-Tariff "FIT". The Feed-in-Tariff, a system that has been implemented in other countries, has proven to be one of the most effective methods of increasing renewable energy development.

The biggest boost in the development of renewable energy came between 2013 and 2014, when the FIT system was implemented. Between 2013 and 2014 the installed capacity from renewable energy[776] facilities utilizing newer technologies (i.e. wind, solar, biomass, and run of river hydro) almost tripled, going from one hundred fifty three (153) MW to four hundred thirty seven (437) MW.

With the introduction of the FIT system, the Philippines saw its greatest growth in total renewable energy capacity since 2004. In 2014, renewable energy installed capacity grew by six percent (6%) (See Fig. 1), the greatest leap in renewable energy installed capacity since 2004 when it grew eight percent (8%) (See Fig. 1).

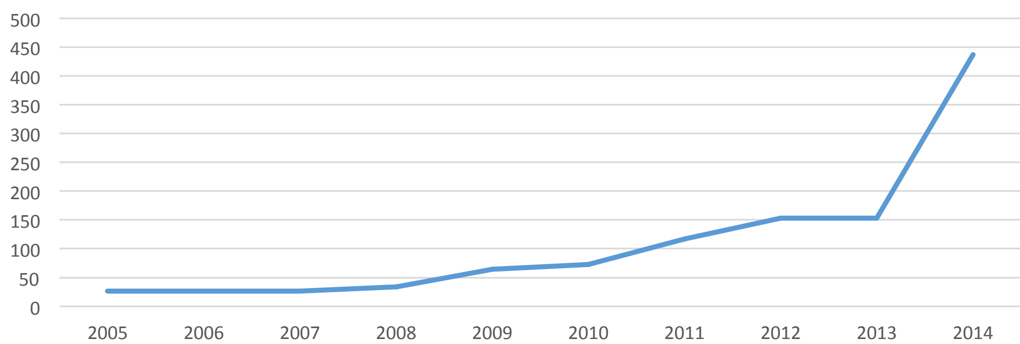

Figure 3: New RE technologies intalled capacity (Mw)

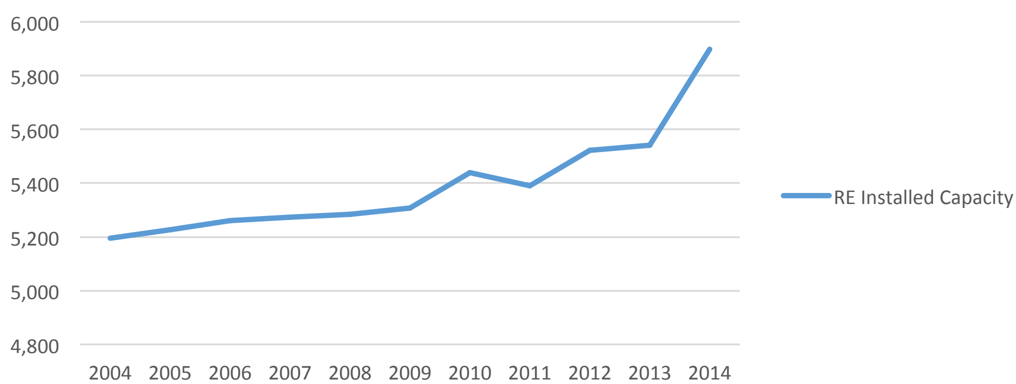

Figure 4: Growth in RE installed capacity

775 To be precise, a 350% increase
776 There was an increase of186%

B. Feed-In-Tariff in the Philippines

The provisions on the FIT within the PRE Act are as follows:

"Section 7. Feed-In Tariff System. - To accelerate the development of emerging renewable energy resources, a feed-in tariff system for electricity produced from wind, solar, ocean, run-of-river hydropower and biomass is hereby mandated. Towards this end, the [Energy Regulatory Commission (ERC)] in consultation with the National Renewable Energy Board (NREB) created under Section 27 of this Act shall formulate and promulgate feed-in tariff system rules within one (1) year upon the effectivity of this Act which shall include, but not limited to the following:

(a) Priority connections to the grid for electricity generated from emerging renewable energy resources such as wind, solar, ocean, run-of-river hydropower and biomass power plants within the territory of the Philippines;

(b) The priority purchase and transmission of, and payment for, such electricity by the grid system operators;

(c) Determine the fixed tariff to be paid to electricity produced from each type of emerging renewable energy and the mandated number of years for the application of these rates, which shall not be less than twelve (12) years;

(d) The feed-in tariff to be set shall be applied to the emerging renewable energy to be used in compliance with the renewable portfolio standard[491] as provided for in this Act and in accordance with the RPS rules that will be established by the DOE."[492]

491 Renewable Portfolio Standards are defined by the PRE Act as "market-based policy that requires electricity suppliers to source an agreed portion of their energy supply from eligible RE resources", Sec 4 (ss); however, as of the writing of this paper, Renewable Portfolio Standards have not been implemented

492 PRE Act, Sec. 7.

Note that the FIT was only granted to four specific technologies: solar, wind, run-of-river hydro, and biomass.

The PRE Act's FIT system possesses the essential qualities of a FIT system insofar as it:

1) Sets a fixed price for the purchase of renewable power, usually paying producers a premium rate;
2) Provides priority grid connection;
3) Provides priority purchase and transmission; and
4) Permits technology-specific tariffs.[777]

The importance of all of these features of the FIT, making it possible to see how it has helped the growth of renewable energy in the Philippines.

777 Miguel Mendonca, David Jacobs, and Benjamin Sovacool, Powering the Green Economy: The Feed In Tariff Handbook, Introduction xxi (2010)

1. Fixed Price

The fixed price purchase of renewable energy (RE) promises developers and owners of renewable energy facilities guaranteed returns on their investments. One of the ways electricity is sold by generators in the Philippines is through an electricity spot market. In the spot market electricity is bought and sold via competitive bidding, and prices vary from hour-to-hour. These fluctuations can wreak havoc on a renewable energy (RE) facility's income, as the availability of electricity in an RE facility cannot be controlled to match the supply and demand of the market. Availability and production of solar, wind, and to a certain extent run-of-river hydro[778] energy in RE facilities are dictated by the weather and not the market. A guaranteed fixed price means that the owner of the renewable energy facility will not need to bid for prices in an electricity spot market where the price of electricity fluctuates with the supply and demand for energy. It means that all the electricity that an RE Facility dispatches will be sold at a guaranteed price.

2. Priority Grid Connection

Priority grid connection assures a renewable energy developer that the grid operator will not deny a renewable energy facility access to the main grid. Grid operators are generally hesitant to allow RE facilities to tap into the grid due to the reputation of renewables creating havoc with the current and voltage regulation and also due to the perceived likelihood of trips and failures in the voltage and current variations caused by fluctuations in the energy output of New RE technology. The requirement of priority grid connection ensures that the grid operator is forced to work with the facility in regulating both voltage and current. Additionally, the Energy Regulatory Commission (ERC) mandated that variable RE technology pass stringent grid connection and operational requirements.[779] As an aside, new developments in RE technologies have given wind and solar power more grid stability and reliability, making the past problems with current and voltage regulation less likely. These developments in the technology should reduce the hesitation of grid operators to connect renewable energy facilities to the grid.

3. Priority Purchase

Priority purchase and transmission of renewable energy addresses the variability of technologies such as solar or wind. Priority purchase ensures that the energy generated by the renewable energy facility is transmitted, consumed and paid for whenever the energy is generated.

Technology-Specific Tariffs

Finally, technology specific tariffs accommodate the costs of newer renewable energy technologies. Solar and wind energy have higher upfront costs compared to run-of-river hydro and biomass.[780] Furthermore the amount of energy wind and solar farms can generate in proportion to a year, also

778 Run of River Hydro is classified as a power plant with pondage, or without pondage. A run-of-river plant without poundage has no control over river flow and uses the water as it comes. A run-of-river with pondage may supply base load or peak power. At times of high water flow it may be base loaded and during dry seasons it may be peak loaded. A.K. Raja, Amit Prakash Srivastava, Manish Dwivedi,(2006). Power Plant Engineering. New Delhi: New Age International. p. 354.

779 ERC Resolution No. 7, Series of 2013.

780 The rates for the specific technologies were adopted in ERC Resolution No 10, Series of 2012

known as the capacity factor, is generally lower than that of other energy resources. This means that to grant New RE the same economic rate of return as other more established forms of generation, they must be awarded higher tariffs to be competitive in the investor market. See FIT rate compared with prevailing rates in Fig. 5.[781]

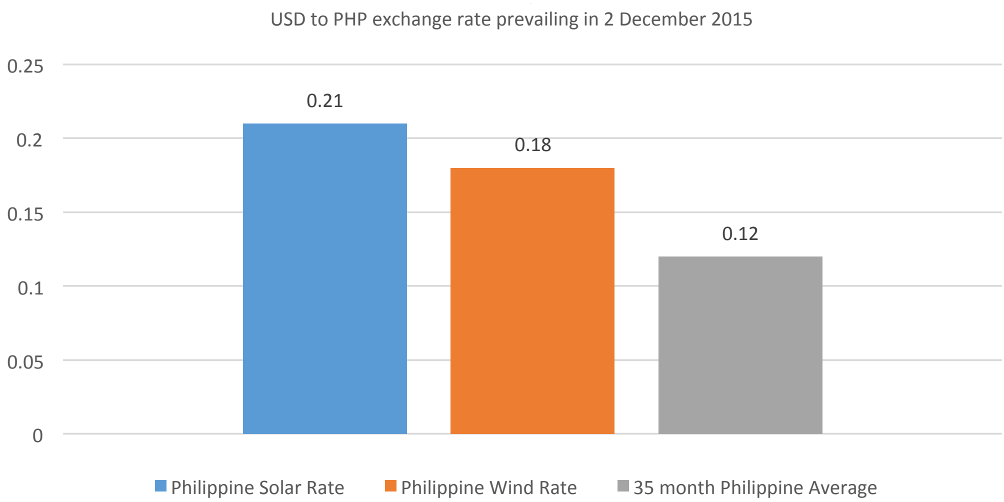

Figure 5: Philippine first round FIT rate (USD) compared to prevailing rates

4. First-Come-First-Served

The Philippines implemented the FIT system by setting FIT installation targets and awarding the FIT rates to any facilities that fell into a prescribed target. The initial target was fifty (50) MW for solar, two hundred (200) MW for wind, two hundred fifty (250) MW for run of river hydro, and two hundred fifty (250) MW for biomass.[782]

DOE Department Circular No. DC 2013-05-0009 awarded the FIT to the facilities that were commissioned before the target was fully-subscribed. This means that the FIT incentives were given to the developers and facilities that could be constructed and commissioned at the soonest possible time. This first-come-first-served system was implemented to discourage overly optimistic developers from attempting to avail of the FIT without the proper development and financing capabilities.[783]

781 In The Matter Of The Application For Approval Of The Feed-In Tariff Allowance For A Calendar Years 2014 And 2015 Pursuant To The Guidelines For The Collection Of The Feed-In Tariff Allowance And Disbursement Of The Feed-In Tariff Allowance Fund, With Prayer For Provisional Authority, ERC Case No. 2014-109 RC, Order dated 7 October 2014

782 ERC Resolution No. 10 Series of 2012. It should be noted that despite a target for ocean power, the ERC ruled that the technology was still too expensive to provide a viable rate for ocean energy.

783 Euan Paulo C. Anonuevo, DOE To Grant Renewable Energy Perks On 'First Come, First Serve' Basis, Interaksyon.Com, Retrieved From: *http://www.interaksyon.com/business/54895/doe-to-grant-* renewable-energy-perks-on-first-come-first-serve-basis

The first-come-first-served system is a natural way of ensuring the technical and financial capacity of developers with minimal government intervention. In essence, to avail of the FIT, the DOE only required developers to 1) state their intent to avail of the FIT, and 2) have an operational project before the FIT target was fully availed. These two requirements were of course on top of the regular reportorial requirements on other power plants which include getting satisfactory service contracts, the submission of accurate monthly progress reports, and the submission of annual work plans, as well as proof of the ability to fund the work plan.[784]

The award of the FIT was then liberally applied to the RE facilities. The DOE endorsed all RE Facilities that were able to construct and commission RE facilities before the FIT targets were filled up, even if the total exceeded the target. By way of example, the FIT target for wind energy was 200 MW, but the FIT was awarded to three facilities totalling 250 MW, a one hundred fifty (150) MW facility, an eighty one (81) MW facility, and a nineteen (19) MW facility.[785]

Including facilities that exceeded the target was done for policy and technical reasons. As a matter of policy, the inclusion of the excess capacity over the target was a way to encourage renewable energy developers to keep building despite not being fully within the FIT target. As a matter of engineering, it would have been difficult, if not impossible to split the energy generated in one facility into two separate rates.

This regulation has spurred the development of more and more solar and wind projects, with a new target solar at 500 MW, expected to be met by March 2016,[786] and the new 400 MW target for wind was fully subscribed even before the target and the rate were finalized.[787]

The 81 MW Caparispisan Wind Energy Facility. Photo courtesy of North Luzon Renewables/ AC Energy

The implementation of the FIT was the direct cause of the growth in the Philippines renewable energy capacity in 2014. Most if not all facilities that utilised New RE technologies availed of the FIT system. The FIT system has also increased the Philippines RE installed capacity in 2015[788] and 2016 due to the increased FIT targets for solar and wind technology.[789]

784 Department of Energy Department Circular No. DC 2009-07-0011

785 Myrna Velasco, Lopez and Ayala are 'big winners' in FIT incentives for wind plants , Manila Bulletin, Retrieved from: http://www.mb.com.ph/lopez-and-ayala-are-big-winners-in-fit-incentives-for-wind-plants/#z04Yhr4SJdDtlMCd.99

786 ADVISORY: SOLAR FIT RACE Deadline, Philippine Department of Energy, Retrieved from: http://www.doe.gov.ph/news-events/events/announcements/2904-advisory-solar-fit-race-deadline

787 In The Matter Of The Adoption Of Amendments To Resolution No. 10 Series Of 2012, Entitled "A Resolution Approving The Feed-In Tariff (FIT) Rates" (Fit Rules Particularly For Wind FIT Rates, As Necessitated By The Review And Re-Adjustment Of The Wind FIT Since The Installation Target For Wind Technology Has Already Been Achieved, ERC Case No 2015-002 RM

788 Feed-in-Tariff Monitoring Board Renewable Energy Registration and Accreditation, Projects With Certificate of Confirmation of Commerciality, http://www.doe.gov.ph/feed-in-tarriff-monitoring-board/with-certificate-of-confirmation-of-commerciality

789 Danessa Rivera, Three More Solar Project Seek FIT Perks, The Philippine Star, Retrieved From: http://www.philstar.com/business/2016/03/06/1559808/three-more-solar-projects-seek-fit-perks

The 81 MW Caparispisan Wind Energy Facility. Photo courtesy of North Luzon Renewables/AC Energy

5. Boom-Bust

However, the Philippine policy of setting relatively low FIT targets (a total 750 MW for the first round with a total of 1400 MW after the second round), and a first-come-first-served system of qualification, creates the threat of having a boom-bust effect on renewable energy growth. As stated, the introduction and implementation of the FIT has led to growth in the Philippine RE industry. It can directly be credited with the increase of hundreds of megawatts in the renewable energy installed capacity in the Philippines.

However, two factors would contribute to a bust in renewable energy growth in the Philippines. The first factor is the requirement that the FIT targets for the different technologies be fully subscribed or expire between 2016 and 2017, and there are no guarantees as to when the next FIT targets will be implemented. Despite the DOE approving thousands of megawatts of new capacity, it is unlikely that any of these projects will be built without the FIT or other income based incentives.

It took five years since the passage of the PRE Act for the energy administrator and regulator to pass the initial target and rates for the FIT. On top of that, the second round of FIT targets for wind energy were fully subscribed before the FIT terms were even finalised. The FIT target for wind was increased from 200 MW to 400 MW, but the increase merely accommodated the wind facilities that were unable to avail of the first round of the FIT, meaning 393 MW out of the 400 MW target was subscribed and filled up, before the new rules for the second round of the FIT was even finalised. As for solar 144.4 MW out of the 500 MW of the solar target has been subscribed, with over 4,000 MW worth of solar projects vying to subscribe to the target.[790]

790 Awarded Solar Projects as of 31 December 2015, retrieved and downloaded from: http://www.doe.gov.ph/awarded-projects/awarded-solar

The second factor is dropping coal prices worldwide. From 2011 to 2015 global coal prices have seen a general drop in cost per metric ton. The Philippines is also developing more coal plants driving energy prices down due to lower fuel costs and the higher capacity factors of coal plants. Currently, 25 new coal plants are in the pipeline, with a total proposed capacity of 12,200 MW.[791] Though lower electricity prices are generally a good thing, low energy prices due to coal don't consider health and environmental costs in the pricing of coal energy. These externality costs of coal have been estimated to reflect more than a doubling of the cost of coal to the consumer.[792]

The apparent lower cost of energy due to the development of more coal plants makes power purchase agreements with energy distribution companies less likely. Currently, coal plants are able to sell the energy they generate at USD 0.08 per kWh, as compared to renewable energy prices which are significantly higher, not considering the externality costs of coal.[793]

Without a guarantee as to the next round of the FIT, potential losses from the investment in renewable energy, place the Philippines on the brink of a renewable energy bust.

6. Way Forward To Prevent a Boom-Bust Cycle

At this time, there have been no increases in the FIT targets, other than a second round of increases for solar and wind power. Increases to the FIT targets are still undergoing public consultation as of the writing of this chapter.

To prevent a boom-bust cycle for renewable energy in the Philippines, there needs to be the bold move of increasing the FIT targets by 1,500 MW for each technology resulting in a cumulative FIT target of 1900 MW for wind and 2000 MW for solar.

The DOE has proposed an auction system for the next round of the FIT.[794] However, the biggest issue with the auction system would be that it would allow overly optimistic developers to gain rights to a FIT without being able to really build renewable energy facilities. Overly optimistic developers may push out realistic developers from availing of the FIT, and may cause less RE facilities to be built.[795]

An increase of the FIT targets by 1,500 MW can allow renewable energy developers to have access to cheaper forms of capital, and better of economies of scale. This in turn will allow for more renewable energy facilities, with bigger capacities.

The general flaw in the first round of the FIT targets was a first-come-first-served system coupled with low targets. This scheme restricted the borrowing ability of the project developers due to unsure returns on the investment if the RE facility was not qualified for the FIT. As debt capital has an interest rate of around 6%, while some other forms of capital such as equity can have interest rates hovering between 14% and 20%, it is generally cheaper to finance a project with debt rather than with

791 Dela Cruz, , 2015, Aug 24, Erik, Philippines' coal-power plans unsettle clean-energy investors, Reuters, Retrieved From: http://www.reuters.com/article/philippines-energy-coal-idUSL3N10U22520150824

792 The Environmental Costs of Electricity, Pace Energy Project, Oceana Publications, 2004.

793 Power Supply Agreements, Power Supply Agreement rate between GN Power and ISECO retrieved from: kuryente.org.ph/power-supply-agreement

794 Department of Energy Department Circular No. DC 2015-07-0014, Sec. 4.

795 Greg Buckman, Jon Sibley, Richard Bourne, The large-scale solar feed-in tariff reverse auction in the Australian Capital Territory, Australia, Retrieved From: *https://www.deepdyve.com/lp/elsevier/the-large-scale-solar-feed-in-tariff-reverse-auction-in-the-australian-CsJdATQINA?key=elsevier*, Originally from: Energy Policy, Volume 72, September 2014, Pages 14-22

equity. A large FIT target of 1500 MW may sufficiently offset the financial risks involved in a first-come-first-served system of awarding the FIT. The offset of the financial risk would give renewable energy developers access to cheaper capital, allowing them to construct more renewable energy facilities at a lower cost.

A larger target will also lead to better economies of scale. A large FIT target can make RE projects with hundreds of megawatts in capacity the norm and not the exception. All energy facilities have some, more or less, fixed costs like the costs of transmission lines, substations, operations' buildings, and other general infrastructure works. By increasing the FIT targets developers can develop larger renewable energy facilities which would grant economies of scale.

If the FIT targets are increased by 1,500 MW, wind energy, that now enjoys a FIT rate of USD 0.18 per kWh, can be successfully developed at a rate of under USD 0.13.[796]

IV. CONCLUSION

In closing, it is clear that the PRE Act has encouraged growth in the renewable energy sector in the Philippines. Installed capacity of renewable energy in the Philippines has undeniably grown since the introduction of the PRE Act and the FIT.

Historically, the Philippines has utilised renewable energy as a significant source of its energy, but there has been a decline in renewable energy utilization in the past two decades. Through the PRE Act, the Philippines has made significant moves towards direction of using renewable and sustainable energy.

The FIT is the most significant contributor to the growth of renewable energy in recent years. The uptick in installed capacity of renewable energy is directly caused by the FIT, and most proposed RE projects are relying on the FIT as a financial incentive. Additionally, the FIT has been recently credited with lower energy prices in the spot market.[797]

To keep the renewable energy sector growing, the laws must provide for policy incentives and be implemented at the executive and administrative level. There must be a new round of FIT targets and FIT rates to encourage the further development of renewable energy. Further development of renewable energy then gives it a chance to achieve grid parity, meaning that conventional energy and renewable energy can eventually be sold at the same price to consumers.

796 2 December 2015 Conversion rate: PHP 47.18 = USD 1.00

797 Lenie Lectura, RE Plants Kept Power Rates Steady At WESM, PEMC Says, Business Mirror, Retrieved From: http://www.businessmirror.com.ph/re-plants-kept-power-rates-steady-at-wesm-pemc-says/

CHAPTER 7 C. Pakistan Energy Efficiency AND RENEWABLE ENERGY POLICIES AND Laws

Shakeel Hussain Kazmi*

I. INTRODUCTION

A global consensus is emerging that progress in renewable energy and energy efficiency is the most effective way of coping with constant global increase in energy demand and growing concerns for energy security and climate change mitigation. However, addressing energy efficiency and development of renewable energy require changes in institutional and governance systems and changes in social policy. Moreover it is strongly believed that these goals can be achieved only by enhancement of private and public sector awareness of efficient use of natural resources, and a change in cultural and behavioural trends at all levels. These are the same challenges that many countries are facing today while pursuing a clean and sustainable energy path. This study will examine the prevailing laws and policies pertinent to energy and particularly energy efficiency and renewable energy initiatives in Pakistan.

Pakistan presents an alarming and critical energy situation. Power shortfall is triggering 12 to 22 hours long black outs. Experts believe that existing shortfall is significantly the result of: transmission and distribution losses and inefficient machines and appliances in common use in the factories, offices and homes. Many power production units are old and inefficient. About 30 percent of existing production capacity is not used because of "circular debt" (a financial management problem). Power distribution systems are leaky, and there is widespread theft of electricity.

A mixture of geology and location gives Pakistan extensive access to renewable energy, but the share of renewables in its energy mix is close to non-existent. Like many other developing countries in similar situations, the country faces a two-fold energy challenge: meeting the needs of millions of people who still lack a proper access to basic energy services, while at the same time participating in a global transition to clean, low-carbon energy systems. Fortunately the solutions to both challenges are compatible.

