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Richard L. Ottinger
Pace University School of Law, rottinger@law.pace.edu

John Bowie
Pace Energy and Climate Center, jbowie2@law.pace.edu

ARTICLE

Innovative Financing for Renewable Energy

RICHARD L. OTTINGER AND JOHN BOWIE*

The following paper was written for the 2014 International Union for the Conservation of Nature Academy of Environmental Law Colloquium in Tarragona, Spain. The paper was presented at the Colloquium, and an abridged version of the paper is being published in *Energy, Governance and Sustainability: Contributions to 2014 Colloquium of the Academy of Environmental Law of the International Conservation of Nature Union*.** The following is the unabridged and updated version of the paper, which includes numerous additional examples and analyses.

I. INTRODUCTION

This paper discusses successful innovative methods for financing the high initial equipment costs of many renewable energy resources, with case studies of their application. Financial instruments for renewable energy installations are frequently dependent on physical and economic infrastructure. In response to this fundamental interconnectedness between infrastructure, economy, and financial instruments, this paper follows a rough structure of financing methods used in:

* Richard Ottinger is Dean Emeritus of Pace Law School and Chair, Energy Law and Climate Change Specialty Group of the IUCN World Commission on Environmental Law. John Bowie is an Energy and Climate Law Advisor at the Pace Energy and Climate Center.

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- Areas unserved by an electricity grid;
- Areas of modest means served by limited transmission interconnections; and
- Areas with developed regional or national grid connectedness.

Renewables have many benefits, but they also face challenges as they enter the existing market of entrenched and highly subsidized fossil fuels. Challenges take many forms but generally include: technical issues with balancing demand and electric system load; unpredictable or politically driven swings in tax structures; and resistance from existing corporate interests. This paper examines how innovative public and private financing can mitigate these issues and carry the industry forward.

A. Why Conventional Finance Is Not Enough: Difficulties with Traditional Financing

Traditional models of financing pose difficulties for investment in renewable energy. First, many sensible renewable energy installations are of a scale that will not attract interest from traditional financial institutions, as transaction costs would be too great.[1] Small-scale energy infrastructure can have a great impact on an individual farm or business, particularly in an underdeveloped or developing area, but the reality of limited return on investment, and conventional banking transaction costs can preclude projects from consideration.[2] Also, renewables with high upfront costs generally must be financed over the life of the asset with strong profit returns delayed until the out years, discouraging private investment.[3] Lack of long-term performance information hinders accurate valuation of the return on investment for many renewable energy assets.[4]

1. *See* UNITED NATIONS DEPT. OF ECONOMIC & SOCIAL AFFAIRS, EXPERT GROUP ON RENEWABLE ENERGY, INCREASING GLOBAL RENEWABLE ENERGY MARKET SHARE: RECENT TRENDS AND PERSPECTIVES 9 (DEC. 12, 2005).
2. *Id.* at 37.
3. *Id.* at 35-36.
4. U.N. ENV'T PROGRAMME, FIN. INITIATIVE, FINANCING RENEWABLE ENERGY IN DEVELOPING COUNTRIES 27 (2012) [hereinafter UNITED NATIONS FIN.

Second, traditional financial instruments are essentially investments for profit. Under typical circumstances, borrowers must pay back the loan with interest. In the setting of a private loan, this cost—the sum of interest rate, transaction costs and margin money—is determined by the risk associated with the investment.[5]

Many regions where renewables could answer an unmet energy need are also areas with high risk attached to financial investment.[6] Underserved areas with fragile economic viability, political instability, and/or underdeveloped energy and financial infrastructures struggle to secure financing within the traditional banking system.[7] Also, the risks are often exaggerated because of lack of familiarity by the financial institutions with renewable energy technology and economics.[8] The results of these considerations often mean that conventional financing is unavailable or that those with greatest need for investment may also pay the highest financing costs.[9] Innovative financing methods can help change these, thereby expanding access.

Third, traditional financial institutions such as banks rely on credit ratings and billing infrastructures to recovery periodic payments on a loan.[10] In many areas suitable for renewable development, there is not a reliable economic infrastructure in

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INITIATIVE]; *see also* Trefis Team, FORBES, *Understanding Solar Yieldcos* (June 17, 2014, 8:39AM) *available at* http://www.forbes.com/sites/greatspeculations/2014/06/17/understanding-solar-yieldcos/, *archived at* http://perma.cc/6YT5-26ZY.

5. *See generally* HANDBOOK OF KEY GLOBAL FINANCIAL MARKETS, INSTITUTIONS AND INFRASTRUCTURE (Gerard Caprio & Doublas W. Arner, eds., 2012) [hereinafter HANDBOOK].

6. *See* U.N. ENV'T PROGRAMME, SCOPING STUDY ON FINANCIAL RISK MANAGEMENT INSTRUMENTS FOR RENEWABLE ENERGY PROJECTS 56-60 (2005), *available at* http://www.globalclearinghouse.org/infradev/assets%5C10/documents/UNEP%20-%20Scoping%20Study%20on%20Financial%20Risk%20Management%20Instruments%20for%20Renewable%20Energy%20Projects%20%20(n%20a).pdf.

7. *Id.*

8. R. MARGOLIS & J. ZUBOY, NONTECHNICAL BARRIERS TO SOLAR ENERGY USE: REVIEW OF RECENT LITERATURE 6, REPORT NO. NREL/TP-520-40116 (Nat'l Renewable Energy Lab., Sept. 2006) ("Lack of information dissemination and consumer awareness about energy and energy efficiency/renewable energy.").

9. *See* UNITED NATIONS FIN. INITIATIVE, *supra* note 4, at 42.