It seems that the present government in Pakistan is taking energy challenges seriously and persuasively working on the agenda to phasedown energy shortfalls and to increase renewables in its energy mix. The government has realized that energy efficiency and renewable energy are the fastest, most economical and most environmentally friendly ways to respond to the power challenges.

Ground-breaking energy policies are being initiated and new laws are being enacted to address the prevailing energy crises. The government has initiated an ambitious plan and launched substantial initiatives to involve the private sector and transnational developers and investors to add at least 3,000 megawatts of clean power to Pakistan's national grid within the next 3-5 years. Pakistan is building partnerships to advance an investment plan for an emerging role for clean energy systems, expanding transmission capacity, and mobilizing development financing to help attract private

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sector investments in hydropower, wind, solar, and natural gas projects. Pakistan signed a bilateral agreement with China to meet these challenges in the power sector and to achieve its goal of massive generation of much needed sustainable electricity.

This paper seeks to identify and analyse Pakistani polices, laws and initiatives dealing with energy efficiency and renewable sources. The paper will also provide an evaluation of adequacy of the laws adopted, and an assessment of success or failure of laws to produce effective or ineffective programs.

II. COUNTRY OVERVIEW

A. Geography, Population, Political System

Pakistan is the second most populous country in South Asia and the sixth largest country in the world, with a rapidly growing population currently in excess of 190 million.[798] The country is located in Southern Asia, bordering the Arabian Sea, between India on the east and Iran and Afghanistan on the west and China in the north.[799] It has a total area of 796,095 square kilometres.[800] The State of Pakistan was created under the Independence Act of 1947 and the transfer of power took place on August 14, 1947.[801]

The Islamic Republic of Pakistan is a federal state comprising four provinces and Federally Administered Tribal Areas (FATA).[802] Its constitution provides for a federal parliamentary system with a president as head of state and a popularly elected prime minister as head of government.[803] The bicameral federal legislature is the Majlis-i-Shoora, consisting of the Senate and National Assembly. Members of the National Assembly are elected by universal adult suffrage. The Senate is a permanent legislative body with equal representation from each of the four provinces, elected by the members of their respective provincial assemblies.[804]

The World Bank reported that country's GDP for the year 2014 (at the market price) is US$243.6 billion.[805] According to Asia Development Bank country's GDP growth edged up slightly to 4.2% in FY2015 (ended 30 June 2015) but remained below the government target of 5.0%.[806] The proportion of people in Pakistan earning less than $1.25 per day declined from 35.9% in 2002 to 12.7% in 2011, while the proportion earning less than $2 per day fell from 73.9% to 50.7% during the same period. Despite these gains, half of the population still lives either in absolute poverty or is vulnerable to it.[807]

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798 Total population 199,085,847 (July 2015 est.) CIA World Fact Book, https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html.

799 The World Fact book CIA https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html (last visited April 23, 2016).

800 Library of Congress, Federal Research Division Country Profile: Pakistan, February 2005. This figure, however, does not include the Pakistan-administered portions of Jammu and Kashmir (known as Azad Kashmir and the Northern Areas, with areas of 11,639 square kilometres and 72,520 square kilometres, respectively) available at

801 National Assembly of Pakistan, Parliamentary History, available at http://www.na.gov.pk/en/content.php?id=75

802 National Assembly of Pakistan, Observation of the Rules of Observation, available at http://www.na.gov.pk/en/content.php?id=1 (last visited Apr. 15, 2016).

803 Pakistan, Government Structure, Country Studies http://countrystudies.us/pakistan/65.htm

804 *Id.*

805 The World Bank, Data, Pakistan, http://data.worldbank.org/country/pakistan (last visited Apr. 27, 2016).

806 Asian Development Bank, Pakistan: Economy, http://www.adb.org/countries/pakistan/economy (last visited Apr. 27, 2016).

807 ADP, Poverty in Pakistan, http://www.adb.org/countries/pakistan/poverty (last visited Apr. 27, 2016).

B. International Commitments

Pakistan joined United Nations on September 30, 1947 and is a Party to all major multilateral treaties.[808] Pakistan actively participates in negotiations at the UN related to environment, climate change, and natural resource conservation and management.[809] The country has joined UN's global initiative, Sustainable Energy for All (SE4ALL) in 2013.[810] The UNGA unanimously passed resolution stressed the need to improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services.[811] The Resolution highlighted the importance of improving energy efficiency, increasing the share of renewable energy and cleaner and energy-efficient technologies.[812] Pakistan co-chaired (with Norway and Denmark) a 32 member countries' Group of Friends on Sustainable Energy for All and agreed that the three countries would push for sustainable energy for all as part of the post-2015 Development Agenda.[813]

Pakistan is also party to Climate Change and Energy bilateral agreements. USAID and Pakistan are working together to meet Pakistan's growing energy demands and to alleviate the country's energy crisis.[814] Pakistan's Intended Nationally Determined Contributions (INDC) submitted to recently adopted Paris Agreement,[815] reaffirms its commitment to promote sustainable energy.[816]

C. Energy Crises in Pakistan

Almost forty-five percent of the Pakistan's population lacks access to electricity.[817] Pakistan's per capita use of 14 million Btu is way below the world average of 75 million Btu. Pakistan has seen a considerable growth in power generation and consumption in the last 63 years. In 1947(at the time of its independence) Pakistan inherited 60MW of power generation capability for its then population of 31.5 million, yielding 4.5 units per capita consumption. In 1959 the generation capacity had amplified to 119 MW and 636 MW in 1964-65. In the year 2012, the total power generation increased to 20,499 MW. Although it seems a big leap in production, but compared to consumption, still a big shortfall exist. According to a statement by the Minister of State for Petroleum and Natural Resources, there will be a 50 per cent increase in primary energy demand in Pakistan between 2014 and 2030.

Energy crises and shortages have a long history but the shortfall peaked in 2011. Electricity shortages exceeded 7,000 megawatts in 2011 and the gas shortfall was two billion cubic feet

808 Pakistan Mission to the United Nations, Pakistan at United Nations, http:// www.pakun.org/Pakistan%20at%20 the%20UN/ (last visited Apr. 24, 2016).
809 Pakistan participates actively in climate change and sustainable development negotiations and is party to almost all environmental treaties.
810 United Nations General Assembly Declares 2014-2024 Decade of Sustainable Energy for All, General Assembly Press Release, available at http://www.un.org/press/en/2012/ga11333.doc.htm.
811 *Id*. See General Assembly resolution 69
812 *Id*.
813 Sustainable Energy for All, Pakistan: Rapid Assessment and Gap Analysis
814 USAID, Energy Pakistan, https://www.usaid.gov/pakistan/energy "USAID has supported infrastructure and operational improvements, and promoted policy reforms to help the energy sector function more efficiently and sustainably"
815 Nations sign historic Paris climate deal, Matt McGrath Environment correspondent, BBC News, New York http://www. bbc.com/news/science-environment-36108194 (last visited April 24, 2016).
816 See Pakistan's Intended Nationally Determined Contributions (INDC) available at www4.unfccc.int/submissions/ INDC/.../Pakistan/1/Pakistan%20INDC.doc (last visited April 24, 2015).
817 In 2006, the Asian Development Bank has estimated that 45 percent of Pakistan's population lacked access to electricity.

per day. Experts forecast that electricity shortfall to further increase to 10,844MW by 2020.[818] The New York Times reported, "lights do go out for at least 10 hours a day in major cities, and up to 22 hours a day in rural areas".[819] Current severe and multifaceted energy crisis threatens the country's economy and its precarious security situation. Long blackouts are also deleteriously affecting the lives of everyday residents across the board. In 2009 economic loss in the industrial sector alone, was over $3.8 billion. The country lost half a million jobs and exports worth of $1.3 billion were lost.[820] In January 2015, the Moody's ratings group warned that energy shortages could damage Pakistan's credit worthiness.[821]

III. ENERGY GOVERNANCE AND LEGAL FRAMEWORK

Pakistan is a net importer of crude oil and refined products. In 2013, electricity was produced from oil (36%), natural gas (29%), hydropower (29%) and nuclear power (5%). There are four major power producers and producer groups in the country: Water and Power Development Authority (WAPDA), Karachi Electric Supply Company (KESC), independent power producers (IPPs), and Pakistan Atomic Energy Commission (PAEC).

Only highly populated areas in the country are connected to the high voltage grid. Due to the scale of country and remote settlements more than one third of the population has no access to the power grid.

The energy regime in Pakistan is governed by a series of acts, ordinances, rules, and regulations enacted by the parliament and various policy documents issued from time to time by the government. The primary source of energy law and policy is the Parliament, which is the supreme legislative body in the country. Provincial energy regimes are emerging but are not very significant at this stage. Recently the judiciary has responded to energy crises.[822] Pakistani court decisions in a landmark case will impact energy laws and policies.[823] Experts blame the stalled energy reforms and policies for the historical energy shortfall. The present Government has responded to the growing energy crises by introducing aggressive energy policies and laws.[824]

The next section will provide an overview of the most recent policies and laws directly related to energy efficiency and renewables.

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818 The Express Tribune, Shahram Haq, Oct. 17, 2015 available at http://tribune.com.pk/ story/974259/cpec-group-forecasts-energy-shortfall-to-increase-to-10844mw/ (last visited Apr. 27, 2016).

819 The New York Times, May. 27, 2013. Available at http://www.nytimes.com/2013/05/28/world/asia/pakistan-electricity-shortages-reach-crisis-stage.html (last visited Apr. 27, 2016).

820 Ziad Alahdad, Pakistan Energy Sector: From Crisis to Crisis- Breaking the Chain, Pakistan Institute of Development Economics Islamabad, https://www.wilsoncente r.org/sites/default/files/Pakistan Energy PIDEMonographSeriesZiadAlahdad.pdf.

821 Michael Kugelman, Pakistan's Other National Struggle: It's Energy Crisis, The Wall Street Journal, July. 9, 2015. http://blogs.wsj.com/washwire/2015/07/09/pakistans-other-national-struggle-its-energy-crisis/ (last visited Apr. 28, 2015).

822 Courts are choosing to engage in and deliberate the basic elements leading to energy crises. The Supreme Court of Pakistan, in the case of Engineer Iqbal Zafar Jhagra and Senator Rukhsana Zuberi v Federation of Pakistan and Others, the court invoked the Articles 38 and 9 of the Constitution and acknowledged that the availability of energy and the progress of the nation/state were inextricably linked. The Court observed that energy could impact the quality of life. See Josh and Mac Internationals, Barrister Aemen Zulfikar Maluka, Legislation for Energy Conservation: The Judicial Response in 2014, http://joshandmakinternational.com/publications/legislation-for-energy-conservation-the-judicial-response-in-2014/ (last visited Apr. 28, 2016).

823 *Id.*

824 In 2013, the PM Nawaz Sharif's government introduced the Energy Policy of 2103. A National Energy Efficiency and Conservation Bill is at the final stage of its enactment after approval from the parliament's committee on water and power in 2015.

A. Energy Efficiency and Renewable Energy

1. Energy Efficiency: Goals, Targets, and Strategies: Analysis of Energy Efficiency Policies and Laws

Energy efficiency is a way of managing and restraining the growth in energy consumption. Something is considered more energy efficient if it delivers the same services with less energy input. Energy efficiency belongs at the heart of a low-carbon economy. Improving the way we use energy is essential to our future way of life. By reducing energy use and cutting down on waste, we can make our energy system more sustainable. Energy demand reduction can play an important role in managing our energy system.

There are a variety of legal measures that can be taken to advance energy efficiency, including for example laws and regulations establishing and enforcing building codes, standards for improved industrial processes, vehicle miles per gallon, appliances, lighting, etc.

Most of the energy efficiency goals remove energy waste and save money, sometimes immediately, but almost always over their useful life. They often can be achieved at little cost. Indeed, saving energy usually is much cheaper than producing energy. In the words of Stephen Chu, the former US Secretary of Energy, "energy efficiency is not just low hanging fruit; it is fruit that is lying on the ground".[825]

Like many other developing countries, economic growth, rise in energy consumption due to affordability, and increasing numbers of consumers linked with grid have significantly increased the demand for energy in Pakistan.[826] This trend is predicted to grow in years to come.[827] The current energy supply is insufficient to meet the demand and constant power shortages have adversely affected the economy's potential. One of the main reasons for energy shortfall is inefficient use of energy resources. Moreover with a significant dependence on hydrocarbons and imported oil as its primary energy source, the situation in Pakistan is not sustainable.

Pakistan's current energy utilization per unit of GDP is inefficient. Primarily highly subsidized gas and electricity prices have resulted in institutionalizing inefficiency and profligate usage of energy resources. Interestingly both federal and provincial governments in Pakistan are keen and determined to improve the alarming energy situation in the country.

To achieve these goals, departments in the government have been aggressively developing and implementing energy efficiency policies, laws and regulations. New strategies for energy efficiency projects are persistently pursued to meet new targets. The government of Pakistan aims to build a power generation capacity that can meet country's energy needs in a sustainable manner and to create a culture of energy conservation and responsibility. Promotion of world-class efficiency in power generation sector is its top priority.[828]

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825 U.S. Energy Secretary Steven Chu's address at Harvard's Afternoon Exercises, Harvard Gazette ,June 04, 2009, available at http://news.harvard.edu/gazette/story/2009/06/u-s-energy-secretary-steven-chus-address-at-harvards-afternoon-exercises/ (last visited Apr. 28, 2016).

826 EIA, Today in Energy, Future world energy demand driven by energy trends in developing countries. http://www.eia.gov/todayinenergy/detail.cfm?id=14011 (last visited Apr. 28, 2016).

827 Woodrow Wilson International Centre for School, Fuelling the Future, Meeting Pakistan's Energy Needs in the 21st Century, https://www.wilsoncenter.org/sites/default/files/Asia_FuelingtheFuture_rptmain.pdf.

828 Id. See Policy Goals

Unfortunately, out of the country's installed 23 GW, the available capacity cannot be more than 14 GW due to some very old and inefficient power production units.[829] The new operational policy for energy is based on three organizing principles: efficiency, competition, and sustainability. Although energy efficiency policies and laws can be found in several places, this paper will focus on the most recent ones and on those directly related to energy efficiency. In the section to follow we will look at the related legal framework ascertained by the government to attain its set targets.

2. Energy Efficiency Incentives

Government energy efficiency incentive programs play a significant role in the overall energy policy of Pakistan. A conservation program based on energy saver lighting is already underway with a potential of saving 1,000 MW by switching the consumers to more efficient light bulbs.[830] The Pakistani utility, PEPCO, has initiated several electricity efficiency incentive programmes. At the provincial level, the Department of Energy, Punjab is working to establish a Punjab Energy Efficiency & Conservation Cell (PEECC). The mandate of the PEECC will be to promote energy efficiency projects on the provincial level. A project of energy efficiency evaluation of public offices is already in progress.

B. Energy Efficiency Laws and Policies: The Pakistan Energy Efficiency and Conservation Act 2011

The Government has developed a policy framework to guide energy efficiency actions and investments. The framework is set in the Energy Efficiency and Conservation Act of 2011. The Act is a driver of institutional development to improve energy efficiency. The Act mandated the creation of the National Energy Conservation Authority (ENERCON), the Fund of ENERCON,[831] and the Pakistan Energy Conservation Council.

The Pakistan Energy Efficiency and Conservation Act of 2011 assigns ENERCON multiple roles.[832] At present ENERCON is evolving towards being an independent authority as provided in the National Energy Efficiency & Conservation Bill 2015. ENERCON serves as the national focal point for energy conservation and energy efficiency activities in all sectors of the economy and it is the sole federal authority for initiating, catalysing, carrying out and coordinating the implementation of all energy conservation programs. It is responsible for undertaking pilot projects, information and outreach, training and education, and development of plans and policies for promoting energy efficiency. It also initiates research and development programs in renewable energy.

ENERCON's other wide ranging responsibilities include formulation of energy conservation programs in all the main energy consuming sectors, planning and initiating energy conservation actions nation-wide, outlining policy guidelines to support energy conservation initiatives, developing a

829 A tale of two energy policies, Can renewable energy bridge Pakistan's energy shortfall? Kunwar Khuldune Shahid, MIT Technology Review Pakistan, http://www.technologyreview.pk/a-tale-of-two-energy-policies/

830 Pakistan Renewable Energy Society, Announcement made by Minister of Water and Power, http://www.pres.org.pk/category/news/national/page/158/ (last visited Apr. 28, 2016).

831 LSE the Global Climate Change Legislation Study, Pakistan http://www.lse.ac.uk/GranthamInstitute/legislation/countries/pakistan/ "The ENERCON fund is to be used to meet expenses incurred in promoting the objectives of the Act including payments of salaries etc., rather than the actual implementation of activities per se."

832 National Energy Conservation Centre (ENERCON) Ministry of Water and Power, http://www.enercon.gov.pk/home.php (last visited April 21, 2016).

comprehensive data base on opportunities for energy conservation, supporting training activities on energy conservation applications, undertaking field research and pilot demonstration activities on specific energy conservation options and technologies; and monitoring the implementation of conservation programs by other public and/or private sector entities.[833]

The Energy Conservation Council (PECC) acts as a custodian of national policy for energy conservation. The Council is envisioned to co-ordinate, supervise and carry out enforcement of the provisions of the Pakistan Energy Efficiency and Conservation Act. The Council ensures proper utilization, planning and management of energy in all sectors of the economy. The primary goal of the Council is to create awareness and disseminate information related to efficient use of energy resources. In addition, it is required to coordinate integration and inculcation of energy conservation concerns in national development plans and policies of the country. Additionally, the Council approves energy efficiency standards and ensures their enforcement and compliance. PECC is also mandated: to provide policy support and guidelines for research and development, to initiate pilot programs on energy conservation, to promote and develop investment partnerships between public and private sectors and to prepare recommendations to the federal government conducive in energy conservation, to facilitate import of technologies and encourage local manufactures to develop technologies needed to promote energy conservation.

An ENERCON Fund established was established by PECC to be used to meet expenses incurred in promoting the objectives of the Act including payments of salaries etc., rather than the actual implementation of activities per se.

C. Renewable Energy Development

Historically Pakistan has relied mainly on hydro and oil power, but it has now progressed to harnessing alternative energy to slash the widening energy shortfall. If we exclude large dam hydroelectric power, then generation from renewable energy currently accounts for less than 1% of the energy mix.

Renewable energy resources are widespread and abundant in Pakistan and the government of Pakistan is looking to exploit potential in wind, solar, geothermal, small hydro, and biomass. It has been estimate that wind energy could produce 350,000 MW, solar 2.9 million MW, and geo-thermal 2,500 MW in Pakistan.

Although the Government has undertaken some necessary measures to increase the renewable share in the national electricity mix, development of renewable energy projects has been somewhat slow over the last decade. In the last five years the country has seen some progress in the wind and hydro sectors but only a little attention is paid on solar. Most recently one utility scale solar project of 100 MW in the province of Punjab is generating and several projects are under way.[834] According to a report prepared from a group of studies from the MIT, the Atmosphere/Energy Program at

833 National Energy Conservation Centre (ENERCON) Ministry of Water and Power, http://www.enercon.gov.pk/home.php (last visited April 21, 2016).

834 Aisha Abdelhamid, Pakistan Solar Park Plugs In 100 MW To Grid, Clean Technica, June 19, 2016 available at http://cleantechnica.com/2015/06/19/pakistan-solar-park-plugs-100mw-grid-2/ (last visited Apr. 28, 2016).

Stanford University and University of California, Pakistan has a potential of producing 92 per cent of its electricity requirements via solar energy.[835]

1. Renewable Energy Infrastructure and Policies

In the last thirty years, the government of Pakistan has established several institutions and associations to promote renewable energy technologies to generate electricity, as elaborated below, an Alternate Energy Development Board (AEDB), and the Pakistan Council of Renewable Energy Technology (PCRET) were created and are considered key players. SAARC Energy Centre in Islamabad, a South Asia Initiative in Energy (SARI/E), and The UN Development Programme (UNDP) are major regional and international organizations involved to promote renewable energy in Pakistan.

2. Alternate Energy Development Board (AEDB)

Established in May 2003, the Alternate Energy Development Board (AEDB) acts as the central national body to promote renewable energy.[836] Its main objective is to facilitate, promote, and encourage development of renewable energy. The AEDB is additionally charged with providing electricity services to 7,874 remote villages located far from the national power grids.[837] The AEDB has formulated renewable energy policy, has launched various renewable energy projects, and has acquired 18,000 acres of land suitable for installation of wind turbine farms in future.[838]

3. Policy for Development of Renewable Energy for Power Generation

In 2006 Pakistan launched its first renewable energy policy dedicated to exploring its untapped renewable energy resources.[839] The primary target of the policy was to adopt renewable energy technologies to cope with continuously growing energy shortage,[840] and to promote environmental protection and awareness.[841] This renewable energy policy proposed relaxation of the governmental approvals and burdensome requirements for renewable projects. It promoted private sector investment, easier financing, encouraged formation of a domestic manufacturing industry and promoted environmental protection and awareness. The policy exempted non-IPP projects from approval and allowed all parties to put up their own projects. It announced that there would be no income tax on renewable energy projects and that renewable energy equipment would be free of sales tax and custom duties. It offered wind risk insurance in certain areas (risk of variability of wind speed) and provided guaranteed electricity purchases, stating that grid access would be the responsibility of the purchaser and provided protection against political risk. It also offered attractive renewable energy tariffs (cost plus with up to 17% ROE), indexed to inflation and exchange rate

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835 Pakistan can achieve highest solar power potential by 2050: Study, Pakistan Today, Dec. 02, 2015, available at http://www.pakistantoday.com.pk/2015/12/ 02/business/pakistan-can-achieve-highest-solar-power-potential-by-2050-study/ (last visited Apr. 28, 2016).

836 Alternative Energy Development Board, Ministry of Water and Power Government of Pakistan, Wind Energy in Pakistan, http://www.aedb.org/Ordinance.htm (last visited Jan. 05, 2013)

837 *Id.*

838 *Id.* Visit AEDB website to see a complete list of projects.

839 AEDB introduced the Policy for Development of Renewable Energy for Power Generation in 2006. Policy document is available at AEDB's website, http://www.aedb.org/Ordinance.htm

840 See supra note 88. Mashael Yazdanie, Renewable Energy in Pakistan

841 *Id.*

variation (Rupee/Dollar). Euro/Dollar parity is allowed and possible carbon credits were to be made available. Issuance of corporate registered bonds were also allowed.[842]

These provisions were amplified in 2011. The Alternative Energy Development Board (AEDB), in consultation with the federal Ministry of Water and Power and other governmental and non-governmental bodies, enacted the Alternative and Renewable Energy Policy (ARE 2011). The policy sets the target of at least 5% of total commercial energy supplies through alternative and renewable energy sources by 2030.[843] The ARE Policy 2011 provides a comprehensive framework encompassing wider scope for utilization of all ARE sources; not only for the purposes of generation of electricity but also for encouraging recourse and utilization of ARE technology (ARET) based applications by commercial and domestic consumers.[844]

The policy director of AEDB stated that the primary difference between new and 2006 policy was that the focus of the previous renewable energy policy was wind and hydroelectric power, but that the new policy included other sources of renewable energy such as geothermal, ocean waves and tides, solar and bio-waste. The policy simplified the licensing procedure for IPPs up to 5 MW and required a concessional fee structure. Net metering and wheeling were the prominent incentives of this policy. The ARE 2011 allowed net metering and billing.

Section 4.4.1 of the policy provided for electricity wheeling. IPP producers were also permitted to inject electricity at one point on one grid and receive an equivalent amount at another location. The policy attempted to improve incentives over the earlier 2006 policy both for individual consumers installing solar panels in their homes and for larger investors. The government announced that it was set to raise feed-in tariffs (FITs) requiring electric supply companies to purchase electricity guaranteeing up to eighteen percent return to private producers of wind and solar power.[845] Section 4.1.1 guaranteed the market for investors and made it mandatory for electric companies to purchase the power from renewable projects. The section reads, 'It shall be mandatory for NTDC/CPPA/DISCOs [utilities] to buy all the electricity offered to them by ARE projects established pursuant to the ARE Policy 2011 at rates determined by [the regulatory agency] NEPRA."[846]

4. Net Metering

Pakistan's energy regulator, NEPRA (National Electric Power Regulatory Authority), has approved and put into effect net metering schemes for solar and wind generation of up to 1MW.[847] The plans were drafted in October 2014 and approved at government level in 2015. NEPRA in

842 See Policy for Development of Renewable Energy for Power Generation (2006). Policy document is available at AEDB's website, http://www.aedb.org/Ordinance.htm

843 See Alternative and Renewable Energy Policy (ARE 2011) Alternative Energy Development Board, Ministry of Water and Power Government of Pakistan, Wind Energy in Pakistan, http://www.aedb.org/Ordinance.htm.

844 See Introduction, Alternative and Renewable Energy Policy (ARE 2011) Alternative Energy Development Board, Ministry of Water and Power Government of Pakistan.

845 See section 4.3.3 ARE 2011, Feed in Tariffs "GOP recognizes that Feed-in Tariff has been globally tested tool to attract prompt investment in ARE sector. Feed in tariffs are therefore to be announced by NEPRA in respect of various ARE sources at such levels as deemed appropriate and duly supported by relevant NEPRA rules on the subject."

846 ARE 2011 Section 4.1.1 1Guaranteed Market: Mandatory Purchase of Electricity.

847 Colthorpe, A. (2015). Net metering law comes into effect in Pakistan for solar up to 1MW. PV- Tech. Published on 7 Sept 2015. [URL: http://www.p www.pv-tech.org/news/net_ metering_ law_comes _into_effect_in_pakistan_for_ solar_up_to_1mw%5D. Accessed 13 September 2015. Eversheds (2015). Pakistan: NEPRA approves Net Metering Regulations. Eversheds. Published on 10 September 2015. [URL:http:// www.eversheds.com/global/en /what/articles/ index.page?Article ID=en/Energy/Pakistan_NEPRA_net_metering%5D. Accessed 13 September 2015.

its announcement called it a "framework for the regulation of Distributed Generation by using alternative and renewable energy net metering." After the notification on (Sep. 01, 2015) the new scheme was put into force immediately. NEPRA will grant generation licenses to interested solar and wind system owners. Requirements for a license include description (maker and model of inverter and generator) of equipment used and the generator must also install a manual disconnect device to take the system off the network if necessary.

D. Renewable Energy Projects and Initiatives

The Government demonstrated serious interest in promoting electricity from renewable sources, especially solar and wind initiating a number of projects in the power sector to overcome the energy shortages in the country; however, most of these solar and wind power projects for exploitation on a commercial basis have not been operational yet.

Nevertheless, there has been considerable progress. The Alternative Energy Development Board (AEDB) announced that foreign investors have poured $3 billion over the last year into the renewable energy sector. The CEO of AEDB stated that 25 letters of intent had been received for construction of solar projects of total capacity of 663 MW. All these projects are expected to be commissioned by 2018.

The provincial government of Punjab has also received letters of intent for 600 MW of solar power projects.

The largest and recent development in the Pakistan's renewable energy sector is from China. Chinese companies are working on a number of wind energy and solar power projects. The construction of the largest solar project, Quaid-e-Azam Solar Power Park (QASP) in Cholistan Desert of the Punjab is already underway. The project currently has an installed capacity of 100 MW and is expected to be increased by another 300 MW soon. The project will eventually have an installed capacity of 1 GW by 2017. China has been supporting Pakistan with financial and technical assistance for setting up power plants across various technologies. QASP is an ambitious plan to build the world's largest solar farm.

Besides these solar projects, several small to large-scale wind project were initiated. The small wind projects include eighty-five micro turbines in Mirpur Sakro (these turbines are enough to power 356 homes), and forty turbines installed in Kund Mali have the capacity to power 111 homes. The major wind energy projects in progress and already completed include a 50 MW wind energy project in the Jhimpir Thata District,[848] and several other smaller projects[849]

Pakistan has also entered into an agreement with a major U.S. power producer, AES Corporation.[850] AES has agreed to build a wind farm to produce 150 megawatts of electricity near Karachi. The $375 million project will develop at three sites with assistance from US Agency for International

848 The project is constructed at Jhimpir in the district of Thatta. It is only 144 kilometres away from Pakistan's largest city and commercial hub. The project was executed by FFC Energy Limited, a subsidiary of Fauji Fertilizer Company, Ltd. (FFCL) and Zorlu Energy Pakistan, the local subsidiary of a Turkish company. The project of thirty-three German made wind turbines was funded by ADB and was completed within a year. According to the Project Director FFECL Wind Farm Brigadier Izaz, total cost of the wind energy project stood at $134 million.

849 For wind energy project status and details, please visit AEDB website. http://www.aedb.org/index.php

850 AES owns and operates a diverse portfolio of electricity generation and distribution businesses. See AES website http://www.aes.com/aes/index?page=home (last visited Dec. 29, 2012).

Development (USAID). China is helping Pakistan build a wind power plant near its southern port city of Karachi with a total investment of $115 million.[851]

E. Recent Laws, Policies, and Initiatives

In 2013 Prime Minister Nawaz Sharif announced a determined, aggressive, and wide-ranging energy policy to meet the country's energy challenges and update its energy management. The government has pursued many measures to implement the National Power Policy (NPP 2013), which was developed by the Ministry of Water and Power.[852]

1. The NPP13 – The National Power Policy

In brief the NPP13 addresses production of new energy, affordability, loss in distribution and transmission and increase in bill recovery. The reform agenda includes stimulus mobilization of private expertise, finances, and management. Energy efficiency, competition and sustainability are 3 basic organizing and strategic principals of the NPP13.[853]

NPP13 sets the following targets:

a. Decrease the supply demand gap from 4500 - 5000 MW today to 0 by 2017;

b. Decrease cost of generation from 12c / unit today to 10c / unit by 2017;

c. Decrease transmission and distribution losses from 23-25% to 16% by 2017;

d. Increase collection from 85% to 95% by 2017; and

e. Decrease decision making processing time at the Ministry, related departments and regulators from long to short durations[854]

The government announced a list of ambitious projects to add more than 16,000 MW of new generation capacity by 2018. To tackle the energy sector's financial constraints, the Government raised tariffs for commercial and industrial users by about 44 percent in August 2013 and for residential consumers by about 32 percent in October 2013.

The policy also calls to improve the efficiency of the utilities, reducing the cost of power generation.

Efforts to privatize the state owned distribution companies are part of a broader package. Apparently the privatization programs have moved slowly because the divestiture of public enterprises requires substantial preparation. Moreover, it faces opposition in political circles and resistance from vested interest groups within the utilities. In response to an inefficient power transmission and distribution system the National Power Policy (2013) aims to "develop the most efficient and consumer-centric power generation, transmission and distribution system." The Policy aims to: create a culture of energy conservation and responsibility; promote world-class efficiency in power generation; and

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851 See Pakistan Today, Aug. 02, 2015. http://www.pakistantoday.com.pk/2015/08/02/business/china-invests-115m-to-develop-wind-energy-in-pakistan/ (last visited Apr. 27, 2016).
852 Ministry of Electric and Water's website and at http://www.ppib.gov.pk/National%20Power%20Policy%202013.pdf (Last visited Apr. 28, 2016).
853 *Id.*
854 *Id.* See Targets

minimize inefficiencies in the distribution system (decrease transmission and distribution loss from 23-25% to 16% by 2017).

2. National Energy Efficiency and Conservation Act 2015 (NEECA).

The present government of PM Nawaz Sharif, acknowledging the need and importance of energy efficiency, introduced a comprehensive law to achieve the vital and challenging mandate of energy efficiency and conservation in all sectors of economy. The Ministry of Water and Power prepared a comprehensive energy efficiency and conservation bill to reach specified energy efficiency and conservation targets more effectively.

On May 14, 2015, the Council of Common Interest (CCI), which is a Pakistani constitutional body that participates with the Parliament in enacting legislation,[855] approved the National Energy Efficiency and Conservation Bill,[856] and in August 2015, the National Assembly's Standing Committee on Water & Power cleared it for parliament to enact. The Act specifies standards for processing and energy consumption for equipment, and it prohibits manufacturing or sale or import of any equipment unless such equipment conforms to its energy consumption standards; and it prescribes penalties for energy inefficient equipment. Key features of the Act follow.

a. Pakistan Energy Efficiency & Conservation Board

The NEECA requires that the Federal Government shall establish a Board to be known as the Pakistan Energy Efficiency & Conservation Board. The section 4 of the Act lists the functions of the Board.[857] The Board is to act as custodian of national policy for energy conservation and is to l coordinate, supervise, and carry out enforcement of the Act. It is to create awareness and disseminate information related to efficient use of energy resources; coordinate integration and inculcation of energy conservation concerns in national development plans and policies; approve energy efficiency standards and ensure their enforcement and compliance; direct the National Energy Efficiency and Conservation Authority to conduct research and development; supervise preparation and execution of demonstration projects and national programs on energy conservation; recommend to the Federal Government the adoption of measures directly or indirectly conducive to energy conservation; promote investment by the public and private sectors in energy conservation through partnerships or otherwise; encourage and facilitate import, local manufacture, and use of indigenous technologies for the promotion of energy conservation; and institute national energy conservation and efficiency and management awards for various categories of energy consumers

855 Council of Common Interests or CCI is a constitutional body in Pakistan. See Constitution of Islamic Republic of Pakistan, Article 153 Council of Common Interests (1) There shall be a Council of Common Interests, in this Chapter referred to as the Council, to be appointed by the President [(2) The Council shall consist of (a) the Prime Minister who shall be the Chairman of the Council; (b) the Chief Ministers of the Provinces; and (c) three members from the Federal Government to be nominated by the Prime Minister from time to time.] Also see UNDP, Opinion: Participatory Decision Making and Inter Provincial Relations: Studying Five Years of the Council of Common Interests (2010-2015), http://www.pk.undp.org/content/pakistan/en/home/library/hiv_aids/development-advocate-pakistan–volume-2–issue-1/opinion–participatory-decision-making-and-inter-provincial-rela.html).

856 ENERCON, http://www.enercon.gov.pk/enercon.php?mc_id=56 (last visited Apr. 28, 2016).

857 *Id.* See Functions and Powers of the Board 4 (1) (2) (3) of the Pakistan Energy Efficiency and Conservation Act

for the promotion and encouragement of energy conservation.[858] Section 21 of the Act gives Board power to make regulations.[859]

b. National Energy Efficiency and Conservation Authority

Section 6 of the NEECA calls for the establishment of the National Energy Efficiency and Conservation Authority.[860] Section 7 (a) of the Act deals with the powers and functions of the Authority, which include: to serve as sole focal Federal authority for initiating, catalysing carrying out and coordinating the implementation of all energy conservation programs in all sectors of economy; administer, implement and enforce the provisions of this Act and the rules and regulations made thereunder, prepare or update national energy conservation policy for the approval of the Board, and prepare draft regulations to be made by the Board pursuant to the provisions of the Act.[861] It empowers the Authority to recommend and ensure implementation of national energy efficiency standards; coordinate energy conservation policies and programs nationally and internationally; establish infrastructure and take appropriate institutional development and capacity building measures for effective implementation of the provisions of this Act; establish systems and procedures for surveys, surveillance, monitoring, inspection and audits to prevent the inefficient use of energy resources; and recommend implementation of specific energy conservation measures.

It also is to conduct research; recommend to the Federal Government or provincial governments the adoption of financial and fiscal incentives or schemes for achieving energy conservation objectives; initiate requests for foreign technical and financial assistance for the purposes of the Act; enter into arrangements with foreign agencies and organizations for exchange of information and materials and participate in international meetings and seminars; undertake inquiries or investigations into energy conservation issues (either on its own accord or upon complaint from any person or on the advice of the Board); carry out energy audits of energy conservation and make recommendations for corrective measures thereof; request tests and analysis from its own laboratory or from a certified laboratory of any equipment, accessory or hardware to measure its energy characteristics; prohibit manufacture, sale or import of equipment or appliances which are not energy-efficient; and ensure display of energy efficiency particulars through labels on equipment or appliances as may be necessary.[862]

According to the Act, the Authority shall have power to acquire, hold and dispose of property, both moveable and immoveable and shall have the capacity to sue and be sued.[863]

858 *Id.* See Sec. 4 of National Energy Efficiency and Conservation Act section

859 *Id.* Section 21 reads, "(1) The Board may, by notification in the official Gazette, make regulations in consultation with the Authority to achieve the purposes of this Act. (2) Without prejudice to the provisions of sub-section (1), the regulations may provide for inter alia the powers and modes of appointments and determination of the terms and conditions of the employees."

860 *Id.* See Pakistan Energy Efficiency and Conservation Act, Establishment of the Authority section 6 (1) As soon as may be after the commencement of this Act, the Federal Government shall, by notification in the official Gazette, establish an Authority to be called the National Energy Efficiency and Conservation Authority

861 See Sec. 7 of National Energy Efficiency and Conservation Act

862 *Id.* Sec. 7

863 *Id.*

c. *Fund of the Authority (Authority Fund)*

Section 9 (1) of the NEECA articulates, "There shall be formed a fund to be known as the Authority Fund, which shall vest in the Authority and shall be utilized by the Authority to meet charges in connection with its functions under this Act including, inter alia, the payment of salaries and other remuneration to the Managing Director, members, officers, employees, servants, experts and consultants of the Authority".[864] Section 9 further provides for the raising of seed money and for the administration and auditing of the fund.[865]

d. *Powers and Functions of the Federal Government to Facilitate and Enforce Efficient Use of Energy and Its Conservation*

Section 11 of the NEECA outlines the powers and functions of the Federal Government to facilitate and enforce efficient use of energy and its conservation.[866] The Act authorizes the Federal Government to specify the norms for processes and energy consumption standards for any equipment, appliance, which consumes, generates, transmits or supplies energy, and to specify equipment or appliance or class of equipment's or appliances. The Act authorizes the Federal Government to prohibit manufacturing or sale or purchase or import of equipment or appliance specified they conform to required energy consumption standards.

The Act also requires the government to establish and prescribe energy consumption norms and standards for designated to require any designated consumer to get an energy audit conducted by an accredited energy auditor. The Government may also require any designated consumer to designate or appoint an energy manager to be placed in charge of activities for efficient use of energy and its conservation and submit a report, in the form and manner as may be prescribed, on the status of energy consumption at the end of every financial year to the designated agency.[867]

Under the Act the Federal Government is responsible to prescribe energy conservation building codes for efficient use of energy and its conservation in buildings or building complexes and to amend the energy conservation building codes to suit regional and local climatic conditions.[868] The government may direct every owner or occupier of the building or building complex, to comply with the provisions of energy conservation building codes.

The Federal Government is to: take all measures necessary to create awareness and disseminate information for efficient use of energy and its conservation, arrange and organize training of personnel and specialists in the techniques for efficient use of energy, prescribe penalties for the use of energy inefficient apparatuses, appliances, equipment, plant and machinery, and take steps to encourage preferential treatment for use of energy efficient equipment or appliances.[869]

Section 11(1) of the Act authorizes the Federal Government to issue an energy saving certificate to a consumer whose energy consumption is less than the prescribed norms and standards.[870] Section

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864 *Id.* See Sec. 9 (1) of Pakistan Energy Efficiency and Conservation Act
865 *Id.* Sec. 9
866 *Id.* See Sec. 11 of Pakistan Energy Efficiency and Conservation Act
867 *Id.*
868 *Id.* Sec. 11
869 *Id.*
870 *Id.* See Sec. 11 (1)

11 (2) of the Act allows the consumer to purchase the energy saving certificate if his or her energy consumption exceeds the prescribed norms and standards.[871]

e. *Powers and Functions of Provincial Governments to Facilitate and Enforce Efficient Use of Energy*

NEECA involves provincial governments in the energy efficiency and conservation actions. The Act designates the provincial governments' role to be to facilitate and enforce efficient use of energy and its conservation. Section 13 (1) states that provincial governments may, after approval of proposals from the Board, and in consultation with the Authority, by notification to do the following: amend the energy conservation building codes to suit the regional and local climatic conditions; direct every owner or occupier of a building or building complex to comply with the provisions of the energy conservation building codes and get energy audits by an accredited energy auditor; establish or designate laboratories duly accredited and certified by the Federal Government; collect data and information and maintain databases; and direct any consumer to furnish, in such form and manner and within such period as may be specified by rules made by it, information with regard to the energy consumed by such consumer.[872]

Section 13 (6) and (7) authorizes provincial governments to adopt or make rules for carrying out the provisions of this Act, (which shall not be inconsistent with Federal Government rules),[873] and to nominate a specific department under its (provincial) control to coordinate with the Authority and facilitate implementation of the provisions of this Act within its jurisdiction.[874] The Authority upon receiving the nomination from Provincial Government, may declare the nominated department as the designated agency. The designated agency may appoint as many inspecting officers as may be necessary for the purpose of ensuring compliance of this Act.[875]

f. *Powers of Inspection*

Section 15 lays down the inspection powers. Under the Act the designated agency is free to appoint an inspecting officer as needed to ensure compliance with the energy consumption standards and to ensure display of labels on equipment or appliances specified under clause (b) of section,[876] to inspect any operation carried on or in connection with the equipment or appliance specified, and to enter any consumer facility at which the energy is used for any activity.[877]

g. *Powers to issue directions and Procedure for conducting inquiry, investigation and energy audit*

Section 16 of the Act addresses the power of the federal and provincial governments under the Act to issue directions related to its functions related to the efficient use of energy.[878] Section 17 deals

871 *Id.* See Sec. 11 (2)
872 Sec. 13 (1)
873 Sec.13 (6) (7)
874 *Id.* Sec.13 (7)
875 *Id.* Sec. 13 (7)
876 *Id.* Sec. 15 (1)
877 *Id.* Sec.15 (2)
878 *Id.* Sec. 16 Powers to issue directions.

with the procedure for conducting an inquiry, investigation, and energy audit.[879] The Authority or a designated agency shall bring any situation of substantial energy wastage to the notice of the responsible person and give reasonable time to that person for taking corrective measures.[880] The Authority or a designated agency shall require (after the expiration of the stipulated time) that person to get a second energy audit or such remedial measures as may be prescribed.[881] Violators shall be subject to a fine that may be recovered as arrears of property taxes if a person is again found to be breaching the provisions of the Act.[882]

Section 19 of the Act provides that federal Government may establish Energy Conservation Tribunals.[883] These tribunals are to consist of a chair and two members. The chair (who must have a minimum qualification of a high court judge) will be appointed after the consultation with the high court chief justice. At least one member (out of two appointed by the federal government) must possess a technical and professional education and experience in energy conservation.[884] The Energy Conservation Tribunals will have jurisdiction over all contraventions under the Act and appellate jurisdiction over decisions of the Authority and any designated provincial agency.[885]

h. Major Activities and Actions Undertaken by the Government During the Year 2015

The National Energy Conservation Centre (ENERCON), Ministry of Power and Water, Government of Pakistan have summarized the major 2015 government energy efficiency activities in "Material for Year Book 2014-15,[886] including some of the following major accomplishments.

The Prime Minister approved the establishment of an "Energy Conservation Cell" noting the following actions:

- Appointment of Energy Conservation Officers (ECOs) in each department and training them to establish respective energy management programs/activities and databases for installed electrical appliances;
- Conduct of Awareness Sessions on Energy Audit in collaboration with power distribution companies (DISCOs) and Industrial Chambers;
- Promoting Energy Efficient Appliances through fiscal incentives;
- Follow up with DISCOs and other entities to provide technical assistance, if required, and to take over implementation of various activities if necessary.
- Compilation and evaluation of the impact of energy savings through implementation of proposed measures by the Cell.[887]

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879 *Id.* Sec. 17 Procedure for conducting inquiry, investigation, and energy audit
880 *Id.* Sec. 17 (2)
881 *Id.* Sec. 17 (3)
882 17 (4)
883 See section 19 (1)
884 *Id.* Section 19 (2)
885 *Id.* Section 19 (12)
886 The National Energy Conservation Centre (ENERCON), Ministry of Power and Water, Government of Pakistan, Material for Year Book 2014-15. *http://www.enercon.gov.pk/enercon.php?mc_id=56* (last visited Apr. 26, 2016).
887 *Id.*

Special attention was given to the industrial and power sector. Work on the launch of National Energy Efficiency & Conservation Awards to compile data of best practices for energy efficiency in different sectors, was initiated. A process of coordination with the Economics Affairs Division for arranging donor assistance to support ENERCON both technically and financially was started. Three day workshops in four major cities were conducted on energy audit and improvement of energy efficiency in electric and boiler operation.[888] ENERCON regularly involved universities in training sessions and in dissemination of manuals on Electrical & Boilers Energy Audits.[889]

Another important measure taken by the government was introduction of an Energy Standards & Labelling regime for domestic household appliances. The minimum energy performance standards (MEPS) for fans, air conditioners, light bulbs, ballasts and motors were approved. Standards for tube lights, microwave ovens, televisions and refrigerators are under development. The Government is offering free energy assessments on a request basis focusing on major energy guzzlers like induction motors and furnaces.

The first round of enlistment of energy auditing firms was completed and seven firms were provisionally listed[890]

A Building Energy Code was launched in collaboration with the Pakistan Engineering Council & Ministry of Housing & Works in 2014.

Under a UNDP Pakistan Sustainable Transport Project, studies have been finalized to be carried out on Improved Energy Efficiency in Truck Freight Transport, International Best Practices /trends in truck freight energy use and its linkage in the context of Pakistan, and Environmental Impacts of a major freight corridor.[891]

The Centre for Clean Air Policy is assisting ENERCON in developing a proposal on energy efficiency in agricultural sector for submission to Green Climate Fund and UK-German Nationally Appropriate Mitigation Action (NAMA) facility.

ENERCON and the World Wildlife Fund, WWF-Pakistan are conducting awareness sessions for children of Green Schools and Energy Assessments in 23 Schools of Rawalpindi/Islamabad region. Approximately 2500 students have already participated in this program. The program is to be replicated in other regions of Pakistan. In 2014-15, training courses related to energy efficiency were conducted with collaboration of Pakistan Engineering Council and from the Institution of Electrical and Electronics Engineers Pakistan in 2015 customized onsite training programs on energy efficiency for industries were conducted[892]

888 In September 2014 workshops were held in Pakistan's four major cities (Karachi, Lahore, Peshawar and Islamabad). Almost 800 participants from different fields including professional engineers, agriculturists, industrialists & students participated in these workshops.