10. *See generally* HANDBOOK, *supra* note 5.

place for periodic payments.[11] Records may not exist to assess credit worthiness and risk.[12] Innovative financing mechanisms for renewable energy must contend with not only a lack of physical infrastructure, but also a potentially an underdeveloped economic, technical and political infrastructure.[13]

B. Landlord-Tenant and Transience Problems in Financing

Another issue confronting the financing of renewable energy investments is the difficulty of meeting the needs of landlords and tenants in leaseholds. Landlords have little incentive to incur a cost associated with an energy installation because they do not receive the direct benefit of resulting electricity cost savings (they do not pay the electricity bill), and tenants have little incentive to incur the long-term cost because they often are transient (creating an uncertain return on investment).[14]

Additionally, homeowners in the United States tend to be quite mobile.[15] A home owner is likely to be reluctant to invest in renewable energy equipment having a high initial cost if he or she intends to move or feels there is a high risk of his or her moving before the equipment's energy savings are realized.[16] The

11. *See* UNITED NATIONS FIN. INITIATIVE, *supra* note 4, at 42.

12. *See e.g.* Scott E. Hartley, *Bringing Africa Online: Leveraging Technology to Enable Entrepreneurs*, 4 YALE J. INT'L AFF.19 (2009).

13. *See generally* INT'L ENERGY AGENCY, MIND THE GAP: QUANTIFYING PRINCIPAL-AGENT PROBLEMS IN ENERGY EFFICIENCY (2007), *available at* http://www.iea.org/publications/freepublications/publication/mind_the_gap.pdf, *archived at* http://perma.cc/YY3M-XJUZ.

14. *Id.* at 25.

15. WORLD BANK, COUNTRY BENCHMARKS: INTERNAL MOBILITY: THE UNITED STATES 97 (2012), *available at* http://siteresources.worldbank.org/ECAEXT/Resources/258598-1284061150155/7383639-1323888814015/8319788-1324485944855/10_us.pdf, *archived at* http://perma.cc/ZG6U-7226.

16. U.S. DEP'T. OF ENERGY, ENERGY EFFICIENCY & RENEWABLE ENERGY, *Property-Assessed Clean Energy Programs*, http://energy.gov/eere/slsc/property-assessed-clean-energy-programs (last visited June, 20, 2014, 2:59PM), *archived at* http://perma.cc/3CQG-PWBP ("Many property owners are hesitant to make property improvements if they think they may not stay in the property long enough for the resulting savings to cover the upfront costs.").

owner is unlikely to recover the full costs of the renewable energy investment in the selling price of the property.[17]

Both these problems, leasing and the transience of home ownership, are major impediments to renewable energy investments and can be overcome with innovative financing measures such as utility or municipal financing of the up-front costs with payments provided through the utility bills or property taxes, relieving the lessor homeowner of the burdens of first cost financing and assuring the renewable energy financier of repayment. High capital cost, difficulty with conventional financial institutions, issues with transient home owners and lessees, assignment of cost and benefit between landlords and tenants, and issues with debt collection all present challenges to financing renewable energy installations. Several emerging innovative financing tools have proven able to address these problems and thus to increase market penetration of renewable energy. The following sections explore selected approaches to financing renewable energy infrastructure.

II. SELECTED INNOVATIVE APPROACHES TO RENEWABLE FINANCING

This section describes innovative mechanisms currently in use in financing renewable energy. Some of these projects are still small, near-incubation phase financial tools, while others are entrenched in some areas, but may not yet be common practice in financing renewable energy. The purpose in documenting the following projects is to chronicle and share methods that may be of benefit in new areas and markets. The general organization follows levels of infrastructure development, but this should not be construed as exclusive; financing mechanisms from less developed areas may be applicable to more developed regions, although the converse does not seem to be true.

17. *See* BEN HOEN ET AL., AN ANALYSIS OF THE EFFECTS OF RESIDENTIAL PHOTOVOLTAIC ENERGY SYSTEMS ON HOME SALES PRICES IN CALIFORNIA 1 (2011), *available at* http://emp.lbl.gov/sites/all/files/lbnl-4476e.pdf, *archived at* http://perma.cc/JN39-HVUX.

A. Programs Suitable to Areas with No Electricity Access

Areas with no electricity access have a unique opportunity for renewable energy deployment. Renewable resources, such as solar, wind, biogas, biomass, or micro hydroelectric resources are often plentiful in developing regions, while more carbon intensive traditional fuels may be unavailable or prohibitively expensive, especially if extension of an electrical grid is required for their utilization. Even the often relatively expensive first costs of solar energy equipment and installation will frequently be cheaper than use of conventional fuels in underdeveloped rural areas.[18]

Several energy companies and innovative financial institutions have recognized this mismatch of need with the shortcomings of traditional finance with new technological opportunities. The following financing tools have helped to expand renewable energy production, and economic opportunity in underdeveloped off-grid markets.

B. Microfinance

Microfinance systems provide alternative loans to individuals and small businesses lacking access to traditional banking and financial services.[19] 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.[20] Different microfinance providers have emerged,

18. Uwe Deichmann et al., *The Economics of Renewable Energy Expansion in Rural Sub-Saharan Africa* 23 (Policy Research Working Paper WPS 5193, Jan. 2011).

19. *What is Microfinance?*, CONSULTATIVE GRP. TO ASSIST THE POOR, http://www.cgap.org/about/faq/what-microfinance (last visited June 15, 2014), *archived at* http://perma.cc/HW8H-K9YB.

20. *See generally* WISIONS OF SUSTAINABILITY, MICROFINANCE AND RENEWABLE ENERGY: INVESTING IN A SUSTAINABLE FUTURE (I. Issue 2006), *available at* http://www.gdrc.org/icm/environ/mf-renewablenergy.pdf, *archived at* http://perma.cc/6VLJ-P5FC. 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, *archived at* http://perma.cc/A6EZ-FMUB.

including non-governmental organizations (NGOs), cooperatives, government agencies and community-based development groups.[21] 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.