889 Id. Manuals are developed by ENERCON and they are shared with Engineering Universities. They are also available at ENERCON's website for easy uploaded.

890 *Id.*

891 *Id.*

892 *Id.*

IV. CONCLUSION

The present Government introduced policies and laws to recover from the chronic energy disease it has experienced and it achieved certain preliminary success. Indeed the country is still very energy stressed. But a few recovery symptoms are noticeable.

New energy policies calling for concentration on diversification, private investments, new energy sources, energy efficiency and conservation, have been adopted and have made some progress. Around 200 MW has been added to the national transmission system, with much more is in the pipeline, helping the share of alternative sources in the national energy mix.[893]

Investment by the private sector is increasing and more international partnerships are building rapidly. But regarding privatization the Government failed to tackle the opposition of political circles and resistance from vested interest groups within the utilities.

The government realized that energy cannot be dealt at federal level alone and that the involvement of provincial government is crucial. The new policies and recent provincial energy efficiency law (pending in the parliament for enactment) outlined the role of provincial governments and they were encouraged to take an active role in the energy regime. As a result, for example, the provincial government of Punjab has issued letters of intent for 600 MW solar power projects.

Federal government policies heavily concentrate on energy governance. New authorities and funds have been established. An implementation and enforcement structure has been designed. A schedule of fines for energy violations and a new energy tribunal have been introduced. But there is a considerable gap between what has been legislated and what has been accomplished.

An advantageous aspect of the new energy policy, however, is promotion of small-scale projects that are easy to initiate without lengthy processes and large investments. These projects are efficient and easy to manage, and since they serve a local community, they usually generate according to the needs of their consumers with a minimum transmission and distribution loss.

Technocrats and experts believe that the current shortfall of electricity is the result of the previous government's failure to invest enough to expand the power system capacity to meet the growth in demand for power for more than a decade. They argue that Pakistan's overall investment rate in energy sector is well below that of its peers. In short stalled power policies of the previous government are blamed for current power shortfall.

But interestingly some experts suggest that more power generation is not the most important cause. They are of the opinion that one of the main reasons for the energy shortfall is inefficient use of energy and that energy efficiency measures are as important as power extension to resolve the problems. Arguments are made that Pakistan's power problem can be solved by generation to the fullest available capacity and by energy efficiency.

Pervez Hoodbhoy, a renown Nuclear Physicist and National Security Analyst claims, "Let's also remember that Pakistan's installed electric capacity of 22.7 GW is adequate in principle to meet the daily average power demand of around 17 GW, a mere 14.3 GW, on average, are actually

893 See Dawn, Sunday Magazine, Oct. 04, 2015 http://www.dawn.com/news/1031108

generated".[894] He continues, "On top of the transmission and distribution losses is the fact that the machines and appliances in common use in Pakistani factories, offices and homes are not energy efficient and so consume more energy than they should."[895]

Martin Straehle, International Project Coordinator, pointed out that Pakistan can save up to 1,100 megawatts of energy if its industries and households – the two main energy consuming sectors with a 74% share – try to change their behaviour about energy conservation.[896] All major policy documents and laws (The National Energy Policy (2013), and Pakistan 2025: One Nation, One Vision (2014), National Energy Efficiency and Conservation Bill (2015) promoted by the Government address energy efficiency and renewable energy. An energy saver lighting program (all 50 million consumers will be provided with florescent light bulbs) is already underway, which will save almost 1,000 MW.[897]

What is Missing?

There is no disagreement that energy efficiency can offer a vast low cost energy resource for Pakistan and particularly for the energy poor, but this cannot be achieved without educating and involving power consumers. Their education and incentives to involve them in energy efficiency and conservation can play a key role in obtaining energy efficiency and conservation targets. Present policies are ineffective to provide a plan to educate and provide incentive to energy users. Energy consumption in domestic sector is increasing but no significant plan for individual homeowners and small business operators exists. A growing trend in power consumption and wasteful use of power by consumers need to be addressed more effectively.

Moreover, a generous policy to easy finance for roof top solar panels, cash incentives, and other motivations such as net metering for homes or business owners are requisite to promote solar energy at the smaller scale. An aggressive campaign to install rooftop solar panels can be a quick fix for energy shortfall as it can release pressure on the grid immediately.

For electrification of remote and rural areas, off grid renewable connections should be the only option. Many countries around the world have already introduced such policies and Pakistan must benefit from those success stories. A good example to follow is Bangladesh's policy to install rooftop solar panels in rural areas before expanding into the more urban and developed areas.

In order to achieve the vital and challenging mandate of energy efficiency and conservation in all sectors, more stringent rules and labelling requirements are needed. The present codes and labelling requirements are for local manufacturing and for imports. According to a field survey, smuggled goods reach approximately 40% of entire imported goods. Smuggled goods will not

894 Quoted in, A tale of two energy policies, Can renewable energy bridge Pakistan's energy shortfall?, Kunwar Khuldune Shahid, MIT Technology Review Pakistan, http://www.technologyreview.pk/a-tale-of-two-energy-policies/

895 *Id.* The NPP 2013 claims, "A conservation program based upon energy saver lighting is already underway with a potential of saving 1,000 MW if all 50 million consumers were to be converted to florescent bulbs. This says, in effect, that simply by switching the country to more efficient light bulbs, enough electricity could be saved to do without one of the new Karachi nuclear reactors."

896 Energy efficiency: Pakistan can conserve up to 1,100MW, says expert The Express Tribune, March, 21, 2014 http://tribune.com.pk/story/685315/energy-efficiency-pakistan-can-conserve-up-to-1100mw-says-expert/

897 For example the NPP 2013 claims that a conservation program based upon energy saver lighting is already underway with a potential of saving 1,000 MW if all 50 million consumers were to be converted to florescent bulbs. Quoted in MIT Pakistan.

be affected by legislation regarding MEPS labelling.[898] A mechanism to enforce custom laws more strictly and introduction of laws discouraging use of smuggled, consumer appliances, accessories, and other apparatuses is needed.

Similarly sustainable building codes are necessary. Pakistan like many other developing countries is involved in heavy construction. A comprehensive building codes regime is essential for effective conservation and efficient use of energy in homes and commercial buildings. Like San Francisco, California, cities in Pakistan should adopt a law requiring solar panels on all new buildings.[899]

Additionally government's policy must support the relevant industrial, professional, and business associations to promote, and get access to state of the art energy efficient technologies. Smart grid technology needs to be incorporated in every aspect of electricity generation, delivery, and consumption in order to improve reliability and reduce costs and improve efficiency.

Financial institutions should be strengthened and made aware of the need to recognize their role in the overall strategy of energy efficiency and renewables. The State Bank of Pakistan needs to develop a green financing guideline for commercial banks to promote energy efficiency and renewable technologies through easy and low interest funding.

Pakistan now has basic legal requisite for success with sustainable energy, but it still has a long way to go to see adequate implementation of these laws.

898 Islamic Republic of Pakistan for Institution – Building and Promotion of Energy Saving, Final Report available at http://open_jicareport.jica.go.jp/pdf/12229381.pdf.

899 San Francisco adopts law requiring solar panels on all new building, The Guardian, Solar power Guardian Environment Network, April 21, 2016. http://www.theguardian.com/environment/2016/apr/21/san-francisco-adopts-law-requiring-solar-panels-on-all-new-buildings (last visited April 25, 2016). Smaller Californian cities such as Lancaster and Sebastopol already have similar laws in place, but San Francisco is the first large city to adopt the new standard.

CHAPTER 7D. LAWS FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY IN SOUTH AFRICA

Tumai Murombo*

I. INTRODUCTION

South Africa has been at the forefront of promoting renewable energy and energy efficiency policy since around the year 2005. This was because of the recognition that a transition to a low-carbon economy required a focus on the demand side of the energy equation equal to that on the supply side. This challenged the country's preoccupation with supply side issues that had characterised its energy policies before 2005. Policy and strategy development focused disproportionately on market building and load shifting for peak demand. Since 2005, South Africa developed various policy and legal instruments to promote energy efficiency and manage demand, while concurrently providing a framework for renewable energy to grow in the country's energy mix.

While the regulatory framework for renewable energy is not yet where it should be,[900] substantial progress has been made in the last four years to facilitate the procurement of renewable energy from independent power producers. The renewable energy independent power producers procurement programme (REIPPPP)[901] has lately overshadowed energy efficiency and demand side management initiatives. Ultimately however, the aim of both programmes is to steer South Africa towards an energy mix that is sustainable and low-carbon while realising the country's socio-economic objectives including access to affordable reliable energy. Recent proposals to direct the economy towards green technology and processes support these objectives.[902]

This chapter evaluates the extent to which South Africa has provided for enabling legislation to promote energy efficiency and renewable energy. The evaluation begins by setting the constitutional context within which initiatives towards sustainable energy are taking place, and then proceeds to specific energy efficacy and renewable energy laws. It closes with a section on the convergence of climate change, energy efficiency and renewable energy, as these are intricately intertwined and mutually reinforcing.

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900 Currently, renewable energy is promoted through s34 of the Electricity Regulation Act 4 of 2006 (ERA) < http://www.saflii.org/za/legis/consol_act/era2006251.pdf > and Electricity Regulations on New Generation Capacity GN R721 in GG 32378 of 5 August 2009 < http://www.energy.gov.za/files/policies/22736_reg_721.pdf >. The ERA is part of legislation that evolved to regulate a fossil fuel intensive energy industry and is ill suited to promote renewable energy sources. South Africa energy laws are generally accessible the Department of Energy's portal: < http://www.energy.gov.za/files/policies_frame.html >

901 Implemented by the Department of Energy, National Treasury, Eskom and National Energy Regulator of South Africa under tripartite underlying agreements was made possible by the IPP Procurement Programme, 2012 GN 1074 in GG 36005 of 19 December 2012 < http://www.saflii.org/za/legis/consol_reg/era4o2006rangnr1074694 > read with the New Generation Capacity Regulations. .

902 See generally UNEP, 'Green Economy Scoping Study: South African Green Economy Modelling Report' (SAGEM) – Focus on Natural Resource Management, Agriculture, Transport and Energy Sectors (2013); Department of National Treasury, 'Reducing Greenhouse Gas Emissions and Facilitating the Transition to a Green Economy: Carbon Tax Policy Paper' (2013) 19 < http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf >.

II. OVERVIEW OF THE ENERGY LEGAL FRAMEWORK FOR SOUTH AFRICA

A. The Constitutional Imperatives

The primary law that provides a context and background to South Africa's energy efficiency and renewable energy policies is the Constitution of the Republic of South Africa[903] which provides that "everyone has a right to an environment that is not harmful to their health or well-being"[904] and that "'everyone should have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures; that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."[905]

Conservation and sustainable use of renewable and non-renewable resources is necessary to promote the environmental objectives envisaged by the Constitution.

Section 24 of the Constitution spawned the environmental laws that directly and indirectly promote energy efficiency and renewable energy. The principles of environmental management[906] include among others the need to use all energy resources, renewable and non-renewable, wisely.

An energy system that promotes energy efficiency and the use of renewable energy is a prerequisite for advancing sustainable development. This realisation is reflected in the new Sustainable Development Goals, globally agreed to by the U.N. General Assembly in 2015.[907] Furthermore, inefficient burning of wood or coal for cooking and heating, which is the order in many African countries, is one of the biggest causes of respiratory health problems, potentially violating s24 of the Constitution. A large number of poor South Africans still burn coal and wood directly in their homes for heating and cooking, resulting in serious indoor air pollution and respiratory health risks.[908] Thus, law and policy must be aimed at replacing these resources to promote energy efficiency and environmental rights.

B. The Policy Framework.

The above Constitutional context led to the development of policies to implement the call to sustainable development. In the energy sector, the immediate concern was to open up the energy markets, expand access to electricity and transform the sector altogether. Chief among the policy

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903 Constitution of the Republic of South Africa 1996 < http://www.gov.za/documents/constitution-republic-south-africa-1996 >

904 Section 24 (a) Constitution of the Republic of South Africa.

905 Section 24 (d) (i) to (ii) Constitution of the Republic of South Africa.

906 Section 2(4)(a)(v) and (vi) National Environmental Management Act 107 of 1998: 'Sustainable development requires the consideration of all relevant factors including the following: (v) that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource; (vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised.' < http://www.gov.za/documents/national-environmental-management-act >.

907 Goal 7 Sustainable Development Goals (SDGs) is to 'Ensure access to affordable, reliable, sustainable and modern energy for all.'

908 See generally N Rosana et al 'Estimating the burden of disease attributable to indoor air pollution from household use of solid fuels in South Africa in 2000.' (2007) 97.8 South African Medical Journal 764-771; B Brendon et al 'Household energy, indoor air pollution and child respiratory health in South Africa.' (2009) 20.1 Journal of Energy in Southern Africa 4-13; R Spalding-Fecher and D Khorommbi Matibe 'Electricity and externalities in South Africa. (2003) 31.8 Energy Policy 721-734.

documents shaping the direction of the energy industry was the Energy Policy White Paper of 1998.[909] The Energy Policy White Paper pointed out that the

> "Government will create an energy efficiency consciousness and will encourage energy efficiency in commerce and industry. Government will establish energy efficiency norms and standards for commercial buildings and industrial equipment, and voluntary guidelines for the thermal performance of housing. A domestic appliance-labelling programme may also be introduced. Publicity campaigns will be undertaken to ensure that appliance purchasers are aware of the purpose of appliance labels."[910]

The policy objective was in a context where 'South African energy consumers in industry and commerce are [were] general unaware of the need for and potential of energy efficiency improvements and savings.'[911] South Africa was therefore well aware of the need to raise awareness and create a legal framework to promote energy efficiency long ago.

A Renewable Energy White Paper[912] soon followed the Energy White Paper in 2003, which highlighted the close connection between renewable energy and energy efficiency. The Renewables White Paper states that

> "Energy efficiency is a measure of the savings of energy, which is used to produce goods and services while maintaining the desired benefits…energy efficiency is an important facet of integrated energy planning. The two sectors with the greatest potential for energy efficiency/ renewable energy interventions are the industrial and household sectors. Coal and electricity constitute the bulk of energy consumption in the industrial sector."[913]

At the household level the government planned to pursue the following measures to improve energy efficiency, including:

- "Regulation of no-cost energy efficiency measures in housing; incorporating passive solar design,
- Heat insulation and air tightness measures in homes,
- Replacement of electric geysers (Gas hot water heaters) by solar water heaters,
- More efficient home electrical appliances as a result of appliance labelling and enforcement of standards,
- Energy efficient lighting (compact fluorescent lights)."[914]

The energy white papers were followed by the Energy Efficiency Strategy of the Republic of South Africa of 2005, last revised and updated in 2013, which is the main strategic document providing

909 White Paper on the Energy Policy of the Republic of South Africa (1998) (Energy White Paper) GN 3007 in GG 19606 of 17 December 1998 < http://www.energy.gov.za/files/policies/whitepaper_energypolicy_1998.pdf >
910 Ibid, 15.
911 Ibid, 85.
912 White Paper on the Renewable Energy Policy of the Republic of South Africa, November 2003 published as GN 513 in GG 26169 of 14 May 2004 (Renewables White Paper) < http://www.energy.gov.za/files/policies/whitepaper_renewables_2003.pdf >.
913 Ibid, 36.
914 Ibid.

for energy efficiency in the country.[915] The Energy Efficiency Strategy is elaborated on in detail below.

Along the way, other energy efficiency instruments were promulgated to implement the policy objectives in these documents. The most important one is the Income Tax Act amendments of 2009[916] that introduced a tax rebate or allowance incentive for energy efficiency measures effective 2013. Probably the first in Africa this 'negawatt' incentive rewards consumers for net negative use of electricity. Thus if an installation that uses 1,000kWh per month saves 500kWh, due to using low energy equipment and installing efficient bulbs, for example it will be able to claim a rebate of 45c per kWh for the 500kWh saved. The rebate is available until January 2020. The rebate applies to energy efficiency measures and excludes renewable energy and co-generation resources.

The South African Bureau of Standards (SABS) produced the South African National Standard (SANS) standard on Measurement and Verification of energy efficiency savings for the purposes of s12L implementation.[917] The South African National Energy Development Institute (SANEDI)[918] is the implementing authority for the energy efficiency tax allowance. To obtain the allowance a user must comply with the requirements to appoint a professional to measure and verify the savings and prepare a report that is assessed by SANEDI, which may then issue a certificate that the user can use for purposes of claiming the tax benefit.[919] SANS were developed to facilitate implementation of the Energy Efficiency Strategy.[920]

C. Environmental Laws Promoting Energy Efficiency and Renewable Energy

A number of other environmental laws also promote energy efficiency and renewable energy. Chief among these is the Air Quality Act of 2004 (AQA), which is aimed at preventing air pollution. Section 21, 23 and 26 of the AQA all indirectly can be used to prevent the use of certain emitting appliances, fuels and activities that pose a threat to health and the environment. Whilst the AQA is a general law aimed at pollution control, it can promote the efficient use of fuels and low-carbon technology through its regulatory disincentives. Read together with the NEMA and in the context of s24 of the Constitution, this legislation creates a regulatory environment in which it becomes necessary to promote the efficient use of energy as well as a shift towards renewable sources of energy. The more energy specific framework discussed below that directly addresses the issue of energy efficiency and renewable energy augments this regulatory environment.

915 Department of Minerals and Energy, Efficiency Strategy of the Republic of South Africa (2005) < http://www.energy.gov.za/files/esources/electricity/ee_strategy_05.pdf>
916 Regulations on the Allowance for Energy Efficiency Savings, GNR 971 published in GG 37136 of 9 December 2013 made in terms of Section 12 L of Income Tax Act, 1962. The regulation were operational in 2013 and last amended by GNR 186 in GG 38541of 6 March 2015 which increased the allowance from 45c to 95c per kWh of energy saved.
917 The South African Bureau of Standards (SABS) produced the South African National Standard (SANS) standard on Measurement and Verification of energy efficiency savings for the purposes of s12L implementation, see SANS 50010 of 2011. The standard provides for an effective methodology for measuring energy savings to ensure that claimed and actual savings are realistic and accurate.
918 More details on the Energy Efficiency Programme is available at the SANEDI portal at: http://www.sanedi.org.za
919 Ibid
920 These include standards on buildings, electric installations and other energy intensive installations.

1. Laws and Regulations on Energy Efficiency

At the general level the overarching energy policy statute, the National Energy Act of 2008 specifically aims to facilitate effective management of energy demand and its conservation;[921] and to provide appropriate standards and specifications for the equipment, systems used for producing, supplying and consuming energy.[922]

The National Energy Act defines 'energy efficiency' as the "economical and efficient production and utilisation of an energy carrier or resource."[923] The National Energy Act further established the South African National Energy Development Institute (SANEDI)[924] the mandate of which, in relation to energy efficiency, includes to:

- undertake energy efficiency measures as directed by the Minister;
- increase energy efficiency throughout the economy;
- increase the gross domestic product per unit of energy consumed; and
- optimise the utilisation of finite energy resources.[925]

Lastly the National Energy Act empowers the Minister of Energy to make regulations to provide for:

- minimum levels of energy efficiency in each sector of the economy;
- steps and procedures necessary for the application of energy efficiency technologies and procedures;
- labelling for energy efficiency purposes of household appliances, devices and motor vehicles;
- prohibition of the manufacture, importation or sale of electrical and electronic products and fuel burning appliances for reasons of poor energy efficiency;
- promulgation of standards and specifications for energy carriers;
- issuance of energy efficiency standards for specific technologies, processes, appliances, devices, motor vehicles and buildings.[926]

What is clear is that South Africa has specific energy legislation that empowers the Minister of Energy and SANEDI to take measures, not only to promote, but also to implement energy efficiency measures across the economy. These measures include setting regulatory controls. Whether these policies and laws are having the desired behavioural effect is another question. People often evade energy laws where there is poor enforcement and select energy choices on factors other than the requirements of the law.[927]

921 Section 2(c), National Energy Act.
922 Ibid, Sec. 2(e).
923 Ibid, Sec. 1.
924 SANEDI replaced National Energy Efficiency Agency (NEEA) previously established as a division of Central Energy Fund (CEF)(Proprietary) Ltd.
925 Section 7(2)(a) National Energy Act .
926 Ibid, Sec. 19(1)(g) to (l).
927 R Spalding-Fecher *et al* 'The Economics of Energy Efficiency for The Poor - A South African Case Study' (2002) 27 Energy 1112.

Among other strategies the Energy Efficiency Strategy sets out are Demand Response and Emergency Demand Response programmes, Demand Market Participation Programme, a Power Conservation Programme (PCP) and Voluntary Energy Conservation Schemes as key to achieving the targets set in the Strategy.[928] These programmes have been implemented from 2006 onwards with various degrees of effectiveness. As of 2015 the Minister of Energy reported that energy efficiency had made huge savings. For example, by end of 2015 the Eskom, electric light company, had distributed more than 64 million energy-saving compact fluorescent lamps (CFL).[929]

2. Laws and Regulations Promoting Renewable Energy

The policy framework for renewable energy in South Africa is set out in the Renewable White Paper briefly discussed above. However, recent renewable energy procurement processes have taken place in terms of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) developed in terms of the Electricity Regulation Act and New Generation Capacity Regulations. This is South Africa's flagship renewable energy procurement programme that has been touted as a success story and a world leading procurement process for low carbon energy.

However, despite the successes of the REIPPPP there remain various obstacles to renewable energy in South Africa. A major challenge is that South Africa remains largely steeped in a coal economy characterised by energy intensive industries that need a stable, reliable supply of base load power that can currently be obtained only from coal and nuclear power generation. Any overtures towards renewable energy are cosmetic and far away from fundamentally changing South Africa's energy mix. This is premised on legitimate socio-economic imperatives that require large current supplies of energy to meet the country's development agenda.

The implementation of the REIPPPP has met with relative success[930] especially given that it is largely experimental and a first for South Africa as a Sub-Saharan developing country.[931] The REIPPPP aims to procure 17.8 GW of energy by 2027 in successive windows.[932] This includes renewables and

928 The initial target was to reduce demand by12% in 2015, this has since been revised upward through 2030. The targets per sector were as follows: Industry and Mining (15%), Commercial and Public buildings (15%), Residential (10%) and Transport (9%). The 2005 targets were set against the baseline of 2000 use levels.

929 'Eskom is to distribute another 10-million energy-saving bulbs. TimesLive (South Africa) 13 February 2016 < http://www.timeslive.co.za/local/2016/02/13/Eskom-to-distribute-another-10-million-energy-saving-bulbs >

930 This success evaluation was calculated on the basis of five criteria for renewable energy success developed by the International Renewable Energy Agency, IRENA, see IRENA 'Evaluating Policies in Support of the Deployment of Renewable Power' Bonn: International Renewable Energy Agency (IRENA) (2012) 11 (the criteria focuses on Effectiveness, Efficiency, Equity, Institutional Feasibility and Replicability). The Minister reported that 'South Africa [is] now being ranked number 9 of the Top 10 Clean Energy Investment countries according to Bloomberg New Energy Finance. South Africa attracted US$4.9 billion in 2013 and US$5.7 billion in 2012' in renewable energy investments under the REIPPPP. 'Keynote Address by the Honourable Minister of Energy, Ms Tina Joemat-Petersson at the Renewable Energy Conference' 30 October 2014.

931 Recent comprehensive empirical reviews of the REIPPPP programme include: L McDaid 'Renewable Energy Independent Power Producer Procurement Programme Review 2014' Electricity Governance Initiative South Africa (2014) 3 Electricity Governance Initiative South Africa - REIPPPP Review 47 (recommendations to address identified weakness of the REIPPPP), A Eberhard 'Feed-in Tariffs or Auctions? Procuring Renewable Energy Supply in South Africa' (2013) 388 Viewpoint. Public Policy for the Private Sector 36,37; Baker & Wlokas, 'South Africa's Renewable Energy Procurement: A New Frontier' Tyndall Centre for Climate Change Research (2014) (being a comprehensive interview based review where the authors interviewed government, public sector regulators, industry, Eskom, IPPs, unions, donor and funding institutions from 2010 to 2013 on their experiences with the REIPPPP); G Montmasson-Clair, K Moilwa & G Ryan 'Regulatory Entities Capacity Building Project, Review of Regulators Orientation and Performance: Review of Regulation in Renewable Energy' Centre for Competition, Regulation and Economic Development (CCRED) (2014) 80 (reviewing success factors and challenges in the REIPPPP- especially in light of the role of Eskom as single buyer, the lack of consumer ability to use competitive pricing, and other obstacles.

932 The IRP 2 is targeting 42% (18,2 GW) of renewable energy by 2030 in South Africa's energy mix.

base load non-renewable capacity. A total of 2,400 MW of capacity was awarded in Bidding Window 1 and 2 for solar photovoltaic, onshore wind, concentrated solar, landfill gas, biogas and other biomass, and small hydro. 651,94MW was operational by June 2014 and most Bidding Window 2 projects are expected to come online by 2016.[933] Under the last Bidding Window 3 in 2013, 1,473MW was awarded.

The Renewable Energy White Paper provided for a target of 10,000 GWh of renewable energy by 2013, a target that has since been missed. The earnest efforts towards renewable energy procurement were driven by the National Energy Regulator of South Africa (NERSA), which initiated the development and setting the rates for a Feed-in-Tariff (FIT) in 2009. However, the FIT was never implemented based on legal challenges to that route. At this stage the Department of Energy together with national Treasury and in consultation with NERSA decided to use a competitive bidding or auction procurement process instead.

The differences between a FIT and an auction system of procurement are insignificant at the technical level but the FIT guarantees a subsidised price and therefore provides a much greater and assured incentive. In the context of other public procurement regulations[934] and the implementation problems of the two models, they could face different challenges in South Africa.[935]

The policy uncertainty of the transformation of a FIT based mechanism to an auction based bidding system caused concern to investors, particularly since the private sector had geared up to enter the electricity sector once the FIT program was announced. However, the level of interest and success rate of the REIPPPP, albeit on a modest scale, indicates that the legal and policy uncertainties created by the abandonment of the FIT program were short-lived.

An evaluation by Eberhard et al shows that the programme has substantially overcome several economic and structural obstacles to renewable electricity by stimulating financing and investment on the back of government guarantees and support.[936] Undoubtedly, the REIPPPP represents a measure of successful planning against some of the obstacles to renewable electricity in South Africa. Clearly, the programme was anchored by triangular agreements involving Eskom, the Government, and the IPP[937] requiring Eskom to enter into a Power Purchase Agreement (PPA) guaranteed by government support through the Department of Energy, which has largely retained control of the programme. This structure gave the private sector and potential investors sufficient motive to bankroll the winning bidders' projects.[938] The result is that, as of 15 January 2015, 1,512.72 MW from the REIPPPP

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933 REIPPP Projects' Status Report, Department of Energy (June 2014) < http://www.energy.gov.za/IPP/Electricity-Infrastructure-Industry-Transformation-30June2014.pdf >.

934 Preferential Procurement Policy Framework Act 5 of 2000 and its Regulations and the Constitution of South Africa, s217.

935 The rest of this section on REIPPP is derived mostly from my doctoral research on 'Law, regulation and the promotion of sustainable renewable energy in South Africa' submitted to Wits University in March 2015 p260-265.

936 A Eberhard, J Koeller & J Laigland 'South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons' (2014) 19 (in light of funding challenges ameliorated as REIPPPP provided a secure investment platform); see further A Eberhard "Feed in Tariff or Auctions? Procuring Renewable Energy Supply in South Africa' (2014) Energize RE: Renewable Energy Supplement 36, 37.

937 Once a bidder wins it must form a Project Company, conclude an Implementation Agreement, a Power Purchase Agreement, a Direct Agreement, a Transmission Agreement or a Distribution Agreement, and a Connection Direct Agreement with the other actors involved.

938 Official status reports and statistics for the REIPPPP programme are available at: < http://www.energy.gov.za/files/events_overview%20IPP.html >

was commercially online,[939] which, while significant, is less than 5 per cent of the peak demand of about 35,000 MW. And Eskom's installed capacity of about 45,000 MW[940] is a stark reminder of the reality that renewables are contributing only a relatively small percentage of the country's energy requirements. This gap will grow with more coal coming online from a new coal project in Medupi and a planned IPP for coal and gas base load as well as planned nuclear capacity.

Nevertheless, the apparent success of the REIPPPP should not overshadow the remaining challenges that IPPs are still faced with in trying to break into the energy sector. Eskom and the Department of Energy remain in full control of the quantity of electricity required and the sources preferred in the bidding process.[941] This defeats the full liberalisation or opening up of the electricity supply industry to private sector participation. A recent empirical study has concluded that 'many stakeholders assert that the flip side of [the REIPPPP] requirements has meant that [REIPPPP] has been a complex and expensive process with very high compliance costs.'[942]

The REIPPPP is probably the most direct and earnest response to the institutional and market barriers to renewable energy. If implemented to the letter, the programme has potential to move South Africa towards an energy mix where renewables contribute a higher percentage. Since its inception, the REIPPPP has resulted in 64 IPPs being awarded contracts to supply renewable electricity. It is reported that in the third bidding window, which closed in August 2013, wind was bid at a lower price[943] compared to the cost of electricity to be charged for Medupi power once the coal plant is complete. This is evidence that renewable electricity can in fact compete with conventionally produced electricity if the correct pricing and regulatory policies are in place. Full cost accounting for Medupi coal power probably accounts for the higher price of electricity from coal than anything else. The International Energy Agency rightly concludes, on price competitiveness, that 'even if cost competitiveness or adequate incentives allowed a [renewable energy] project to be profitable in principle, significant barriers and investor risk perceptions generally remain.'[944] This is the case with REIPPPP in South Africa.

3. Climate Change, Renewable Energy and Sustainability: Complex Regulation.

Energy efficiency and renewable in South Africa have become key strategies that the country intends to leverage to address the challenge of climate change. Among the key flagship programmes that South Africa will focus on in mitigating greenhouse gas (GHG) emissions and adaptation are the renewable energy procurement programme and the energy efficiency programme.[945]

939 Lebogang Mojanaga 'Energy Programmes and Projects: Electricity Infrastructure/ Industry Transformation' Department of Energy, REIPPPP Projects Status Update (15 January 2015) <http://www.energy.gov.za/IPP/Electricity-Infrastructure-Industry-Transformation-13January2015.pdf >.

940 Peak demand statistics from NERSA System Adequacy Report, Issue 6, 15 January 2015 < http://www.nersa.org.za > Eskom's installed capacity is forecasted to grow to 47,697MW (2016) and 49,864 (2017) including imports. The imports may include a small proportion from hydropower, which is technically renewable.

941 For instance the 'List of Preferred Bidders for the Third Bid Submission Phase' 05 November 2013 < http://www.ipprenewables.co.za/gong/widget/file/download/id/199 > shows that total bids received (93) were for 6,023MW but only 1,473MW was available. This confirms the argument that the REIPPPP is being seen as stop gap measure to meet Eskom's shortfall rather than a robust programme to grow the renewable energy sector.

942 Baker & Wlokas (note 914 above) 8.

943 Eberhard, Koeller & Laigland (note 914 above) 14.

944 O Muller et al 'Renewable Energy: Policy Considerations for Deploying Renewables' OECD/IEA 2011, 57.

945 National Climate Change Response White Paper (Climate Change White Paper) GN 757 in GG 34695 of 19 October 2011< *http://www.gov.za/sites/www.gov.za/files/national_climatechange_response_whitepaper_0.pdf* >

Box 1: White Paper on the National Climate Change Response (2011) 31.

8.3 The Renewable Energy Flagship Programme

The Renewable Energy Flagship Programme is inclusive of a scaled-up renewable energy programme, based on the current programme specified in the IRP 2010 and using, for example, the evolving South African Renewables Initiative led by the Department of Public Enterprise and Department of Trade and Industry (DTI), as a driver for the deployment of renewable energy technologies. The programme will be informed by enhanced domestic manufacturing potential and the implementation of energy efficiency and renewable energy plans by local government.

Furthermore, the Department of Energy's (DoE) solar water heating programme will be expanded through, amongst others, the promotion of the domestic supply of products for solar heating with support from the DTI to build local manufacturing capacity.

8.4 The Energy Efficiency and Energy Demand Management Flagship Programme

As part of the Energy Efficiency and Energy Demand Management Flagship Programme, the DoE will continue to develop and facilitate an aggressive energy efficiency programme in industry, building on the experience of Eskom's Demand Side Management programme and the DTI's National Cleaner Production Centre, and covering non-electricity energy efficiency as well. A structured programme will be established with appropriate initiatives, incentives and regulation, and a well-resourced information collection and dissemination process. A residential energy efficiency programme will also be included, consisting of two parts:

- The development of appropriate initiatives, incentives and regulations will be finalised by the DoE and the DTI. Furthermore, the development of energy specifications for low-income housing will be determined through the National Sustainable Settlements Facility under the Department of Human Settlements.
- Regulation of commercial and residential building standards to enforce green building construction practices. The National Regulator for Compulsory Specifications in conjunction with the National Home Builders Registration Council will ensure that building construction and operation conform to green building requirements, including measures such as controlled ventilation, using recycled material, solar power, etc.

A government building energy efficiency programme led by the Department of Public Works that initiates energy and emissions audits of all government buildings and facilities will be developed. It will develop comparable indicators and benchmarks, and make appropriate interventions. The programme will include lead programmes for key government buildings, including Parliament and the main government buildings in Pretoria. Ambitious goals for energy efficiency will be set for all new government buildings.

III. CONCLUSION

The Future of Renewable Energy and Energy Efficiency in South Africa

South Africa has provided a sufficient legal framework to promote energy efficiency but implementation remains behind scheduled objectives. Whilst progress has been made in introducing renewable energy through the REIPPPP and other initiatives, there is a general belief that legal and regulatory uncertainty remains an obstacle to large-scale investments into renewable energy. This is despite the REIPPPP being a successful model globally commented.

Much remains to be done in terms of raising awareness among consumers to make informed energy choices when procuring appliances, installations and buildings. The energy consciousness is rising but a large majority to the people are only alerted by erratic supplies of electricity that the national grid is increasing unable to cope with demand. The government and Eskom have a building programme that aims to meet the growing demand while a national energy efficiency programme is hoped to reduce demand in the long term. Renewable energy sources are not expected to replace fossil fuels anytime soon given the entrenchment of the fossil fuels industry and its coupling to the South African economy.

CHAPTER 7E. GHANA CASE STUDY

Nana Osei Safo*

I. INTRODUCTION

Developing countries need energy to power economic growth to improve the lives of their citizens. Electricity generation is therefore a key component that is needed to support commercial activity in the process. Concerns about climate change mainly due to anthropogenic activities, however, means that a balance must be struck between boosting energy production to fuel this economic growth and producing this energy in a manner that is not destructive to the environment. Thus, energy production sources must be shifted to approaches that are environmentally friendly and sustainable. Also, when produced, energy must be used efficiently to maximize utility and limit wastage.

To achieve this objective, the role of governments cannot be underestimated as they can set operational rules of conduct through legislation and implementing regulations. In Ghana, rules and regulations on energy efficiency and conservation, and in some cases, policies have been implemented to accomplish some of these goals. Recently, in keeping with the move towards renewable energy to help diversify energy production sources and reach targets set by the Economic Community of West African States (ECOWAS), the government passed a law on renewable energy aimed at attracting private investments in the country's renewable energy markets. Part I will discuss the statutes passed and implementing regulations, and in court cases where they exist, policies that have been put in place to promote energy efficiency and conservation. Part II will focus on legislation on renewal energy in Ghana. Overall, Ghana has made some positive strides in these areas, but significant challenges exist which can be addressed through legislative fixes to make the programs more viable in the long run.

II. POLICY FOR PROMOTION OF ENERGY EFFICIENCY

Ghana has developed a Strategic National Energy Plan (SNEP) that has as its core increased energy capacity, energy efficiency and sustainability, and diversification of energy sources, including renewable energy, as overarching goals to secure its future energy needs.[946] SNEP arose as a matter of national imperative, constraints and demands imposed by the country's main funding source for continued financing of its energy programs, and a general sense of acknowledgment that there was the need to generate increased capacity and system performance to support growing demand for electricity.[947] A brief historical background of the events leading to the development of SNEP in 2006 is important to understand legislative acts and instruments promulgated by the government to enhance continued growth of Ghana's energy sector.

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946 Energy Commission, Strategic National Energy Plan (SNEP) 2006 -2020, Main Report. 2006. (http://www.energycom.gov.gh/files/snep/MAIN%20REPORT%20final%20PD.pdf, accessed January 8, 2016).

947 Ishmael Edjekumhene et. al. Power Sector Reform in Ghana: The Untold Story. 2001. (http://pdf.wri.org/power_politics/ghana.pdf, accessed January 12, 2016).

A. Historical Background

Ghana had depended almost exclusively on hydroelectricity generated from its two dams at Akosombo and Kpong. Hydro power provided about 99% of the country's electricity needs, but a severe drought in 1983 through 1984 led to significantly lower water levels in the dams diminishing their generating capacity. By 1983, the dams were only capable of supplying about 30% of their 1980 level of electricity production. This led to power rationing because of an inability to meet increased customer and consumer demand in a growing economy. Before water in the dams had been able to recover to their pre-drought levels, in 1994, another drought occurred exacerbating an already dire circumstance. Thus, it became apparent that overreliance on a single energy type and source for all of the country's energy needs was untenable.

In addition, the principal financier of Ghana's power sector, the World Bank, had grown increasingly frustrated with the lack of reforms that the industry needed, especially on issues of government monopoly and lack of competition, lack of clarity in regulations, and an environment that was not conducive to private investment and participation in the energy market. The World Bank was unequivocal about its position, namely that unless there were reforms made in the power sector, the bank would not provide any more funding to finance projects for the country's energy programs.[948] As a consequence, the Power Sector Reform Committee (PSRC) was established after the government had agreed to undertake reforms, issued strategic frameworks and policy statements in support, engaged the services of external consultants to test this framework, and for the PRSC to design and implement the reform agenda. In 1997, the PRSC issued recommendations in a four-point action plan to the government to reform the sector.[949] Though the PRSC recommended one regulatory body, to ensure more independence for these agencies in the role they would have to play in the power sector, the Cabinet overruled the PRSC's recommendation and provided support for the establishment of two regulatory bodies, the Public Utilities Regulatory Commission (PURC) and the Energy Commission (EC).

B. Strategic National Energy Plan (SNEP)

For the purposes of this section on the issue of energy efficiency, the discussion is limited to the role of the EC. As part of power sector reform, the Ghanaian Parliament passed the Energy Commission Act in 1997.[950] As the name implies, the Act called for the establishment of an Energy Commission (EC) that would perform "functions relating to the regulation, management, development and utilization of energy resources" and issue licenses to candidates for commercial participation in the energy markets, among other duties.[951] In pertinent part, the Act calls on the EC to "advise the Minister [of Energy] on national policies for the efficient … supply of electricity" and other energy

948 For more on this, see World Bank. 1993. The World Bank's role in the electric power sector: policies for effective institutional, regulatory, and financial reform. A World Bank policy paper. Washington, DC: The World Bank. (http://documents.worldbank.org/curated/en/1993/01/440599/world-banks-role-electric-power-sector-policies-effective-institutional-regulatory-financial-reform, accessed January 13, 2016).

949 Ishmael Edjekumhene et. al., supra, at 14. In brief, the specific recommendations were: 1) new laws to establish a regulatory framework to create a regulatory body to make "regulations," "rules of practice" and "standards of performance" for operations in the power sector; 2) introduction of competition on the supply side including wholesale transactions, transmission and distribution; 3) reorganization of the state-owned private utilities; and 4) transparency in tariff setting in the energy market.

950 Energy Commission Act, 1997 (Act 541) (http://energycom.gov.gh/files/ACT.pdf, accessed January 6, 2016).

951 *Id.*

sources.[952] Importantly, Part IV of the Act calls for the establishment of an Energy Fund that directs the EC to use money from the fund for "promotion of energy efficiency and productive uses of electricity, natural gas and petroleum products," and for "other relevant purposes" that the commission may determine.[953] Another role of the EC is to give advice to the Minister of Energy to issue legislative instruments to make regulations that target conservation during use of electricity and natural gas.[954] Given such a broad mandate under the Act on energy efficiency and conservation, the EC started to develop SNEP in 2000 and completed the task in 2006 with the added benefit of helping Ghana achieve universal penetration of electricity throughout the country by 2020.[955]

The goal of SNEP is to contribute to the development of the Ghana energy market.[956] The means rely on a system that recognizes the need for energy efficiency and conservation on both the demand and supply sides of the market. On the demand side, energy efficiency targets include the residential, commercial and service, agricultural and fisheries, transport and industrial services. For residential services, the aim is to increase rural electrification through decentralization of renewable energy to achieve a penetration of 30% by 2020. Further, both rural and urban areas were targeted to reduce reliance on wood fuel for cooking by 10% in rural and 50% in urban areas by 2020.[957] Within the commercial and service sectors, the objective was to reduce energy consumption by 50% within military and police facilities, and buildings of educational institutions by 2015. Here, focus was on development of solar energy, then virtually non-existent. In addition, for cooking needs in these areas, there would be a greater shift towards the use of liquefied petroleum gas (LPG), increasing penetration to 30% by 2020, while decreasing wood fuel use to 40% within the same period. Further, use of improved cook stoves were to have 10% penetration, while biogas penetration was to reach 2% penetration by 2020.[958]

Energy efficiency within the agricultural and fisheries sectors called for a substitution of diesel with biodiesel for mechanized equipment, with grid electricity and wind pumps for irrigation. Commercial animal farmers were encouraged to increase the use of biogas generated from animal droppings to reach 10% of their electricity needs. Overall, the strategic targets were for %biodiesel penetration to 10%, solar energy to 20% and general electricity to 5% in these sectors by 2020.[959]

As Ghana's transport sector consumes about 85% for diesel and 99.7% for gasoline vehicles, the government aims to reduce such dependence on imported fossil fuels. The objective is to increase fuel efficiency standards in the sector while providing incentives for private sector participation in mass transit systems in urban areas and long distance freight railways systems' development. Here, the impetus is to curtail fuel consumption per GDP growth from 2:1 to 1:1 by 2015 and maintaining that level to 2020.[960] With a growing industrial sector, the government aims to introduce pollution charges on high-energy industries to promote energy efficiency. In addition, reliability of power supply was to be increased to achieve 95% rate without interruption by 2015 to 98% by 2020. Over the same period, the electricity power factor in the sector was to be increased from 90 to

952 Energy Commission Act, 1997 (Act 541). § 2.
953 Energy Commission Act, 1997 (Act 541). §§ 2, 42.
954 *Id.*
955 Ishmael Edjekumhene et. al., at 9, 20; SNEP Report at 17.
956 *Id.* at 9.
957 *Id.* at 36.
958 *Id.* at 36-37.
959 *Id.* at 37-38.
960 *Id.* at 38.

95 and 98% by 2015 and 2020, respectively. With completion of the West African Gas Pipeline (WAGP), there would be encouragement for the use of natural gas to displace other fossil fuels by 2015 in the industrial sector.[961]

C. Electricity Efficiency and Conservation Regulations

With these objectives in mind, the government has taken some steps to show its commitment towards energy efficiency granting authority to the EC through Section 56(1)(a)(i) of the Energy Commission Act to issue regulations touching on electricity conservation.[962] Regulations were introduced for energy efficiency standards and labelling for non-ducted air conditioners and self-ballasted fluorescent lamps in 2005 (LI 1815).[963] Another set of regulations was introduced in 2008 that placed an outright ban on the manufacture, sale or importation of incandescent lamps, used refrigerators and freezers, and used air-conditioners (LI 1932).[964] Other regulations introduced targeted energy efficiency standards and labelling for household refrigerating equipment in 2009 and 2010 (LI 1958, LI 1970).[965]

LI 1815 specifies the standards, minimum performance and labelling requirements for both non-ducted air conditioners and self-ballasted fluorescent lamps. Standards for air-conditioners and fluorescent lamps, whether manufactured or imported for use in the country, must conform to the specifications of the given Ghana Standard as published in the Ghana Gazette.[966] Violation of the standards is an offence punishable by a fine or term of imprisonment, or both.[967] The required minimum energy efficiency ratio for air-conditioners is 2.8 EER and fluorescent lamps must have a rated life of at least 6,000 hours with a minimum efficacy as given in a schedule based on the configuration of the lamp. Air-conditioners and fluorescent lamps must bear labels that clearly carry the required standards and minimum performance metrics. Similar to the efficiency standards and performance requirements, violations of these labelling regulations can result in a fine or imprisonment, or both, for the offender. Conduct that may lead to penalties have been extended to include storing, offering for sale, distributing, importing or disposing of air-conditioners and fluorescent lamps that have no labels. Removal of labels can also lead to similar penalties.[968]

The Energy Commission Act also gave the EC the power to establish an inspectorate division.[969] With that power, LI 1815 gave inspectors from the EC the authority to inspect facilities holding air-conditioners and fluorescent lamps. The inspector's power also extends to seizure of non-compliant items or items that have labels that are "deceptive, misleading or false." While inspectors may detain non-compliant items, there are procedures in place to permit importers to fix labelling issues

961 *Id.* at 39.
962 Energy Commission Act, 1997 (Act 541)
963 Energy Efficiency Standards and Labelling (Non-Ducted Air Conditioners and Self-Ballasted Fluorescent Lamps) Regulations, 2005 (http://energycom.gov.gh/files/LI_1815.pdf, accessed January 14, 2016).
964 Energy Efficiency (Prohibition of Manufacture, Sale or Importation of Incandescent Filament Lamp, Used Refrigeration, Used Refrigerator-Freezer, Used Freezer and Used Air-Conditioner) Regulations, 2008 (http://energycom.gov.gh/files/LI_1932.pdf, accessed January 14, 2016).
965 Energy Efficiency Standards and Labelling (Household Refrigerating Appliances) Regulations, 2009 (http://www.energycom.gov.gh/files/LI1958.pdf, accessed January 14, 2016); Energy Efficiency Standards and Labelling (Household Refrigerating Appliances) (Amendment) Regulations, 2010 (http://energycom.gov.gh/files/LI1970.pdf.
966 Regulation 2. LI 1815
967 *Id.*
968 See Regulations 2- 6. LI 1815
969 Energy Commission Act, 1997 (Act 541). § 52

or re-export such deficient items, or if relabelling cannot be accomplished within a stipulated time, may result in seizure and forfeiture.[970],

In furtherance of the objectives of LI 1815, the Ghana government undertook the National Compact Fluorescent Lamps (CFLs) Exchange Program in 2007.971 Six million incandescent lamps were directly replaced freely with the same number of CFLs by the government on the advice of the EC over a 3-month period.[972] Peak electricity demand was reduced by 200-220MW. There were respective energy and cost savings of 162.7GWh and US$39.5million annually. Between September 2007 and September 2009, CFLs had an increased penetration of 3 to 79% while that of incandescent lamps decreased from 59 to 3%. In addition, 2 CFL factories were built in Ghana providing employment to 100 people in the process.[973]

The EC has also used the power delegated to it under the Act to issue LI 1932 to prohibit the manufacture or importation of incandescent filament lamps into the country and further to prohibit storage, offering for sale or distribution of such lamps. The above prohibitions were also extended to used air-conditioners, used refrigerators, refrigerator-freezers and freezers. Enforcement powers are also granted to inspectors to enter any premises on reasonable belief to inspect and/or seize such lamps and appliances without releasing them to the importer. These non-conforming items were required to be destroyed with the offender financially responsible for the cost of destruction. Offenders may also be fined or made to serve a term of imprisonment, or both, if found in violation of these regulations.[974]

LI 1958 (and LI 1970 as amended) specifically regulates household refrigeration appliances on energy efficiency standards and labelling whether manufactured or imported for use in Ghana. Such appliances include refrigerators, frozen food storage cabinets, food freezers or any combinations thereof. All such appliances must conform to a specified Ghana Standard[975] and must be properly labelled with clearly visible minimum energy efficiency ratings[976] that are not deceptive, misleading or false. Suppliers of appliances have a duty to provide accurate[977] technical information on their products on minimum energy efficiency and standards and shall make this information available to enforcement officials for inspection within 3 years of the date of last model manufacture. Enforcement authorities have the power to require production of technical documentation of incorrect information sheets or labels on notice to suppliers or importers.