1. Microfinance Case Study: Grameen Shakti

Grameen Bank, a Bangladeshi bank focused on lending to poor, presents one of the most established and successful examples of microfinance.[22] Grameen Bank created a family of micro-investment programs to finance economic activities for poor communities in a variety of sectors, including Grameen Shakti, a program devoted to financing rural renewable energy.[23]

Established in 1983, by visionary economist Muhammad Yunus, Grameen Bank now provides over 2.5 billion dollars of microloans to rural Bangladeshi families.[24] The bank is considered a pioneer in microfinance. Grameen Bank and the suite of investment programs surrounding it change traditional finance models not only by dealing in micro-loans, but also by incorporating a set of social and environmental principles into the financial institution.[25] Thus, the Grameen Bank's *modus*

21. *See generally* HANDBOOK, *supra* note 5. Other entities such as credit unions, commercial and state banks, insurance and credit card companies, telecommunications and wire services, post offices, and other points of sale, have emerged as viable candidates to provide microfinance services.

22. *Introduction*, GRAMEEN BANK, http://www.grameen.com/index.php?option=com_content&task=view&id=16&Itemid=112 (last visted June 15, 2014), *archived at* http://perma.cc/C5WV-KMNJ [hereinafter GRAMEEN BANK: Introduction].

23. *A Short History of Grameen Bank*, GRAMEEN BANK, *available at* http://grameen-info.org/index.php?option=com_content&task=view&id=19&Itemid=114 (last visited June 2, 2015), *archived at* http://perma.cc/NQ9T-MV3D.

24. *Id.*

25. *Id.* Grameen Bank was founded on the following objectives:

> extend banking facilities to poor men and women; eliminate the exploitation of the poor by money lenders; create opportunities for self-employment for the vast multitude of unemployed people in rural Bangladesh; bring the disadvantaged, mostly, the women from the poorest households, with an organizational format which they can understand and manage by themselves; and reverse the age-old vicious circle of "low income, low saving & low investment", into

operandi is to lend seed money to groups of people, mostly women, to start small economic enterprises under expert guidance and under strict conditions for quality control and repayment.[26] The bank receives an average of about 97% repayment of these community loans, largely as a result of peer pressure from the financed groups.[27] The Grameen Bank has won several awards, including the 2006 Nobel Prize.[28] As of October 2011, Grameen Bank had 8.349 million borrowers, 97% of whom are women.[29] The bank's services cover 97% of the total villages in Bangladesh.[30]

Building on success in other areas, Grameen Bank launched Grameen Shakti,[31] a Bangladeshi market-based company created to focus on microfinance for renewable energy. Grameen Shakti is a rural-based renewable energy company, founded as a biogas program in 2005 that rapidly grew to include an Improved Cooking Stoves Program in 2006, and later a Solar Home Systems (SHS) program.[32] By December 2012, Grameen Shakti had installed more than 1 million SHSs in rural areas of Bangladesh.[33]

The company uses several options for microfinancing solar energy projects. Under each option, homeowners must pay a down payment (15 – 25%), and then pay off the balance in modest

> virtuous circle of low income, injection of credit, investment, more income, more savings, more investment, more income.

Id.

26. GRAMEEN BANK: Introduction, *supra* note 22.

27. Grameen Bank reported a 97.28% recovery rate in its May 2014 monthly update. *2014-04 Issue 412 BDT,* GRAMEEN BANK (May 06, 2014) *available at* http://www.grameen.com/index.php?option=com_content&task=view&id=1285&Itemid=84, *archived at* http://perma.cc/AL86-485K.

28. *The Nobel Peace Prize 2006*, NOBELPRIZE.ORG, (last visited June 15, 2006) http://www.nobelprize.org/nobel_prizes/peace/laureates/2006/, *archived at* http://perma.cc/28AM-C93T.

29. GRAMEEN BANK: Introduction, *supra* note 22.

30. *Id.*

31. GRAMEEN SHAKTI, http://www.gshakti.org/ (last visited June 25, 2014), *archived at* http://perma.cc/U86Q-DAQW.

32. *Grameen Shakti Evolving as a Social Business to Meet the Energy Needs of the Rural People*, GSHAKTI.ORG (last visited June 15, 2014), *available at* http://www.gshakti.org/index.php?option=com_content&view=article&id=57&Itemid=77, *archived at* http://perma.cc/G7RH-TM6V.

33. *Id.*

monthly payments over a period of two to three years.[34] Micro-utility customers must pay 10% of the total price as down payment[35] with the remaining price to be repaid in 42 payments without any service charge.[36]

Through microfinance, Grameen Bank was able to effectively fund several types of developments, including a robust biogas and home solar system.[37] While Grameen is the paragon micro-lender, several other providers now offer microfinance to different settings with similar success. Grameen Shakti demonstrates the potential for micro-lending to transform and expand a rural renewable energy market.

2. International Bank Financing

The World Bank, Global Environmental Facility (GEF),[38] and the various other international and regional banks within the United Nations system, make loans for renewable energy projects, mostly in developing countries, and the United Nations Development Program (UNDP)[39] and United Nations Environment Program (UNEP)[40] provide funding and technical assistance for them. Such grants play a large role in initiating renewable energy programs and they catalyze and expedite the renewable energy market investment. These loans are not considered at length here because they are already well known and established.

34. *Financial Solar Home Systems,* GSHAKTI.ORG, http://www.gshakti.org/index.php?option=com_content&view=article&id=66&Itemid=62 (last visited June 15, 2014), *archived at* http://perma.cc/V3H7-VSKB.

35. *Id.*

36. *Id.*

37. *See* PLANÈTE D'ENTREPRENEURS, GRAMEEN SHAKTI: A COMPREHENSIVE APPROACH OF RURAL ENERGY IN BANGLADESH: PLANÈTE D'ENTREPRENEURS MEETS GRAMEEN SHAKTI IN DHAKA, *available at* http://www.planetedentrepreneurs.com/wp-content/uploads/entrepreneurs/Bangladesh/Grameen%20Shakti/Grameen%20Shakti.pdf.

38. *See* GLOBAL ENV'T. FACILITY, http://www.thegef.org/gef/ (last visited June 16, 2014), *archived at* http://perma.cc/RK9Z-XEPD.

39. *See* UNITED NATIONS DEV. PROGRAMME, http://www.undp.org/content/undp/en/home.html (last visited June 16, 2014), *archived at* http://perma.cc/PR7E-LS94.

40. *See* UNITED NATIONS ENV'T. PROGRAMME, http://www.unep.org/ (last visited June 16, 2014), *archived at* http://perma.cc/N4SH-QQ9R.

3. Margin Money Finance

The traditional loan structure typically includes a down payment requirement,[41] also known as margin money. Frequently, a borrower seeking a loan for a renewable energy system would have the means to cover the term payments, but often would lack the ability to cover the margin money payment. Margin money finance support generally comes from government sources because private financial institutions typically will not take the risks of default involved. Subsidized relief for margin money financing has proven successful in several cases.[42]

The Indian government launched a successful margin money finance program.[43] This public program demonstrates the viability of margin money financing as a method to encourage investment in renewable energy. In this particular instance, the small government investment of margin money financing allowed rural and urban business owners without access to electricity to install reliable renewable power generation. In effect, margin money financing bootstraps investment, as new owners use the benefit of their first installation to purchase additional units under their own financing.

4. Case study: SELCO Margin Money Finance, Chitradurga, India

The village of Doddaullarthi has a small handloom weaver community.[44] Silk weaving requires meticulous attention and concentration.[45] Bright light is essential to this concentration and detail, making the weaver's work and economic livelihood

41. *See* CHRIS GROOBEY ET AL., WILSON SONSINI GOODRICH & ROSATI, PROJECT FINANCE PRIMER FOR RENEWABLE ENERGY AND CLEAN TECH PROJECTS (2010), *available at* http://www.wsgr.com/PDFSearch/ctp_guide.pdf, *archived at* http://perma.cc/M35C-SWKG.

42. *Id.* at 2.

43. *Village Industries*, JAMMU & KASHMIR KHADI & VILLAGE INDUSTRIES BOARD, *available at* http://jkkvib.nic.in/village_industries.html, *archived at* http://perma.cc/2SM2-MYEP.

44. SELCO, ACCESS TO SUSTAINABLE ENERGY SERVICES VIA INNOVATIVE FINANCING: 7 CASE STUDIES 8 (2008), *available at* http://www.selco-india.com/pdfs/selco_booklet_web.pdf [hereinafter SELCO: 7 CASE STUDIES].

45. *Id.*

dependent on a steady power supply.[46] The Solar Electric Light Company (SELCO), based in Bangalore, India, aimed to provide solar power as a solution to this necessity. SELCO is a commercial entity with social objectives, providing a variety of innovative finance and financial incubation services throughout India since 1995.[47] Specifically, SELCO launched a margin money program in conjunction with the Indian government to provide assistance financing for renewable energy installations in rural weaver communities.

SELCO operates in connection with a variety of financial institutions, including microfinance institutions, co-operatives, and Regional Rural Banks.[48] Regional Rural Banks are a specific type of financial institution created through an ordinance passed by the Indian government.[49] In its incubation handbook, SELCO states, "Regional Rural Banks (RRBs) are the best suited and most reliable financial linkage in remote regions."[50] SELCO has worked with many RRBs to provide financing for solar electric lighting.[51] These efforts promoted increased working hours and income to rural weavers.[52]

In addition to financing through RRBs, SELCO expanded its efforts with solar electric lighting through "Mission Projects."[53] These projects typically fall outside mainstream financing, and require first-time bridges to financial institutions. SELCO facilitates these bridges through several mechanisms including

46. *Id.*

47. SELCO INCUBATION CENTRE, FINANCING FOR OFF-GRID SOLAR HOME LIGHTING SYSTEMS (2013), *available at* http://www.selcoincubation.org/publications [hereinafter SELCO INCUBATION CENTRE].

48. *Finance*, SELCO, http://www.selco-india.com/finance.html (last visited June 2, 2015), *archived at* http://perma.cc/Q2WS-5XS5. *See Harish Hande Citation*, RAMON MAGSAYSAY AWARD FOUNDATION, http://www.rmaf.org.ph/newrmaf/main/awardees/awardee/profile/52 (last visited June 2, 2015), *archived at* http://perma.cc/X3X6-K4MG.

49. Regional Rural Banks Act, No. 21 of 1976, INDIA CODE (1993).

50. SELCO INCUBATION CENTRE, *supra* note 47, at 8.

51. *Id.*

52. *Id.*

53. *Position: Mission Projects Coordinator*, SELCO (last visited Mar. 12, 2015), http://www.selco-india.com/mission_projects.html, *archived at* http://perma.cc/UTT9-9J5G.

Risk Guarantees, Margin Money Financing, Interest Subsidy and Partial Contributions.[54]

Under SELCO's margin money Mission Financing program,[55] the margin finance is bundled into the loan. The down payment often amounts to as much as 15% of the loan.[56] SELCO covers this contribution as a part of the loan, accelerating the economic growth achieved from solar energy installations. By amortizing initial costs, margin money financing matches repayment to the long-term income producing nature of renewable energy assets.

5. Business-in-a-box for micro-entrepreneurship

Some companies adopt a system approach to the problems of energy distribution and economic development, opting to provide a complete platform. The "business-in-a-box" is as much a sales and distribution model as a financial tool per se. The business-in-a-box is a tool for so-called "micro-entrepreneurs," circumventing traditional avenues of finance by providing business people with all the tools needed to set up a business. As the case study below shows, micro-entrepreneurs using business-in-a-box financing set up solar charging or solar light businesses and repay a central provider company over time.