Enforcement authorities have the power to inspect, seize and detain, and test[978] appliances on reason of suspicion of regulatory violations of the standards and labelling requirements. There is opportunity for redress when labels are corrected for seized appliances that meet minimum efficiency requirements. A person whose appliance has been seized or detained may petition with the Commissioner of the EC for its release. Should any loss or damage to an appliance in seizure or detention occur, the enforcement authority is to be held liable and compensate the person if

970 See Regulations 7(4)-(6) and 9. LI 1815
971 Copenhagen Centre on Energy Efficiency (2015). Accelerating Energy Efficiency: Initiatives and Opportunities, Africa. Copenhagen Denmark (http://www.energyefficiencycentre.org/Publications, accessed January 14, 2016).
972 Copenhagen Centre; Agyarko.
973 See Agyarko, supra note 28.
974 See Regulations 1-6. LI 1932
975 Regulation 3(a), (c). LI 1958; LI 1958 Table 1
976 Regulation 4. LI 1958
977 Regulation 8. LI 1958
978 See Regulations 4-15. LI 1958

the reason for the seizure or detention was not through the person's fault or neglect, or the person did not violate the regulations; the right to, and the compensation amount is to be determined through arbitration. Seized appliances that do not conform to the standards are subject to forfeiture, destruction or re-export. The supplier is required to pay the enforcement authority for costs incurred for actions taken by authorities to enforce these regulations. Violations of the regulations may also lead to imposition of fines and/or terms of imprisonment for offending parties.[979]

In collaboration with the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), the government initiated a pilot "rebate and turn in" program in September 2012 that was extended throughout the country in May 2013.[980] The program sought to remove inefficient refrigerating appliances[981] from the Ghana market and households through rebates and loans towards the purchase of 50000 energy-efficient ones.[982] Average electricity consumption per refrigerator was reduced from 1200 to 385kWh annually.[983] It is worth noting that there has been a significant reduction in the importation of used refrigerators into the country. For example, in 2012, 419145 such appliances were imported into the country compared to the 2013 figure of 158699.[984] This demonstrates that with the right policy implementation, legislative goals can be accomplished when the right incentives are available to support.

As part of SNEP, the Ghana government is exploring other opportunities to improve energy efficiency in the economy. These include imposing time of use (TOU) tariffs on industries that use heavy doses of electricity to encourage shifting some operations from high peak to off peak hours based on detailed electrical load management studies.[985] Other actions include energy management in high-rise buildings, electric motor improvement development in electrical fans and pumps, industrial co-generation and fuel substitution, establishment of more industrial energy assessment centres in institutions of higher learning, and increasing the energy fund levy to promote energy efficiency projects.[986]

The Ministry of Energy, in its 2010 energy policy, also emphasizes energy efficiency and conservation as important objectives in the country's energy plan.[987] Ghana experiences about 25% systemic losses during distribution and 30% waste in end use of electricity.[988] To this end, the Ministry advocates developing and implementing programs to optimize energy usage through public education and awareness campaigns, and push for legislation that bans both local production and importation of energy inefficient vehicles and equipment. Together with the SNEP Report released

979 Regulation 23. LI 1958
980 UNDP in Ghana Project: Promoting of Appliance of Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana (http://www.gh.undp.org/content/ghana/en/home/operations/projects/environment_and_energy/Susdevclusterprojects/, accessed January 17, 2016); For UNDP Project Document, see Promoting of Appliance of Energy Efficiency and Transformation of the Refrigerating Appliances Market in Ghana (http://www.gh.undp.org/content/dam/ghana/docs/Doc/Susdev/UNDP_GH_SUSDEV_Refrigerator%20energy%20efficiency%20project.pdf, accessed January 17, 2016).
981 About 2 million inefficient refrigerators are in use in the country, See Agyarko
982 Energy Commission News Release: Refrigerator Rebate Scheme Commences Nationwide (http://www.energycom.gov.gh/energyguide/news.php?news=95, accessed January 17, 2016)
983 Agyarko
984 *Id.*
985 SNEP Report, at 41.
986 Id.
987 Ministry of Energy, Republic of Ghana: National Energy Policy 2010 (http://www.purc.com.gh/purc/sites/default/files/ENERGYPOLICY.pdf, accessed January 8, 2016).
988 *Id.*

by the EC, the Ministry of Energy is also interested in increasing the share of renewable energy as part of the total energy mix for Ghana going forward.

II. PROGRAM OF RENEWABLE ENERGY

The installed electricity supply capacity in Ghana was 2837MW with a dependable capacity of 2515MW as of 2014.[989] Of the dependable capacity, about 55% was hydroelectric, about 45% was thermal, and less than 0.5% was renewable energy (solar).[990] Thus, as an electricity supply source, renewable energy was virtually non-existent. As also indicated above, Ghana's overreliance on hydroelectricity remains untenable to sustain the country's economic growth into the future. This is an acute problem the government recognizes as the SNEP report and the Ministry of Energy policy paper indicate. Both reports view renewable energy as part of the solution to the country's energy problems in increasing energy supply sources with both efficiency and conservation in mind. As a consequence, and as part of its commitment to the Economic Community of West African States' (ECOWAS) Renewable Energy Plan (EREP), Ghana aims to have its renewable energy share of its electricity supply mix reach 10 % by 2020.[991]

With the passage of the Renewable Energy Act in 2011, it is becoming more likely that the right set of regulatory conditions may have been created to make private investment in the industry more appealing. Indeed, Blue Energy, through its subsidiary Mere Power Nzema Ltd (MPNL), is building Africa's largest solar photovoltaic (PV) power plant in Ghana as a direct consequence of the Renewable Energy Act.[992] The 155MW plant will provide enough energy to account for 20% of Ghana's renewable energy target set for 2020. There follows a brief historical background of events leading to the passage of the Renewable Energy Act in Ghana.

A. Background to Passage of RE Act: Program of Renewable Energy

As noted, the Energy Commission Act, 1997, established the Energy Fund.[993] One use of money in the fund was for the "promotion of projects for development and utilization of renewable energy resources, including solar energy."[994] Further, the act gave the EC the power to "regulate and manage the utilization of energy resources" including indigenous ones while formulating and coordinating policies nationally on the same.[995] While "renewable energy" was not specifically defined in the act, "energy resources" was interpreted to include, but not limited, to "hydropower, solar, biomass, wind [and] geothermal,"[996] which are regarded as renewable energy sources.[997] With this broad mandate, the EC developed the SNEP report completed in 2006 from which the Ministry of Energy adopted some of the recommended policy positions on renewable energy in its energy

989 GRIDCo 2014 Electricity Supply Plan (http://www.gridcogh.com/media/photos/forms/supplyplan/2014_Electricity_Supply_Plan.pdf, accessed January 8, 2016).
990 *Id.*
991 ECOWAS Renewable Energy Policy 2015 (http://www.ecreee.org/sites/default/files/documents/ecowas_renewable_energy_policy.pdf, accessed January 19, 2016).
992 Blue Energy News Release: Africa's Largest Solar (PV) Power Plant. (08/05/2015) http://www.blue-energyco.com/africas-largest-solar-pv-power-plant/, accessed January 19, 2016).
993 Energy Commission Act, 1997 (Act 541). § 41.
994 Energy Commission Act, 1997 (Act 541). § 42(b).
995 Energy Commission Act, 1997 (Act 541). § 2.
996 Energy Commission Act, 1997 (Act 541). § 57.
997 Renewable Energy Act, 2011. § 51.

development strategy and policy outlook for the country released in 2010.[998] In arriving at the policy decision that Ghana should have 10% of its energy needs provided through renewable energy by 2020, the ministry identified the lack of enabling legislation and its implementing regulations that specifically addressed renewable energy, especially on tariff setting and grid connectivity, as a major impediment to that goal.[999] To fill that legislative void, in 2011 the Renewable Energy Act was passed. There follows a discussion of the relevant provisions of the law taking into account how the component parts fit into the quintessential renewable energy program

B. Performance of Environmental Impact Statement with Public Hearings at Every Stage of Project Initiation and Development

The main objective of the Renewable Energy Act, 2011 is to provide for "development, management and utilization of renewable sources … in … [an] environmentally sustainable manner."[1000] The Energy Commission (EC) was tasked with the responsibility of achieving the objectives of the Act.[1001] In carrying out this mission, other government ministries and agencies are ordered to collaborate with the EC, and vice versa, to accomplish that goal.[1002] Notable are the Environmental Protection Agency (EPA), Ministry of Science, Environment and Technology, and Ministry of Food and Agriculture,[1003] especially on issues of environmental impact and concern. The EC and EPA are ordered to collaborate on issuance of biofuel (feedstock) licenses[1004] and programs to sustain wood fuel production and consumption.[1005] Even greater collaboration is called for where the EC may refuse to grant a license for commercial activities in renewable energy for health, public and environmental safety reasons.[1006] In the latter case, refusal of the license may be conditioned on the failure to provide an environmental impact assessment (EIA) to the EC.[1007] Licensees or renewable energy producers have a duty to comply with the terms of the issued EIA permit.[1008]

The EPA has responsibility for issuance of environmental permits and to ensure compliance with EIA procedures leading to grants for development projects' planning and execution.[1009] If an undertaking is likely to cause adverse effects on the environment, the EPA may provide written notice to the responsible person to provide an EIA within a specified period. The EPA is required to inform the agency responsible for issuing a license that requires an EIA permit of this notice. This agency is prohibited from issuing the license until receipt of written approval from the EPA that the person has complied with the notice. Thus, the EC may not grant a license to anyone undertaking commercial activities in renewable energy if such activities may adversely impact the environment without having first obtained an EIA permit from the EPA.[1010]

998 Ministry of Energy, Ghana. National Energy Policy 2010; Ministry of Energy, Ghana. Energy Sector Strategy and Development Plan 2010.
999 *Id.*; Energy Commission (2006). Strategic National Energy Plan 2006-2020, Annex IV, Woodfuels and Renewables (http://www.energycom.gov.gh/files/snep/WOOD%20FUEL%20final%20PD.pdf accessed Jan 8, 2016).
1000 Renewable Energy Act, 2011 (Act 832). § 1
1001 Renewable Energy Act, 2011 (Act 832). § 4(j)
1002 Renewable Energy Act, 2011 (Act 832). § 7(1)
1003 Renewable Energy Act, 2011 (Act 832). § 7(2)
1004 Renewable Energy Act, 2011 (Act 832). § 41
1005 Renewable Energy Act, 2011 (Act 832). § 44(b),(d)
1006 Renewable Energy Act, 2011 (Act 832). § 11
1007 Renewable Energy Act, 2011 (Act 832). § 12
1008 Renewable Energy Act, 2011 (Act 832). § 45
1009 Environmental Protection Act, 1994 (Act 490). § 2(i)
1010 See Environmental Protection Act, 1994 (Act 490) Sec. 12

The EPA Board may advise the Minister of Environment, Science and Technology to issue regulations for activities for which the EPA may require an EIA, environmental management plan, or environmental permit.[1011] Acting under this authority granted by the EPA Act, environmental assessment regulations were released that outlined the procedural and administrative mechanisms for obtaining a license for activities that may have significant negative impact on the environment (LI 1652).[1012] A subsequent regulation amending LI 1652 gave certainty to specific fees the EPA may charge for various activities based on the scale of the commercial undertaking (LI 1703).[1013]

As the regulations indicate, if an activity is likely to cause significant impact on the environment, the person responsible must register with the EPA to obtain an environmental permit before the activity commences.[1014] If it is a small to medium scale activity, as LI 1652 (Schedule 1) indicates, the EPA may issue a screening report granting approval after inspection of the proposed site without requesting an EIA.[1015] The screening report may also decline approval and require a preliminary environmental report or an environmental impact statement. The EPA's decision must be given within 25 days after application It is possible for the EPA to grant approval after initial disapproval when the agency accepts a subsequent preliminary environmental report. In that case, the license may be issued without an EIA. Under these circumstances, renewable energy projects and heavy construction involving power plants for hydroelectricity and related structures, including dams and reservoirs could thus be undertaken without an EIA.[1016]

Otherwise, undertakings that are large scale or have significant environmental impacts require EIAs before environmental permits may be issued.[1017] Though large-scale undertakings are not defined in the regulations the fee schedule considers a commercial activity with development costs greater than US$10 million as large scale.[1018] The EIA process involves the submission of a scoping report[1019] with draft terms of reference indicating essential matters to be included in the environmental impact statement (EIS).[1020] When accepted by the EPA, this report forms the basis of the assessment for the EIS. While public hearings are an important part of the EIS, they are not mandatory. Public hearings become a part of the process when the public reacts adversely to the particular undertaking under consideration, communities may have to be dislocated, resettled or relocated, or the EPA decides the effect on the environment may be extensive.[1021] The EPA may then review a draft of the EIS after the public hearing. If found unacceptable, it may be revised for later submission, or require that

1011 Environmental Protection Act, 1994 (Act 490). § 62(1)(b),(h)
1012 Environmental Assessment Regulations, 1999. LI 1652.
1013 Environmental Assessment (Amendment) Regulations, 2002. LI 1703.
1014 Environmental Assessment Regulations, 1999. LI 1652. Regulation 1.
1015 Environmental Assessment Regulations, 1999. LI 1652. Regulation 6, Schedule 1; EPA Ghana. Guidelines For Obtaining Environmental Permits (Small And Medium Scale Activities). (http://www.epa.gov.gh/web/index.php/about-us/permitting-procedures/242-guidelines-for-obtaining-environmental-permits-small-and-medium-scale-activities, accessed January 23, 2016).
1016 See Environmental Assessment Regulations,1999. LI 1652. Regulations 6-9 and Schedule 1.
1017 EPA Ghana. Guidelines For Obtaining Environmental Permits For Large Scale And Significantly Impacting Undertakings (http://www.epa.gov.gh/web/index.php/about-us/permitting-procedures/243-guidelines-for-obtaining-environmental-permits-for-large-scale-and-significantly-impacting-undertakings, accessed January 23, 2016)/
1018 Environmental Assessment (Amendment) Regulations, 2002. LI 1703.
1019 Environmental Assessment Regulations, 1999. LI 1652. Regulation 11.
1020 Environmental Assessment Regulations, 1999. LI 1652. Regulation 9.
1021 Environmental Assessment Regulations, 1999. LI 1652. Regulation 17; For more on the public hearing process in Ghana, See Ebenezer Appah-Sampong, Case Study 9: Public Hearing Within the Environmental Impact Assessment Review Process, UNEP EIA Training Resource Manual.

further studies be conducted. On acceptance of the EIS, the EPA may then issue an environmental permit for the undertaking to proceed.[1022]

C. Requirements for Developer Qualifications

Specific statutory requirements must be met under the Renewable Energy Act, 2011 (Act 832) to qualify for a license to engage in any kind of commercial activity in the industry. To qualify for a license, the applicant must be a citizen of Ghana, a corporate entity or partnership organized under the laws of Ghana. The EC will grant the license if the applicant meets the conditions specified in the license. The EC has the authority to determine the conditions for license suitability and if license applicants have satisfied those conditions on application. For applicants that want to generate and supply renewable energy products, qualifications require the licensee to demonstrate the ability to "manufacture and assemble … [the] product," "install, generate and supply electrical energy," or "produce biofuel or wood fuel" in order to qualify for a production and supply license.[1023]

The EC has set in place the conditions for obtaining, for example, a biofuel production license and wholesale electricity supply license.[1024] Qualification for each license is based on meeting specific metrics during each of the three phases of the license application process. In the first phase, the developer or wholesale electricity supplier must acquire a provisional license. In the second phase, prior to construction, a siting clearance or permit and a construction work permit must be acquired. Finally, in the third phase, an operational license must be acquired prior to operations. When all requirements under each phase have been submitted to the satisfaction of the EC, the agency may then proceed to issue the license as evidence of the qualification of the biofuel producer or wholesale electricity supplier.

The EC makes a determination of whether the license applicant has personnel with the operational experience and required expertise to carry out the operations of the enterprise. An important consideration is their knowledge and experience, specifically in the renewable energy industry, and their technical capacity to meet the relevant license requirements. This vetting occurs in phase one of the process. Thus, if the EC is not satisfied with the qualifications of such personnel, it is likely that the provisional license may not be granted.

D. Due Diligence Concerning Developer Experience and Reliability and Reliability of Equipment Contemplated for Use

The EC is charged with implementing the Renewable Energy Act, 2011 (Act 832). With this mandate, any participant in the renewable energy market must engage with the EC to get approval (license) for market entry unless exempted by the act. The EC performs due diligence on future market participants to determine their level of experience and capability to perform after license approval.[1025]

1022 See Environmental Assessment Regulations, 1999. LI 1652. Regulations 18 and 19.
1023 See Renewable Energy Act, 2011(Act 832), Secs. 9, 11, 20.
1024 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1025 See Renewable Energy Act, 2011. Secs. 4, 8.

Using the approval process of wholesale electricity supply (WS) license as an example, the EC performs due diligence during each of the three phases of the application process by requiring certain submissions from license applicants at the beginning of each phase. Proceeding to the next phase of the application process is contingent on successfully satisfying the requirements of the previous phase. Sticking with the WS license, in the first phase where a provisional license may be issued, applicants are required to disclose all their past, pending and existing liabilities and how that may negatively impact their financial and operational ability to supply electricity generated from renewable energy. In addition, officers of the company must disclose whether they have been denied a license or had their license cancelled or revoked, and the particular circumstances leading to that. Further, applicants must detail their level of operational experience and expertise that demonstrate their technical knowledge of the renewable energy resource they intend to develop. Other submissions include the demonstration of financial capability through submission of three most recent years of audited financial statements and two years of forecasted statements and the applicant's financial arrangements to perform in business such as bank commitments, credit agreements, guarantees and contractual arrangements.[1026]

The second and third phases also have significant due diligence requirements on developer reliability. For example, in the second phase, the applicant should have implementation agreements such as memoranda of understanding (MOUs) and licenses with other agencies. Construction contracts between the applicant and contractors must have been executed showing responsibilities of the contractor, including bonds and insurance. Even more important, the applicant should have an approved feed-in-tariff rate from the Public Utilities Regulatory Commission (PURC). A power sales and purchase agreement (PPA) must also exist with distribution utilities or bulk customers.

For the third phase, the applicant must submit supply agreements with providers for major equipment parts or frequently used parts, operations and maintenance plans and agreements, an approved safety and technical management plan (STMP), among others.[1027]

The Renewable Energy Act imposes a duty on renewable energy producers to maintain their equipment and property in a manner that ensures services for which they obtained a license.[1028] The Act adds teeth to this requirement by imposing penalties for breach of this duty to provide maintenance.[1029] License requirements outlined by the EC include submission of operations and maintenance plans with maintenance agreements containing details of maintenance schedules for property and equipment.[1030] Thus, the license application requirements tie operational efficiency to reliability of safety equipment.

1026 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1027 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1028 Renewable Energy Act, 2011. § 45.
1029 See Renewable Energy Act, 2011. § 45(c).
1030 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).

E. Requirement for Developer Bonding in the Event of Problems That May Occur Relating to the Developer or the Equipment Provided

There is no provision in the Renewable Energy Act, 2011 that specifically imposes a duty on producers of renewable energy to have bonding and insurance. The focus of the EC is directed at standards of performance between producers of renewable energy and contractors under contract to provide construction services. Both parties must sign a construction contract that is a required submission in the license acquisition process. The contract must have terms that address bonding and insurance requirements, progress reports, payment schedules and substantial performance of project deliverables.[1031]

F. Training Requirements for Project Managers and Maintenance Personnel

License applicants must describe the skills and experience of company directors and senior managers detailing their background, including their ability to function in business operations in renewable energy. Specific training requirements that must be met are not categorically called for, other than for applicants to show how the background of their personnel is "relevant to meeting the [technical] requirements of the license."[1032] Should the applicant choose to rely on a separate entity to provide technical services, the applicant must provide information on the experience and knowledge of the renewable industry by the entity's personnel and the existence of formal agreements between the parties to provide such services. Periodic training requirements for various personnel is not specifically stated in the Renewable Energy Act, 2011, as the act is silent on such training for players in the industry. The EC has not promulgated regulations calling for this requirement as a condition for license issuance or renewal for continued participation in the industry. However, for installation and maintenance licenses, the EC specifically asks for "personnel skill upgrade information."[1033] The license applicant is required to provide information on technicians, their qualifications, and the skills they acquired over the course of the year. This information must be provided to the EC as it is seemingly a part of the "license conditions" that must be satisfied for the license holder to obtain the license.[1034]

G. Developer Post-Initiation Obligations to Provide Equipment Spare Parts, Necessary Repairs or Replacement, and Assistance to Project Personnel Concerning Problems That May be Experienced

Problems often arise during large-scale project deliverables. Even though the Renewable Energy Act, 2011 does not address problems post-initiation, the EC incorporates mitigation strategies during license acquisition. By contract, license applicants have to enter into supply agreements for equipment and parts for major spare parts and for parts that need to be changed frequently when plants become operational.[1035] Wholesale electricity suppliers, biomass power plants, biofuel producers and other industry players must all have existing supply agreements to participate in

1031 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1032 *Id.*
1033 *Id.*
1034 *Id.*
1035 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).

the industry.[1036] The EC imposes this contractual duty at the third and final phase of the license acquisition process when the applicant applies for the authorization to operate. Without these agreements secured, the EC may refuse to grant the license.