6. Case study: ToughStuff

ToughStuff supplies durable solar powered lighting, radios, and mobile chargers.[57] ToughStuff couples these sales of durable renewable power with business-in-a-box services including up front financing of solar capital costs. Entrepreneurs purchase a packaged solar kit from ToughStuff, which they use to operate as

54. *See generally id*.

55. *Approach,* SELCO INCUBATION CENTRE, http://www.selcoincubation .org/approach, *archived at* http://perma.cc/895S-2ALT.

56. SELCO: 7 CASE STUDIES, *supra* note 44.

57. *Toughstuff*, ENERGY MAP, http://energymap-scu.org/toughstuff2/ (last visited June 15, 2014), [hereinafter Toughstuff], *archived at* http://perma.cc/CF75-P3Y8. The ToughStuff Solar kit includes an LED Lam and Solar Panel. *Id.* Customers may also purchase battery packs, mobile chargers and a radio connector to replace D-Cell batteries. *Id.*

their own business.[58] Due to the nature of this relationship, ToughStuff operations are often called micro-franchises.[59]

Many rural households rely on kerosene or oil lighting.[60] These kerosene or candle lighting are more expensive than solar, result in harmful fumes and create a risk of fire.[61] In addition, fuel-based lighting produces carbon dioxide, carbon monoxide, and harmful particulate pollution.[62] Renewables help to address these environmental issues associated with candles and kerosene lamps.[63] Off-grid communities using solar electricity benefit from reduced costs, local economic activity and safer, cleaner operations.

ToughStuff programs for mobile solar chargers also promote the local economy and an improved environment. Many off-grid communities leapfrog past wired telecommunications, building a wireless network before wired infrastructure.[64] Within this expanding wireless telecommunication infrastructure, many communities will have access to cellular service and the Internet before they have access to grid power supplies. Wireless cellular electric service is catalyzing economic growth in numerous rural communities, even absent grid electrification.[65]

Frequently, residents in off-grid communities used to travel great distances to charge their phones and spent several hours waiting for their phones to charge.[66] ToughStuff's solar chargers enable off-grid users to avoid this process, while further

58. *See generally id.*

59. *See id.*

60. *Id.*

61. *See* Peter Alston, et al., *High Life Cycle Efficacy Explains Fast Energy Payback for Improved Off-grid Lighting Systems*, J. INDUS. ECOLOGY 1, 2 (2014), *available at* http://evanmills.lbl.gov/pubs/pdf/Alstone-etal-2014-jie-c12117.pdf, *archived at* http://perma.cc/XUL2-TA3L.

62. *See id.*

63. *See generally id.* Candles and kerosene lamps provide little light; produce noxious fumes, and contribute 24.2 million tons of CO_2 per year. Toughstuff, *supra* note 57.

64. *See* MICHELLE W. L. FONG, TECHNOLOGY LEAPFROGGING FOR DEVELOPING COUNTRIES, ENCYCLOPEDIA OF INFORMATION SCIENCE AND TECHNOLOGY 3707, 3708 (2009).

65. *See id.*

66. *Id.* One resident operates a makeshift charging service. She travels 20 miles by bus to a gas station to charge her battery.

mitigating the need for traditional grid development. ToughStuff succeeds on both technological and business model grounds. In addition to the traditional wholesale-to-retail sale distribution model, ToughStuff builds "alternative" distribution networks through partnerships with NGOs and microfinance institutions, allowing use of solar energy kits to permit expansion into otherwise inaccessible markets.[67]

Many micro-entrepreneurs purchase their equipment using a microfinance loan.[68] These micro-entrepreneur deployments (the Business-in-a-Box) enable market expansion without government intervention, relying on a market mechanism for renewable development. Business-in-a-box micro-entrepreneurs also greatly expand the reach of the products into more remote areas.[69]

ToughStuff plans on expanding from "Business-in-a-Box" to "Company-in-a-Container."[70] The Company-in-a-Container will provide a larger scale of the solar kit franchises, increasing market penetration and speeding renewable energy capacity development. Advancing renewable energy market penetration will both build economic capacity and eliminate the need for fossil fuel power investment. Models such as ToughStuff illustrate how renewables can affordably address a myriad of public health, economic, and environmental problems.

C. Financing Intermediate, Community/Village Scale Projects

Intermediate scale renewable energy development permits consideration of more financing options than for rural non-grid installations. In terms of return on investment, larger scale provides larger markets and greater resources to devote to renewable energy development. The previously discussed small-scale one-off projects provide some opportunity for return on investment, but often fail to reach an economic scale that can

67. *Case study summary: ToughStuff International, UK and Africa*, ASHDEN AWARDS (Apr. 2011), *available at* http://www.ashden.org/files/ToughStuff%20winner.pdf, *archived at* http://perma.cc/QGT4-YSXD [hereinafter Toughstuff award].

68. *Id.*

69. *Id.*

70. Toughstuff, *supra* note 57.

attract larger investors. With larger scale installations, community projects with microgrids become feasible and advantageous.

1. Community Microgrid Projects

Community renewable energy projects at the village level with microgrid distribution tend to be anchored by larger community structures such as hospitals, military installations, schools, and village halls or community centers that can afford to provide important financial help for solar projects.[71] Frequently, such critical infrastructure receives at least some government support. The larger institution anchors help to support electricity for residential use.[72]

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-

71. *See generally* Daniel Schnitzer et al., *Microgrids for Rural Electrification,* UNITED NATIONS FOUND. 13 (Feb. 2014), *available at* https://wpweb2.tepper.cmu.edu/ceic/pdfs_other/Micro-grids_for_Rural_Electrification-A_critical_review_of_best_practices_based_on_seven_case_studies.pdf.

72. *See generally id.*

payment risks may even be less than in large grid communities due to peer pressures in intermediate village communities.[73]

Community scale electric generation usually requires investment in a distribution infrastructure.[74] 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 employees and a higher qualified staff. On the other hand, the scale and efficiency of such projects may result in lowering of costs.[75]

Microgrids[76] 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.[77] 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.[78] The following section will discuss physical improvements, billing strategies, and financial tools that

73. Rana Foroohar, *A Bank from Bangladesh Brings Microlending to U.S.*, NEWSWEEK (July 19, 2010), http://www.newsweek.com/bank-bangladesh-brings-microlending-us-74333, *archived at* http://perma.cc/3GPT-WXLU; *see* Kale Seagraves, *How Grameen Bank Uses Peer Pressure*, POVERTY NEWS BLOG (Aug. 06, 2010), http://povertynewsblog.blogspot.com/2010/08/how-grameen-bank-uses-peer-pressure.html, *archived at* http://perma.cc/U6H8-K5L4.

74. Daniel L. Bond, Daniel Platz & Magnus Magnusson, *Financing Small-Scale Infrastructure Investments In Developing Countries* 16 (United Nations, Dep't. of Econ. & Soc. Affairs, DESA Working Paper No. 114, 2012) *available at* http://www.un.org/esa/desa/papers/2012/wp114_2012.pdf, *archived at* http://perma.cc/X6FJ-LCSK.

75. *Id.*

76. U.S. DEP'T OF ENERGY, 2012 DOE MICROGRID WORKSHOP REPORT 1 (2012), *available at* http://energy.gov/sites/prod/files/2012%20Microgrid%20Workshop%20Report%2009102012.pdf, *archived at* http://perma.cc/8HB4-YAGH ("[A] group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid [and can] connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.").

77. *See Global Microgrid Market 2012-2016,* TECHNAVIO (July 26, 2013), http://www.technavio.com/report/global-microgrid-market-2012-2016, *archived at* http://perma.cc/Y2GS-AVGD ("TechNavio forecasts the Global Microgrid Market 2012-2016 with a CAGR of 25.7 percent for the period 2012-2016.").

78. *Id.*

can help to spur investment in intermediate scale renewable energy infrastructure.

2. Case Study: Husk Power Systems

Husk Power Systems (HPS),[79] an India based company, specializes in the design, installation and operation of biomass-based power plants.[80] Each HPS biomass plant uses gasification technology to convert agricultural waste from local farms into electricity, which is then distributed to rural households and micro-enterprises through a microgrid system.[81] Plants range from 25-kW to 100-kW and serve up to 4000 inhabitants on a pay-for-use basis.[82]

Frequently, this local source and distribution model provides a higher quality, cheaper way to meet the community need for energy.[83] HPS biomass systems embody the organic microgrid model by creating an "ecosystem" that provides income opportunities for local farmers and entrepreneurs.[84] Since 2008, HPS has successfully installed more than 80 plants in Bihar, providing electricity to over 200,000 people across 300 villages and hamlets."[85]

D. Distributed Finance – Internet Lending

The Internet is rapidly creating new avenues for fundraising and investment. Individual borrowers can now present their ideas

79. HUSK POWER SYS., http://www.huskpowersystems.com/ (last visited June 16, 2014), *archived at* http://perma.cc/Z839-2MEH [hereinafter HUSK: Main page].

80. *See generally id.*

81. *Business Model,* HUSK POWER SYS., http://www.huskpowersystems.com/innerpagedata.php?pageT=Business%20Model&page_id=77&pagesub_id=114 (last visited Mar. 11, 2015), *archived at* http://perma.cc/JA94-85C8.

82. *Id.*

83. HUSK: Main Page, *supra* note 79.

84. *Community Impact*, HUSK POWER SYS., http://www.huskpowersystems.com/innerPage.php?pageT=Community%20Impact&page_id=81, *archived at* http://perma.cc/C2X2-Q3BQ; *see also How Social Entrepreneurs Use Rice Husks to Fuel Micro Power Girds in India*, PBS NEWS HOUR (Jan. 17, 2013), http://www.pbs.org/newshour/bb/world-jan-june13-india_01-17/, *archived at* http://perma.cc/EDH8-XE66.

85. *Community Impact*, *supra* note 84.

directly to individual lenders, circumventing traditional financial institutions. Direct connections between lenders and borrows promotes 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 paradox presents an opportunity for financing renewable energy projects. Direct lending between investors and borrowers through the Internet, frequently called peer-to-peer lending (and related crowdfunding),[86] has potential to expand renewable energy in novel ways to developing settings.

E. 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.[87] 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.[88]

1. Peer-to-Peer Funding Case Study

Zidisha is a P2P lending website that connects lenders and borrowers directly across international borders.[89] Zidisha does not allow any third-party local organizations to post content for borrowers, or act as managers for individual loans. Instead of third-party local organizations, Zidisha staff manages operations

86. *Crowdfunding Definition*, MERRIAM-WEBSTER ONLINE, http://www.merriam-webster.com/dictionary/crowdfunding (last visited June 16, 2014), *archived at* http://perma.cc/GT77-73G2.

87. 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, *archived at* http://perma.cc/RE99-A9EE.

88. *See id.*

89. *See* ZIDISHA, https://www.zidisha.org/ (last visited June 16, 2014), *archived at* http://perma.cc/5H62-PBZS.

directly, including reviewing applications, loan disbursements, and repayments.[90] Using this methodology, Zidisha achieves an average interest and fee rate of 5%.[91] Zidisha's P2P model also implements an online social element allowing lenders to post questions to entrepreneurs, while entrepreneurs can post progress and reports.[92] A successful example of Zidisha's loan program applied to solar energy is W. Aldophe Kabre, from Koudougou, Burkina Faso. Kabre received a loan of $414 USD, at 4.21% interest.[93] Kabre used the loan to buy solar panels and a two-wheeled cart for water to intensify production on his poultry farm.[94] The possibility of online social lending opens a new individually motivated investor-class, who may support otherwise untended projects.