H. Project Financing

Monies from the Energy Fund established under the Renewable Energy Act must be used to provide "financial incentives, feed-in-tariffs, capital subsidies, production based subsidies and equity participation" for various renewable energy activities.[1037] The Minister of Energy has the mandate to issue regulations on financial incentives to promote project development.[1038] Seemingly this is sound; however, it has been found that the high initial capital costs required for industry development cannot be met from the Fund alone. Project financing must be provided primarily by investors…

Industry attractiveness to private investors depends on whether there is a return on investment. Among other concerns, two issues present significant barriers to investor willingness to commit private capital. First, whether there is a reasonable feed-in-tariff rate set by regulators that ensures energy generated by developers can be purchased by bulk customers and distribution utilities to generate a reasonable return on investment. Second, allowance for investors to repatriate their monies out of the country if they so desire. When these two issues are properly addressed it may make the environment suitable for private investors to put capital at risk.

The Renewable Energy Act, 2011 addresses feed-in-tariffs by granting the Public Utilities Regulatory Commission (PURC) the authority to set tariff rates taking into account several factors, including costs, reasonable rate of return, and the balance of interests between consumers and investors.[1039] In certain situations, the government may have to provide purchase guarantees to investors should distribution utilities fail to purchase developer-generated renewable energy.[1040] The Ghana Investment Promotion Centre Act, 2013 provides investment guarantees and severely restricts expropriation of assets without fair and adequate compensation.[1041] In addition, investors are guaranteed the ability to transfer capital, profits and dividends connected to their investments outside the country.[1042] Dispute resolution mechanisms are also in place to address disagreements with the Government, with investors having the right to use international judicial bodies/tribunals to settle investment disputes.[1043]

These provisions have created an environment that makes Ghana suitable for foreign investments.[1044] Indeed, since the passage of the Renewable Energy Act, 2011, foreign investments have significantly been the major source of funds for projects within the industry. As earlier mentioned, Mere Power

1036 *Id.*
1037 Renewable Energy Act, 2011. § 45.
1038 Renewable Energy Act, 2011. § 50.
1039 Renewable Energy Act, 2011. § 27
1040 Theo Acheampong, Dumsor: STARRFM Online. GGDP Lauds Plans to Bring in $250M, 450MW Barges, Feb 25, 2015 (http://www.starrfmonline.com/1.2009906, accessed February 4, 2016); Xinhuanet. Ghana's 350 Million USD SoProject to Commence in September, (http://news.xinhuanet.com/english/africa/2014-03/01/c_133151192.htm, accessed February 4, 2016).
1041 Ghana Investment Promotion Centre Act, 2013 (Act 865). § 31.
1042 Ghana Investment Promotion Centre Act, 2013 (Act 865). § 32.
1043 Ghana Investment Promotion Centre Act, 2013 (Act 865). § 33.
1044 Department of State. Ghana: Investment Climate Statement 2015 (http://www.state.gov/documents organization/241784.pdf, accessed February 4, 2016).

Nzema Ltd, a subsidiary of Blue Energy, a UK-based company, is committed to invest USD350 million in building the largest photovoltaic solar farm in Africa in Ghana, a project scheduled to be fully operational in 2017.[1045] The company will finance the project with both direct investments and debt secured by international financial institutions, and infrastructure and global equity funds.[1046] France's Total Group, forming a consortium with renewable energy experts from the Neon solar energy company, will invest about USD80-100 million in solar energy farms to produce about 40MW of power in northern Ghana.[1047] A register of licenses issued by the EC shows the level of participation and interest by various private investors in Ghana's renewable energy industry.[1048]

Another project financing source is through the United Nations-backed Climate Investment Fund (CIF) acting through a consortium of multilateral development banks (MDBs) including the African Development Bank (AfDB).[1049] One of two CIF funds is the Strategic Climate Fund (SCF) that has as one of its targeted programs the Program for Scaling-Up Renewable Energy in Low Income Countries (SREP).[1050] SREP, as its name indicates, is "empowering transformation in developing countries by demonstrating the economic, social, and environmental viability of renewable energy."[1051] In its SREP Investment Plan presented to the CIF, Ghana's estimated budget was USD230 million with USD40 million requested for mini-grids and stand-alone solar photovoltaic systems, solar photovoltaic based net metering with battery storage, and utility-scale solar photovoltaic/wind power generation projects.[1052] CIF has approved the requested USD40 million for the above projects.[1053]

I. Feed-In-Tariffs and Net-Metering

Of primary concern to developers of renewable energy is how they would be remunerated for the energy they produce. Investors may not find a market attractive if the level of remuneration is not enough to cover costs and give them a reasonable return on investment. So pricing of renewable energy is of extreme importance to market attractiveness and participation by investors. For the ECOWAS region, the most effective remuneration mechanism to promote sources of renewable energy in electricity markets is through feed-in-tariffs and net-metering because of limited competition and small national markets. In addition, investors find these mechanisms less risky than other methods such as green certificate systems.[1054]

1045 Blue Energy News Release: Africa's Largest Solar (PV) Power Plant. (08/05/2015) http://www.blue-energyco.com/africas-largest-solar-pv-power-plant/, accessed January 19, 2016).

1046 *Id.*

1047 Xinhuanet. Justice Lee Adoboe. Interview: Total Petroleum to Invest 80 Million USD in Ghana's Solar Energy Farms, February 10, 2015 (http://news.xinhuanet.com/english/2015-02/11/c_133984676.htm, accessed February 4, 2016).

1048 Energy Commission. Register of Licenses (http://www.energycom.gov.gh/index.php/licensing/2015-02-06-12-43-21, accessed February 4, 2016).

1049 Climate Investment Funds. (http://www-cif.climateinvestmentfunds.org/, accessed February 4, 2016)

1050 Strategic Climate Fund. (http://www-cif.climateinvestmentfunds.org/fund/strategic-climate-fund, accessed February 4, 2016).

1051 SREP: Funds & Programs (http://www-cif.climateinvestmentfunds.org/fund/scaling-renewable-energy-program, accessed February 4, 2016).

1052 Climate Investment Funds. SREP Investment Plan For Ghana, May 15, 2015 (http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/SREP_13_4_SREP_Investment_Plan_for_Ghana.pdf, accessed January 21, 2016)

1053 Out-Law.com. Funds Back Ghana's Plans for Renewable Energy Sector Investment. May 27, 2015 (http://www.out-law.com/en/articles/2015/may/funds-back-ghanas-plans-for-renewable-energy-sector-investment-/, accessed January 21, 2016).

1054 See Matteo Leonardi, Principles of Regulating Clean Energy in the ECOWAS Region, (http://regulationbodyofknowledge.org/wp-content/uploads/2015/01/Matteo_Principles_of_Regulating.pdf accessed Jan 12, 2016).

1. Feed-In-Tariffs

Ghana's renewable energy markets rely on a feed-in-tariff scheme to set prices for various renewable energy products with the Public Utilities Regulatory Commission (PURC) given the authority to set rates. The scheme has three components: purchase obligation for renewable energy, feed-in-tariff rate and connection to transmission and distribution systems.

To create a ready market, the Renewable Energy Act, 2011 requires distribution utilities and bulk customers to purchase a specific percentage of their electricity supply from renewable energy developers. PURC sets the percentage level of the electricity supply mix for buyers and takes into account the nature of the renewable energy technology, financial capability of the purchasing utility and net cost impact of tariff on end user. Distribution utilities and bulk customers may substitute payment of a premium to the energy fund in exchange for failure to purchase the specified percentage of electricity from renewable energy sources. For failure to comply with the purchase obligation, the EC may suspend the buyers' permits to purchase wholesale supply electricity and order them to pay penalties.[1055]

PURC also has responsibility for setting the feed-in-tariff rate for renewable energy[1056] based on the specific technology cost methodology.[1057] Distribution utilities cannot negotiate a power purchase agreement (PPA) with renewable energy developers without written permission from PURC that indicates the rate at which utilities may charge for such energy. On the other hand, utilities cannot demand a feed-in-tariff rate unless the chargeable rate demanded has been approved by PURC, and utilities cannot request a feed-in-tariff rate higher than that approved by PURC.[1058] However, utilities can receive a higher than approved feed-in-tariff rate from consumers on agreement between the parties and with written permission from PURC. The Renewable Energy Act dictates that PURC must consider multiple factors such as the renewable energy technology and its norms of operation, costs, location of developer facility, reasonable rate of return, and balance between consumer and investor interests in preparing guidelines for setting feed-in-tariff rates. In the spirit of transparency, PURC publishes all approved feed-in-tariff rates in the Gazette newspaper and at least one national daily newspaper. On approval, the fixed rate is guaranteed for 10 years after which it can be reviewed every 2 years.[1059]

Grid access is an important component of the tariff scheme. Operators on request and through a connection agreement must grant renewable energy access to the transmission and/or distribution systems in their coverage area. Operators, as soon as practically possible, must upgrade their transmission and distribution systems to accommodate developer-generated renewable energy on the grid at a reasonable price. Developers of renewable energy bear the costs of connecting installations to grid metering points.[1060]

1055 See Renewable Energy Act, 2011 (Act 832) Sec. 26 (1-6). § 26(6).
1056 Renewable Energy Act, 2011 (Act 832). § 27.
1057 Matteo Leonardi, Principles of Regulating Clean Energy in the ECOWAS Region, (http://regulationbodyofknowledge.org/wp-content/uploads/2015/01/Matteo_Principles_of_Regulating.pdf accessed Jan 12, 2016).
1058 Renewable Energy Act, 2011 (Act 832). § 28(2).
1059 Renewable Energy Act, 2011 (Act 832). § 27(4).
1060 See Renewable Energy Act, 2011 (Act 832).30(1-3, 5).

2. Net-Metering

PURC, under the authority of the Renewable Energy Act, 2011 has issued guidelines for renewable energy self-generators whose generation facilities are connected to the main distribution network. Electricity consumers are given a limited right to supplement their purchases through self-generated renewable energy connected to the grid. Net-metering provides authority for consumers to sell electricity in excess of their usage back to the utility Here, the motivation is to help consumers lower their energy costs and, by encouraging use by customers of solar energy to mitigate climate change.

The PURC's net-metering scheme is designed to limit the amount of surplus generated electricity that the self-generator can sell back to the utility within the year in order not to allow net-metering to cause excessive increases in rates to all customers. This is accomplished by limiting net-metered renewable energy to 200kW capacity. Every excess kWh exported to the distribution utility above customer consumption levels is recorded as a credit in the billing period which may be applied to subsequent billing periods; however, excess kWh credits do not carry over to subsequent years but are made to lapse at year's end. The customer is required to pay all approved PURC taxes, levies and charges on total electricity consumed from the distribution utility.[1061]

J. Performance Time Requirements

The Renewable Energy Act, 2011 gives the EC powers of suspension or cancellation of licenses. If a licensee fails to comply with the terms of its license, the EC may suspend or cancel the license. A license that is not used by the licensee within a year of issuance may be cancelled by the EC.[1062] Poor finances leading to inability to perform under the conditions of the license may lead to its suspension or cancellation at any time.[1063] Additionally, failure to perform according to permit requirements of other regulatory agencies such as when the EPA revokes an environmental permit, or a licensee fails to follow Public Utility Regulatory Commission (PURC) instructions, could lead to EC sanctions.

The whole license application process for wholesale electricity supply and biofuel production is a graduated three-phase process in performance. There are specific phase-specific tasks that must be completed before progression to the next phase is permitted in license acquisition. For example, in the second phase of the electricity supply situation, when seeking siting clearance, license applicants must have implementation agreements, memorandum of understanding (MOUs), feed-in-tariffs, environmental permits and various licenses from other regulatory agencies secured to fulfil application requirements at that phase. Again at this phase, detailed implementation schedules that provide timelines for performing various project activities must be submitted to the EC.

1061 Energy Commission, Ghana. 2015. Net Metering Sub-Code for Connecting Renewable Energy Generating Systems to the Distribution Network in Ghana, (http://www.energycom.gov.gh/files/Net%20Metering%20Sub-Code,%202015.pdf, accessed Jan 5, 2016).

1062 Renewable Energy Act, 2011 (Act 832). § 16.

1063 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).

K. Observance of All Government Health, Safety and Performance Requirements

As part of the license application process, the applicant must submit a Safety and Technical Management Plan (SMTP) that must be approved by the EC.[1064] The SMTP is an important document because it envisages potential problems likely to exist at employment facilities and locations and demands from the applicant key protective mechanisms and procedures.

The applicant must comply with Ghana labour laws and regulations on employee health. This means environmental hazards (air quality, water toxicity, etc.) must be recognized and precautions, actions, plans and mitigation measures instituted to limit their impact. The developer must have a waste management policy consistent with WHO and/or EPA regulations and standards. The applicant must demonstrate commitment to safety by having a defined policy statement, safety codes and practices, fire safety, maintenance and operational rules for safety, and other safety measures. A compliance plan to ensure that safety management procedures are being followed is an important component of the SMTP. Without satisfying these requirements, the applicant may be prohibited from getting authorization to operate in the third and final phase of the license acquisition process.

L. Dispute Resolution

Disagreements may occur between license applicants or licensees and the EC during license application, renewal or modification. The EC has powers to suspend or cancel a license if the agency believes a licensee is not complying with license terms or conditions. If a license application is refused or denied, the applicant may lodge a complaint with the Minister of Energy within 30 days of denial.[1065] The Minister must resolve the matter within 30 days of receipt of the complaint or set up an arbitration panel to settle the matter with the applicant. Should either approach fail, or if the Minister fails to act within the allotted period,[1066] the applicant has 14 days to pursue the matter further with the high court of Ghana. License renewal follows the same procedure as the original license application so the same resolution mechanism is followed in case of dispute. Treating a renewal application the same way as an original application makes sense as a biofuel production license, for instance, has a 20-year term,[1067] giving the EC the chance to re-examine the license holder's viability as a going concern. Generally, the licensee may apply to renew the license within 60 days of expiration.

The EC may seek to modify a license if the agency believes the licensee has failed to honour license terms or such modification would be in the public interest. Within 60 days of that action, the EC must give notification to both the licensee and the public about the modification proposal, what the effect of it would be, and present an opportunity for public participation. The licensee may treat expenses or damages suffered as a consequence of modification if a license ordered by the EC as a capital expenditure.[1068]

1064 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1065 SEE Renewable Energy Act, 2011 (Act 832), Secs. 10-17.
1066 Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1067 See Energy Commission, Ghana. 2012. License Manual for Service Providers in the Renewable Energy Industry (http://www.energycom.gov.gh/files/RE%20LICENCE%20MANUAL.pdf, accessed Jan 6, 2016).
1068 Renewable Energy Act, 2011 (Act 832). § 15.

The EC may suspend or cancel a license; however, this is a drastic remedy. As a result, the EC must determine the necessity of such action and take into account the loss or damage that a licensee is likely to suffer. The EC must provide notice of the intent to suspend or cancel the license, giving reasons and provide rectification measures and what action the agency would take for licensee failure to comply with the notice. The EC must give the licensee a reasonable period to rectify the situation. Before the license is finally suspended or cancelled, the licensee must be given an opportunity to be heard.[1069]

Just as it is in the case when the EC makes the decision to deny a license or refuse to renew an existing one, the aggrieved party if not satisfied with a modification, suspension or cancelation decision from the EC may file a complaint with the Minister of Energy. Further recourse may be obtained from the high court of Ghana if the licensee is not satisfied with the Minister's decision.[1070]

Arbitration is the required method of dispute resolution between license holders. The EC can initiate or a licensee can ask the EC to set up an arbitration panel to assist in the resolution of a dispute between license holders. Even in that case, the license holders are required to have made an effort to come to agreement, and with that failing, the arbitration panel is to settle the dispute between the parties.[1071]

III. CONCLUSION

Ghana is making strides in its energy program towards greater energy efficiency and sustainability, and a shift to incorporation of renewable energy components into its total energy mix. Rules and regulations do exist in support of its energy efficiency program with policies that were introduced in the past to support these policy initiatives. However, there is still significant room for improvement in this area. Of primary concern on energy efficiency is the lack of any rules that codify the policy pronouncements in order to make them mandatory. This is a glaring weakness in the country's energy program that the Energy Commission recognizes. The EC's 2006 SNEP report acknowledges the necessity for adoption of laws to achieve this.[1072] Key components of this Act, from the EC's perspective, must include codifying energy management practices, building codes, and programs for auditing industrial and commercial entities for initiatives on energy efficiency to be effective.[1073]

The Ministry of Energy National Energy Policy (NEP) report released in 2010 also identifies key challenges to energy efficiency and conservation measures within the country. One observed significant barrier to progress is energy pricing insufficiency that fails to make both residential and industrial users voluntarily modify their behaviour towards optimal use of energy for their various ends.[1074]

In addition, there is insufficient public education and awareness of the benefits of energy efficiency and conservation methods at sustainable levels to make a lasting impact.[1075] Lack of proper

1069 Renewable Energy Act, 2011 (Act 832). § 16.
1070 Renewable Energy Act, 2011 (Act 832). § 17.
1071 Renewable Energy Act, 2011 (Act 832). § 18.
1072 Energy Commission, Strategic National Energy Plan (SNEP) 2006 -2020, Main Report. 2006. (http://www.energycom.gov.gh/files/snep/MAIN%20REPORT%20final%20PD.pdf, accessed January 8, 2016).
1073 *Id.*
1074 Ministry of Energy, Ghana. National Energy Policy 2010 (http://www.purc.com.gh/purc/sites/default/files/ENERGYPOLICY.pdf, accessed January 8, 2016).
1075 *Id.*

enforcement of already existing regulations because of weak enforcement divisions within the government is another impediment to success. Finally, there is the perennial problem of inadequate financing for energy efficiency and conservation programs even when particular initiatives on a small scale have proven effective. For example, in the mid-1990's, despite the success enjoyed in replacing the traditional "coalpot" with energy efficient Ahibenso stove that significantly reduced the quantities of wood fuel during use, the wood fuel energy efficiency program essentially died out when the Ministry of Energy's funding support ended.[1076]

The passage of the Renewable Energy Act, 2011 has given some clarity to industry participants concerning their rights and obligations for renewable energy market participation. This legislation, coupled with a suitable investment climate, has encouraged some investors to put capital at risk in Ghana's renewable energy market. Purchase obligations imposed on suppliers and bulk customers ensure a ready market for renewable energy producers. In spite of these positives, a significant drawback is the 10-year duration of the feed-in-tariff rate. There is thus a duration mismatch between the term of the feed-in-tariff rate and that of the electricity supply/production license that is granted for 20 years. A legislative fix through an amendment to the Renewable Energy Act to increase the feed-in-tariff rate from 10 to 20 years would eliminate the duration mismatch and would make the incentives for market participation stronger for investors.

Finally, lack of grid capacity in the country's electricity infrastructure may be a significant impediment to market growth in the renewable energy industry. The targeted share of electricity from renewable energy may not be realized in due time, but not for a lack of willing participants in the market. The EC has placed interim production limits on the amount of energy that certain producers may contribute or supply to distribution utilities and bulk customers.[1077] This may create a chilling effect on market entry by potential investors, a problem that the Renewable Energy Act did not anticipate and on which it is silent. This may not, however, be an issue that is unique to the renewable energy industry, as an overall improvement in grid capacity can be beneficial to all energy producers regardless of the source of production.

Community mini-grids (solar photovoltaic plus storage batteries or wind or fossil backup) that are not directly connected to the national grid may seem a better solution to provide electricity to certain rural and geographic areas that are not easily accessible. Though this off-grid approach has not been frequently used in Ghana, lack of foreign private investment can be attributed to the uniform low tariff rate that also applies to mini-grids in Ghana.[1078] Private sector participation could be encouraged through a legislative act or regulation that makes provisions for special tariffs in the case of mini-grids.

1076 Energy Commission, Strategic National Energy Plan (SNEP), Annex IV, Woodfuels and Renewables 2006 -2020. 2006. (http://www.energycom.gov.gh/files/snep/WOOD%20FUEL%20final%20PD.pdf accessed Jan 8, 2016).
1077 PVTech, Ben Willis. Ghana Cap Puts Brakes on Utility-Scale Solar (Apr 22, 2015) (http://www.pv-tech.org/news/ghana_utility_solar_cap_casts_doubt_on_africas_largest_pv_power_plant, accessed January 20, 2016).
1078 Gauri Singh et. al. IRENA Publication (2015). Ghana: Renewables Readiness Assessment (http://www.irena.org/DocumentDownloads/Publications/IRENA_RRA_Ghana_Nov_2015.pdf, accessed February 18, 2016).

CHAPTER 7F. The Renewable Energy laws and Policies of the Republic of Korea

Sungja Cho*

I. INTRODUCTION

At the end of June 2015, the Republic of Korea submitted to the 21st session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) a pledge that Korea's target for reducing greenhouse gas emissions (GHG) by 2030 would be 37% from business-as-usual levels, which is higher than its earlier plans for a 15% - 30% cut. If implemented successfully, Korea's GHG emissions will be less than 536 million tons in 2030.[1079]

Currently, Korea has the14th largest economy by GDP (Gross National Product) and is the 6th largest exporter in the world as of 2014.[1080] However, on the energy side, Korea relies on imports to meet about 97% of its total primary energy consumption since its domestic resources are inadequate.

According to the BP Statistical Review of World Energy 2015, the primary energy consumption by fuel type of Korea in 2014 was composed of petroleum and other liquids of 39%, coal 31%, natural gas 16%, and nuclear 13%. Korea was the world's 9th-largest energy consumer in 2014.[1081] Korea ranks among the world's top 5 importers of liquefied natural gas, coal, crude oil, and refined products.[1082] In short, though Korea is 14th largest economy in the world, the majority of its energy depends on imports, which makes it very vulnerable to the international energy market fluctuations. Thus, energy independence for sustainable growth is the most critical goal for Korea. In that sense, renewable energy is the best alternative for sustainable growth of Korea.

However, the Korea's renewable energy supply and consumption in 2014 were 3.4% and 3.9%, respectively.[1083] Considering the sources of electricity only, as of 2013, 69.6% of electricity was from fossil fuels like coal and gas; 26.8% from nuclear fuels; 1.7% from hydroelectricity; and 1.9% from other renewable sources. This contribution rate of renewable energy sources to the total primary energy supply (TPES) in Korea is one of the lowest among the 34 OECD (Organization for Economic Cooperation and Development) countries. Thus, the current reality is gloomy.

But, the Korean government now seems serious to develop and expand renewable energy sources and industries for reduction of GHG emission as well as for energy security and independence. On November 30, 2015, in COP 21, Korean President Park Geun-Hye, announced a Korean vision of new energy industry promotion, as a ''*Strategy for Nurturing New Energy Industries 2030"* for mitigating climate change, before the Heads of over 140 countries in the world.[1084]. In this Strategy,

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1079 The Korea Times, http://www.koreatimes/cp/lr/www/news/nation/2015/06/16-181923.html.