F. 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 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.[95] Under this model of crowd funding, as solar projects produce and sell electricity, investors are paid back with interest.

1. Crowd Funding Case Study – Mosaic

Mosaic, is a US based company[96] that uses Mosaic Notes as a written promise for money owed over a fixed term, and each

90. *See Frequently Asked Questions,* ZIDISHA, https://www.zidisha.org/faq (last visited June 16, 2014), *archived at* http://perma.cc/Q8B8-T7QT.

91. *Id.*

92. *Id.*

93. *W. Adolphe Kabra*, ZIDISHA, https://www.zidisha.org/loan/1600 (follow "Show Cost Breakdown"), *archived at* http://perma.cc/RA7L-U8ZZ.

94. *See id.*

95. *About Mosaic*, MOSAIC, https://joinmosaic.com/about-mosaic (last visited Apr. 22, 2014), *archived at* http://perma.cc/2YVY-L4EC.

96. MOSAIC, https://joinmosaic.com/ (last visited June 16, 2014), *archived at* http://perma.cc/X3G8-VEXG.

payment account is FDIC-insured.[97] Mosaic has successfully funded several solar projects of varying scales including different generation capacities, returns on investments, yields, and terms.[98] Mosaic projects range from just a few kilowatts to well over a megawatt.[99] Most present Mosaic investments, however, are currently limited to California. Guaranteed returns are created through the use of power purchase agreements.[100] Limitations on power purchase agreements with utility scale providers, access to the Internet, and issues with federal deposit insurance may limit systems like Mosaic to developed economies and infrastructure.

G. Billing at the Village Scale

In addition to challenges of formulating village scale projects, investors must also contend with complications of loan disbursement and bill collection.[101] Fortunately, advances in wireless communications, cloud accounting software, and the efforts of a variety of Internet startup companies are simplifying and securing the billing process. In particular, remote internet-hosted services ("cloud") and wireless solutions are making micro- and community scale billing much simpler, providing small to mid-scale investors with a more certain return on investment.[102] Cloud solutions connect home Internet servers with other Internet servers programmed to perform specific services,

97. *Long-term Investment*, MOSAIC, https://joinmosaic.com/long-term-investments/ (last visited Feb. 5, 2015), *archived at* http://perma.cc/KX6L-WEYB.

98. *See Mosaic Places*, MOSAIC, https://joinmosaic.com/solar (last visited June 2, 2015), *archived at* https://perma.cc/WS39-KU78.

99. *Id.*

100. Power purchase agreements are essentially long-term contracts for the purchase of electricity from a particular source. Investors prefer PPAs due to the security of long-term return on investment. For a more detailed analysis, see discussion *infra* Part II.L., *Existing Utility Programs*.

101. UNITED NATIONS FIN. INITIATIVE, *supra* note 4, at 42.

102. *See generally Final Version of NIST Cloud Computing Definition Published,* NAT'L INST. OF STANDARDS & TECH. (Oct. 25, 2011), http://www.profsandhu.com/cs6393_s13/nist-SP800-145.pdf, *archived at* http://perma.cc/W3RR-X77S.

including billing services.[103] Cloud solutions enable companies to rely on remotely located servers to host software services, enabling a more complicated, secure, and technological solution at lower cost.

Village-scale power providers particularly can benefit from these services. Cloud billing enables a greater variety of pricing options. Moreover, cloud billing and cloud meters can help energy service providers address power theft, a rampant problem that can undercut the energy providers' return on investment.[104] Cloud billing and smart meters can tailor billing to suit the needs of energy customers.[105] The result is a more secure and effective economic financing for renewable energy projects.

1. Prepaid Meters

Many rural, or otherwise grid-underserved areas, face challenges with bill collection, power theft, tampering with meters, or unauthorized splitting of electricity feed lines allowing electricity to be diverted to a non-paying resident. These problems impede efforts to balance load and demand, resulting in brownouts, and create challenges to recouping investments. Customers may not have meters, and may instead be forced to pay onerous flat rates.[106] Mafia-style organizations often spring up around illegal grid access, leading to social and political

103. *See generally* Rene Sotola, *Billing In The Cloud: The Missing Link for Cloud Providers,* 3 J. OF TELECOMM. MGMT. 313 (2011).

104. *See, e.g., Power Theft….a Blow on Consumer,* ELECTRICITY CRISIS IN INDIA (July 17, 2008, 6:10 AM), http://www.electricityinindia.com/2008/07/power-thefta-blow-on-consumer.html, *archived at* http://perma.cc/65HF-ACB9 (describing that power theft in India may result in an overall loss of nearly 30 percent of power generated).

105. *See, e.g.*, James Grundvig, *Detecting Power Theft by Sensors and the Cloud: Awesense Smart System for the Grid,* HUFFINGTON POST (Apr. 15, 2013, 12:44 PM), http://www.huffingtonpost.com/james-grundvig/detecting-power-theft-by-_b_3078082.html, *archived at* http://perma.cc/EC2P-ANAY.

106. *See* Kim Jansen, *Nigeria to Fast Track Prepaid Meters to 6.4m Customers*, METERING.COM (Apr. 4, 2014), http://www.metering.com/nigeria-to-fast-track-prepaid-meters-to-6-4m-customers/, *archived at* http://perma.cc/633M-22QQ.

instability.[107] Even conventional non-renewable energy resources often face these problems.

However, expanding wireless coverage and cloud-based services are opening new avenues for secure payment. Prepaid meters provide electricity as long as the meter has credit, and turn off the power when the credit runs out, much like prepaid telephones. These meters require the customer to pay onsite or purchase credits for use, similar to prepaid cellular telephone service.[108] Prepaid metering operates through cloud accounting, enabling the energy provider to control the meter and billing remotely. Such prepaid service eliminates lenders and the providers' exposure to risk of payment default. If there is no payment, the electricity cannot be used. Prepaid electricity for renewables secures production costs for generators, making renewables more reliably profitable and more attractive to investors.