1080 World Factbook, Korea, South, 2015/11/10 .

1081 BP Statistical Review of World Energy 2015.

1082 EIA estimates, Global Trade Information Service, and IHS Energy.

1083 Korea Energy Economics Institute, Monthly Energy Statistics, March 2015, p. 15, p. 21, available at http://www.keei.re.kr/keei/download/MES1503.pdf.

1084 United Nations Framework Convention on Climate Change (UNFCCC), Remarks at The Climate Summit of President Park Geun-hye Republic of Korea, November 30 2015, Paris, France; See http://unfccc.int/files/meetings/paris_nov_2015/application/pdf/cop21cmp11_leaders_event_rep_korea.pdf.

President Park announced 4 new industry models to advance renewable energy development:

- Electricity prosumer (producer + consumer) market, where an electricity consumer can be also a producer. For development of this market, the government is planning to form a market where every citizen can produce and store electricity through renewable energy and sell such stored electricity in the electricity market.;
- Zero-energy buildings, future building that will produce electricity through heat-insulation technology and renewable energy. The Korean government is considering making this feature a mandatory requirement for new buildings after 2025;
- Smart plants to optimize the production process and energy consumption through the "Internet of Things" (IoT)[1085] and an Energy Management System (EMS) to be instituted.[1086] The government plans to apply these methodologies to two thirds (2/3) of the domestic manufacturing plants, about 40,000, by 2030; and
- Carbon-zero Jeju,[1087] a project to replace all vehicles in the Korean island of Jeju with electricity cars and to provide all electricity for Jeju from new and renewable energy sources.

Also, Korea has developed one of the most advanced smart-grid technologies and energy storage systems (ESS), successfully exporting smart-city and smart-village models to United Arab Emirates (UAE) and Mozambique. Now, Korea is trying to assume a role of bridge between the advanced countries and the developing countries in renewable energy technology support and transfer.

Domestically, though, the industry associations fiercely protested against the heightened enforcement of renewable energy performance standards and reduction of greenhouse gases, including a cap-and-trade market that was begun in early 2015. Thus, at this point, it can be said that Korea has a huge gap between the goals to achieve and the current reality in renewable energy sources utilization. The current laws and policies of the Korean renewable energy system are explained below.

1085 According to the "Internet of Things Global Standards Initiative," the Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, that enables these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across the existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

1086 As used here, an Energy Management System (EMS) is a system of computer-aided tools used by operators of electric utility grids to monitor, control, and optimize the performance of the generation and/or transmission system.

1087 Jeju Province, officially called the Jeju Special Self-Governing Province, is one of the nine provinces of South Korea. The province is situated on the nation's largest island of Jeju (also Jejudo), formerly called as Cheju, Cheju Do, etc. The island lies in the Korea Strait, southwest of South Jeolla Province, of which it was a part before it became a separate province in 1946. Its capital is Jeju City.

II. RENEWABLE ENERGY LAWS IN KOREA

A. Renewable Energy Governing Law: Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy[1088]

In Art. 1, the Act of NRE proclaims its purpose:

> "to contribute to the preservation of the environment, the sound and sustainable development of national economy, and the advancement of national welfare, by diversifying energy resources through the promotion of technological development, use and diffusion of new energy and renewable energy, and the energy industry activation of new energy and renewable energy; and by furthering stable energy supply, transformation to environment-friendly energy structure, and reduction of greenhouse gas emissions".[491]
>
> 491 *Id.* Art 1, Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy (amended Apr. 12, 2014).

To further this purpose, the Act of NRE imposes specific requirements and responsibilities on the government and agencies. The Act's main features may be summarized with the following 10 categories.

1. Art. 5 (Establishment of Basic Plan)

   Every 10 years, the Minister of the Ministry of Trade, Industry and Energy (MTIE) should establish a basic plan for the promotion of technological development, use and distribution of new and renewable energy, setting forth the objectives and duration of the basic plan; the objectives of technological development, use and distribution by new and renewable energy sources; the target ratio of the quantity of new and renewable energy power generation to the total quantity of power generation; the reduction target of greenhouse gas emissions; the methods of implementing the basic plan; an assessment of technological level, the prospects for distribution, and the expected effects of new and renewable energy; supporting actions for technological development, use and distribution of new and renewable energy; and training plans of experts in the fields of new and renewable energy.

2. Article 9 provides for the Government to appropriate project funds for performing implementation plans in its expenditure budget for each fiscal year, and the Minister of Knowledge Economy shall use the project funds created pursuant to Article 9 for listed renewable energy projects.

3. Art. 12 provides that the Minister of MTIE may require government buildings, public corporations, and government-invested institutions, under the relevant laws, to mandatorily install new and renewable energy facilities in a building newly built, extended, or remodelled in order to use energy supplied utilizing new or renewable energy for a certain percentage of the estimated volume of energy use computed at the time of its design.

1088 The Korean Law Information Center, http://law.go.kr/engLsSc.do?menuId=0&subMenu=5&query=#liBgcolor0.

4. Arts. 12-5~12-10 provide that the Minister of MTIE may require an operator of an electric generation business under the relevant laws to mandatorily supply a certain percentage of the volume of electricity generation using new and renewable energy. Penalty Surcharges may be imposed on those who fail to meet this requirement. New and Renewable Supply Certificates will be issued to compliant suppliers.
5. Art. 13 provides that a person who intends to sell new and renewable energy by manufacturing or importing them may obtain certification through undergoing a performance inspection by the performance examination agency designated by the Minister of MTIE.
6. Art. 17 provides that the Minister of MTIE Knowledge Economy give public notice of any determined standard price of electricity generated from new and renewable energy. Where the transaction price of electricity generated from new and renewable energy is lower than the standard price publicly notified, the Minister of MTIE is required to preferentially subsidize the difference..
7. Arts. 20 &.21 provide that the Minister of MTIE may provide facility certification institutions with necessary support, such as establishing the foundation for standardization or international activities in order to bring new and renewable energy technologies already developed or being developed domestically in conformity with the international standards. Also, the Minister of MTIE may designate and operate new and renewable energy facilities and their components in order to improve their compatibility.
8. Art. 27 that the Minister of MTIE may carry out pilot projects of new technology; for creating environmentally-friendly new and renewable energy clusters and model housing complexes; distribution projects carried out in collaboration with local governments; projects supporting the distribution of commercialized new and renewable energy facilities; and others deemed necessary.
9. Art. 28 provides that the Minister of MTIE may provide the support necessary for promoting the commercialization of technology developed independently or through the subsidization of project funds, such as development projects for new and renewable energy technology; and education and publicity on the developed new and renewable energy technology.
10. Art. 29 provides that the Government shall devise financial or taxation support for necessary supporting measures.

In sum, the Act of NRE enables the Government to take any measures for financing, distribution, and supply of renewable energy sources in a very broad and comprehensive sense.

B. Governmental Commitments For Korean Renewable Energy Developments

1. The Renewable Energy Governing Policy: 4th Basic Plan of NRE (2014) provides for a consumer-friendly system by requiring consumer participation in renewable energy projects by inviting local resident participation in a community where a new and renewable energy plant is planned to be built and consumer protection by evaluating after-service satisfaction of the NRE businesses, and providing the consumers with new information and statistics about the renewable energy companies.

2. The Act provides for a market-friendly system by taking the following steps:

   a. Re-evaluating a yearly assigned target of RPS (renewable portfolio standard) to modify the market conditions, and consolidating the solar & non-solar markets to provide more choices among NRE sources;

   b. Providing flexibility to the performance period of RPS with lengthening the special circumstance exception deadline. Currently, a portion of assigned RPS performance may be delayed by 1 year, which grace period may be expanded to 3 years, with an incentive for early performance;

   c. Varying the weighted values of RECs (renewable energy certificates) depending on the scales and types of energy generation;

   d. Providing optional variable weighted values for off shore wind power, tidal, and geothermal generation where initial investment costs are high, such as preemptive weighted value to induce new industry investments;

   e. Activating a fair RECs trading market between businesses and suppliers, and increasing the frequency of REC spot market to twice a month;

   f. Expanding the purchase quantity from solar energy suppliers to enable them to make 12 year-long term supply contracts with electricity companies, and pre-allocating a certain quantity for small-scale solar businesses (less than 100Kw);[1089]

   g. Changing the NRE investment style to support large comprehensiveprojects;

   h. Providing post-incentive support, like the Utility Rebate Program of the US, for individual solar and wind power generators, in proportion to the energy generation quantity achieved from initial funding support;

   i. Enhancing flexibility in the selection of support and funding candidates, considering the renewable energy markets, such as favouring new technology and new solar facility financing; and

   j. Raising the mandatory requirement of NRE in public buildings, previously 20%, by 2020 to 30%, with proportional increases every year.

3. Development of Foreign NRE Markets By:

   a. Expanding the financing category for NRE businesses to medium-small businesses abroad, and providing preferential trade insurance for NRE export companies;

   b. Updating information database about international NRE buyers, auction information, and foreign countries' projects status, on the governmental website portal, 'New and Renewable Energy Korea', and providing foreign market analysis and quarterly reports;

   c. Providing field expert support from NRE export advisor groups for all export companies;

1089 The standard for small scale solar business was 100MW for 2012~2013, and 150MW for 2014~2015, and is supposed to be increased to 200MW for 2016~2017, and 250MW for 2018~2019.

d. Developing foreign markets for NRE businesses through all available international cooperation channels. For example, a renewable energy resources cooperation committee is under negotiation for formation with 24 other countries, and may be a good channel to develop NRE foreign markets;

e. Developing a country-specific strategy to export NRE technology, considering each country's policy, natural resources, and development stage, aiming at middle east, Africa, Southeast Asia, EU, Japan, USA, etc.; and

f. Expanding renewable energy resources to the North Korean region, however depending on political cooperation on the south-north Korean relationships.

4. Development of domestic NRE markets by:

   a. Inducing active investments for new renewable energy generation sources, such as geothermal, tidal, and solar-heat, currently in the development and experimental stages;

   b. Donating a generous amount of solar rental or renewable energy for a public welfare facility, as an RPS mandatory performance;

   c. Increasing the REC weighted value for installation of specified wind energy generators, possibly expanding it for other renewable energy sources later; and

   d. Recognizing cogeneration features of energy generation, like reuse of hot water drained from a coal power plant, or energy cost savings by constructing an agricultural and stockbreeding facility, like a glass greenhouse or animal barn, near a coal power plant, qualifying as satisfying RPS requirements.

5. Introduction of RFS (renewable fuel standards) by starting mandatory requirements to mix motor gas with a certain amount of renewable energy fuel from July 2015; providing a roadmap for biodiesel mixing requirements; and Issuing a certificate for an extra amount of renewable energy fuel used in RFS performance.

6. Introduction of Renewable Heat Obligations (RHO) system by requiring buildings to have a certain ratio of heat from renewable energy, especially for new large buildings;

7. Introduction of a consolidated renewable energy requirement system in the mid term, by consolidating REC trading markets for electricity, heat & transportation, in order to enhance flexibility for a renewable energy performance obligator and expand the REC trading market.[1090]

8. Investment for NRE research and development (R&D):

   a. Short-Term Goals:

   - Intensive investment to develop technologies for cost reduction, commercialization, or policy-related practical methods;
   - Support for commercialization to resolve barriers to new technology use, enhance business profitability, and assist technology development;

1090 For example, if electricity company A is an RPS obligator, under this system, A may use the heat provider certificate to provide heat in constructing a waste disposal power plant that is a heat-combining facility, as its RPS performance.

- For superior R&D technology, comprehensive support for financing and distribution for its commercialization and utilization, especially financing available for commercialization at low interest after2014;
- Export support of NRE technology from the testing stage prior to commercialization, such as:
- R&D support to develop country-specific export strategy;
- Expansion of R&D support for exporting BIPV (Building-integrated photovoltaics), large scale wind power, or IGCC (integrated gasification combined cycle power plants); and
- Establishment of a virtuous cycle between R&D and distribution.

b. Mid- and Long-term Goals:

- Investment for future technologies capable of commercialization within 10 years;
- Intensive investment in core technologies of solar, fuel cells, bio fuels, and jumbo scale off shore wind technology; and
- R&D support for consolidating and converging technology

9. Expert training to increase employment:
   - Expanding a system for licensing renewable energy experts to increase employment. In 2013, solar generation technician license examinations were instituted and 67 licenses were issued; and
   - Creation of a standard and certification academy for NRE, mainly for small- and mid- scale businesses.
10. Establishment of a regulatory support system:
    - For internationalization of NRE industry standards (Korean Standard, KS), 55 kinds of international standards (IES/ISO) need to be domesticated. Currently, the compliance ratio of KS renewable energy standards to the international standards is only 66%;
    - KS certification needs to incorporate the international renewable energy system certification, starting from designating a certification organization;
    - For export support, the domestic certification needs to be expanded through bilateral mutual recognition for renewable energy systems with counterpart countries. Currently, the Korea Energy Agency (KEA) has obtained qualification agency status as an international certification organization only for solar; and
    - The government built a1st stage of test-bed for newly developed renewable energy technologies for mid- and small- businesses in solar, wind, and fuel cells, so that renewable energy product reliability experiments can be conducted by 2014. From 2016, the government plans to build a 2nd–phase industry-academic-research incorporated cluster based on the 1st test-bed, to support renewable energy-specializing businesses.

C. Challenges for Korean Renewable Energy Developments

1. International energy market changes

International energy markets have been highly fluctuating, especially in relation to the skyrocketing increase of energy demand all over the world, especially for the developing countries like China and India, resulting in scarcity and increased costs of materials; development of non-traditional energy sources like shale gas and; changes in nuclear policy after the nuclear power plant melt down in Fukushima, Japan.

2. Domestic challenges

With these international conditions significantly affecting the Korean energy markets and policies, Korea has its own difficulties in the energy market.

First, the Korean government has maintained electricity at low level prices compared with other countries.[1091] So, the electricity demand for industry and for individuals' heating-cooling has increased rapidly.

Second, since the Fukushima nuclear power plant melt down accident in 2011, the safety of nuclear plants has been a critical issue. With increased criticism of existing nuclear plant safety, the 6th Basic Plan for Power Supply suspended a decision to build a new nuclear power plant.

Third, the conflicts around energy policies has deepened. Generally, when a plan to build a new nuclear power plant is made, the transmission networks should be expanded to connect the new power plant. However, for the past decades, the transmission networks around metropolitan areas reached their maximum capacity, and so the incongruence between power plant locations and power consuming locations has become seriously unbalanced. The power authorities tried to build super-high power transmission lines, but local residents whose residential areas are affected by the power transmission lines, fiercely protested. Now, the central concentrated power systems have reached their limit.

Fourth, the nuclear power plant policies and treatment of nuclear fuel wastes have been very controversial. In this respect, the government's unilateral decision-making and execution style seems to have lost its effectiveness and reached its limit.

Fifth, in 2008, the first National Energy Basic Plan set a target to increase the share of NRE sources in TPES, 2.4% at 6% in 2020 and 11% in 2030. This Plan has been executed through the four Basic Plans of NRE, and is still in progress. Also, the cap & trade system for carbon emission rights has been in effect since 2015. However, the utilization of NRE sources have not made significant progress, and in contrast, recently, the operation of coal power plants has increased due to the controversy around old nuclear power plants. Also, on the demand side, the production of energy-

1091 The Korean government has applied a couple of different tariff systems for growth and protection of industry sufficiently enough to lower its price for residential use, and the electricity for agricultural use is much lower than industrial use. Since 55% of electricity generated in Korea is used by industry, the imbalance in the electricity price for industry seems to take away the incentive to save the electricity. http://www.iea.org/publications/freepublications/publication/KeyWorld_Statistics_2015.pdf.

intensive industries such as steel and oil refining has been increased. Thus, the policy conditions to reduce GHG emission have deteriorated.

3. Other Korean domestic problems with the transition to renewable resources include:

a. *Inefficient allocation of energy resources*

To spur economic development, the Korean government has maintained the energy prices low. So, an excessive energy consumption structure has resulted and worsened, especially for electricity. This electricity-centred energy consumption structure has generated several serious problems:

First, electricity losses are 63% during both production and supply, and in both generation and transmission; so the more electricity is consumed, the larger is the energy imbalance.

Second, excessive electricity demand may directly cause unstable demand-supply imbalance due to insufficiency of electricity facilities;

Third, the expansion of electricity generation facilities has caused environmental pollution, saturation of transmission networks, and local residents' protests; and

Fourth, the low electricity prices have become a main obstacle to generating new markets for NRE and smart-grids.

b. *Limits of quantity-centred growth and supply-oriented policies*

To meet the increased power demand, the government has expanded the central supply system around large facilities in some highly populated cities. As a result, the power supply system had to be scaled up especially for Seoul-metropolitan area, and so the demand-supply imbalance of the metropolitan capital area has seriously worsened, thereby causing some problems for electricity production, transmission and control.

Also, nuclear power policies have prioritized rapid energy independence. In emphasizing such rapid growth, a lot of criticism has been raised about lack of transparency, safety investment, and safety systems of the nuclear power industry.

c. *Goal-oriented energy policy*

To meet a goal of sustainable growth, the government decided not to build new power plants, but to positively control energy demand, but it has not been very effective.

D. Legal Assessment and Suggestions for Korean Renewable Energy Development

The Korean energy policy has been focused on enabling economic development and growth.

Now, Korea seems to be at crossroad. On one hand, it wants energy to produce enough electricity to maintain economic growth. On the other hand, it wants to keep its commitment to reduce GHG emissions by 37% of the business as usual level by 2035 submitted to UNFCCC for the Paris international climate change treaty.

Korea needs to institute production of a significant level of renewable energy to meet these objectives. Korea has few natural resources, and the ever-changing international energy market conditions are constantly challenging, so renewable energy is attractive.

This crossroad reality seems to appear as contradicting laws and policies. According to the Korea Energy Economics Institute (KEEI), a government-run think tank, in 2016, the South Korean coal demand will rise 6.3 percent to more than 140 million tonnes, and 9 new coal plants with a combined capacity of 7.7 gigawatts will come into operation, and by 2022, 19 new coal-fired power plants will be built.[1092] Immediate energy demand to sustain Korea's economy seems to take priority at least today.

On the other hand, the Korean government has begun to enact renewable energy-related laws. As one recent example, the Green Building Development Support Act (GBDSA)[1093] was enacted to enforce the green building requirement in the Framework Act on Low Carbon and Green Growth Act (FALCGG). Among other things, the GBDSA requires new buildings above a certain size to submit energy conservation plans; and public authorities to submit building energy efficiency plans including a plan to reduce GHG emissions, aiming toward zero energy buildings. Thus, the GBDSA seems to be a cornerstone to lead in energy saving and control systems for the buildings.

Thus, the road ahead is still covered with doubt and uncertainty, but Korea will meet the deadline eventually, as it has done before.

Last but not least, one governmental policy for promotion of renewable energy development seems to need reconsideration. Governmental subsidies have been a key factor to steer renewable energy development. As the main renewable energy development strategy since 2012, the Korean government has utilized a RPS (renewable portfolio standard) to replace FIT (feed-in-tariff). However, many problems and controversies have been raised relating to this change. So, now, some modifications need to be made to this main NRE support system, in consideration of RPS and FIT.

Before 2012, under the FIT system, small scale solar generators had been increased a lot, leading to a boom in the renewable energy industry. However, in 2012, the government phased out the FIT and adopted the RPS system and trading of RECs. The performance of RPS had been somewhat successful, but many small investors in renewable energy, especially solar resources, who got financial support under FIT, are now experiencing serious problems. In phasing out the FIT system.

1092 Reuters, http://www.reuters.com/article/southkorea-coal-demand-idUSL3N16B2JG.

1093 Ministry of Legislature, Green Building Development Support Act, Law No. 13790, scheduled to be effective on Jan. 20, 2017 (Korean). The current version was revised on Jan. 19, 2016 and is scheduled to be in effect on Jan. 20, 2017.

The Government shut down the RPS system because it felt that the RPS had not achieved adequate results. However, the RPS system had not been successful enough because of several limitations:

- The price of RECs was hard to predict;
- General prohibition of resale of RECs was an obstacle for investment in renewable energy sources; and
- RPS mainly benefited large scale energy generators.

On the other hand, many small scale solar generators are at great risk of perishing under RPS because the average auction price for electricity at the national level rapidly dropped; the competition is very high, and the generated power sale route is not certain. Thus, experts propose to reintroduce FIT and improve RPS system. Under this change, FIT may be available for varied sources and levels. For example, as micro-FIT, small scale generators including individual solar homes may get financial support, thereby inducing more investments in renewable energy sources.[1094]

Second, the RPS system has been much criticized for not being successful enough. The current RPS system should be improved to modify its shortcomings and correct malfunctions of the REC market. To survive the market function of RPS, governmental intervention and regulation should be minimized, only to the extent of preventing market failure. Also, the regulations should be revised to lessen the burden of RPS on the generators.

Third, the FIT and RPS have different purposes: FIT aims to promote the scale of renewable energy industry, but RPS aims to achieve a certain target in the proportion of non-fossil fuel usage. These two systems work totally differently, and one should complement the other. By the combination of RPS and FIT, Korea may achieve two goals of growing renewable energy industry and reducing the GHG emission level.

Now, the world is starting to share all the information and know-how of energy transition through real time internet. As a method to counter climate change and a means to secure sustainable growth, renewable energy seems to be the best resource, maybe the only recourse for Korea as well as most countries in the world. Therefore, with one shot of sustainable renewable energy, it is great for Korea to catch two birds of replacing the fossil fuel enough to reduce the GHG emission level promised to UNFCCC, and securing its energy security and independence. Through relentless efforts, Korea of 2035 will have a much better blueprint in terms of energy and environment.

1094 Choi, Jong-Jae; Hwang, Chan-Gyu; and Moon, Chae-Joo, Development of Evaluation Model for the Korean New and Renewable Energy Policies: Focusing on FIT and RPS, Journal of Korea Institute of Electronic Communication Science, Vol. 8, No. 9, pp. 1333-1342, 1335-1336, Aug. 9, 2013, http://ocean.kisti.re.kr/downfile/volume/kelects/KCTSAD/2013/v8n9/KCTSAD_2013_v8n9_1333.pdf.

III. CONCLUSION

Energy efficiency and renewable energy hold great promise for a more secure, safer, cleaner and more economic future for the world. For developing countries, they present the opportunity for leap-frogging over traditional energy resources and avoiding the myriad of environmental problems that accompany them. Some of the renewable technologies, however, are not yet cost-competitive. And there still are many barriers of technology transfer, financing, pricing, infrastructure and education and training to be dealt with before these clean resources become universal. Nevertheless, they are the fastest growing of the energy media.

This Guide has sought to demonstrate legislative solutions that have been adopted around the world that have had success in overcoming many of these barriers. The legal draftsmen and policy makers as they promote efficiency and renewable technologies and seek to assure the protection of the environment they can hopefully be assisted in developing better laws and regulatory mechanisms for enhancing sustainable development by these examples.

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