2. Prepaid Meter Case Study: Lumeter Networks

Prepaid meters have been deployed in several electricity markets as elements of a greater overarching strategy.[109] For example, Lumeter Networks is a company that developed an affordable pre-paid off-grid electricity meter.[110] Using pre-paid meters in conjunction with wireless internet service, and internet-hosted accounting software, Lumeter provides renewable energy providers with a billing tool for providing access to electricity even to the poorest populations in developing

107. *Ashok Bharti*, ASHOKA INDIA, http://india.ashoka.org/fellow/ashok-bharti (follow "Fellows" hyperlink; then search "Ashok Bharti"), *archived at* http://perma.cc/ANH4-RJ4G.

108. R. Rejikumar, *Prepaid Electricity Meters and Issues Related to Implementation of Prepaid Metering Systems*, ENERGY CENTRAL (July 26, 2005), http://www.energycentral.net/article/05/07/prepaid-electricity-meters-and-issues-related-implementation-prepaid-metering-systems, *archived at* http://perma.cc/92T8-9TKV; *see*, *e.g.*, *Pay-As-You-Go Electricity*, LUMETER NETWORKS, http://www.lumeter.net/index.php/overview/paygelectricity (last visited June 17, 2014), *archived at* http://perma.cc/645J-2HFD.

109. Jansen, *supra* note 106.

110. *See* *Pre-Paid Electricity*, LUMETER NETWORKS, http://lumeter.org/index.php/34-static/frontpage/3102-pre-paid-off-grid-electricity (last visited June 17, 2014), *archived at* http://perma.cc/C8J3-DL47.

countries.[111] By creating a model for distributed metering, Lumeter offers an option for distributed renewable energy providers to bill and collect without a wired infrastructure.

In 2013, Lumeter launched field trials of its product and accounting platform in Peru and Zambia.[112] The company plans rapid growth to approximately half a million houses that are to be electrified by 2016.[113] The main benefit of pre-paid meters and cloud accounting software is to enable renewable energy providers to access customers who were previously perceived as too great a financial risk. Pre-paid meters are analogous to pre-paid credit cards.[114] The pre-paid meters also allow energy producers to know in advance how much money they have available prior to providing the service.[115] For electricity consumers, the benefits of prepaid meters come from greater access to electricity and a "better allocation of resources," while utilities receive benefits from a reduction of "arrears in accounts receivable and operation and financial costs."[116]

Lumeter Inc.'s business model uses internet-hosted (cloud-based) accounting software, to provide back-end accounting and administrative systems, and to integrate into providers' payment systems.[117] Meters have a payment mechanism where customers can use their cell phone's text message service to buy electricity credit.[118] Lumeter specifically offers a solution that can be integrated across different generation sources and between

111. *Id.*

112. *Lumeter Networks, Inc.*, ENERGY MAPS, http://energymap-scu.org/lumeter-networks-inc/ (last visited June 17, 2014) *archived at* http://perma.cc/ZWA9-MR34.

113. *Id.*

114. Daniel Soto et. al., *A Prepaid Architecture for Solar Electricity Delivery in Rural Areas*, ICTD '12 PROCEEDINGS OF THE FIFTH INT'L CONFERENCE ON INFO. & COMMC'NS TECHS. & DEV., ACM 130, 133 (Mar. 2012) (stating that the consumer would purchase a scratch-off card that is able to be refilled).

115. Ariel A. Casarin & Luciana Nicollier, *Prepaid Meters in Electricity: A Cost-Benefit Analysis* (IAE Bus. Sch. Austral Univ., Working Paper Series No. DT 03, 2009), *available at* http://mba.americaeconomia.com/sites/mba.americaeconomia.com/files/paper_IAE.pdf, *archived at* http://perma.cc/GKD6-R8PT.

116. *See id.*

117. *See Pre-Paid Electricity*, *supra* note 110.

118. *Id.*

customers attached to a common microgrid.[119] Lumeter itself will take approximately 10% of payments, with 5% to local companies, and the remaining 85% payment going to the renewable energy partner.[120] Through this partnership, Lumeter helps to insure stable customer-side payments where they otherwise may be unachievable.

H. Grid-served Communities

For larger community installations supported by a grid, use of renewables will require smart grid technology to balance variable supply loads. In the absence of economic storage technology, the availability of solar and wind resources fluctuate with access to adequate sunshine and wind, requiring backup power when the resources are not sufficient, as well as sophisticated management to assure that electricity availability is smoothly available and not disrupted.[121] Grid infrastructure usually relies on an Independent Service Operator (ISO) to balance the total demand and load, bringing generation resources on- and off-line as needed.[122] The intermittent qualities of renewable resources force distribution technologies that can automatically compensate for these fluctuations. Energy storage mechanisms, a major world-wide R&D focus, will likely play a central role in relieving the problems of balancing consumer demand and variable renewable energy load in the future and will give a big boost to large scale use of renewable energy.[123]

119. *Id.*

120. *Lumeter Networks, Inc.*, *supra* note 112.

121. *See* Ruud Kempener et al., *Smart Grids & Renewables: A Guide for Effective Deployment* 15 (IRENA Working Paper, Nov. 2013), *available at* http://www.irena.org/DocumentDownloads/Publications/smart_grids.pdf.

122. *Id.*

123. The United States and China have both announced significant plans to develop and implement greater battery and energy storage projects. *See* David J. Unger, *Obama at Argonne Lab: Why Batteries Matter*, CHRISTIAN SCI. MONITOR (Mar. 15, 2013), http://www.csmonitor.com/Environment/Energy-Voices/2013/0315/Obama-at-Argonne-lab-Why-batteries-matter-video, *archived at* http://perma.cc/27NM-3XNT; Jake Schmidt, *China Clean Energy Development in Action: Seeing the Coda-Lishen Battery Plant in Person*, NRDC SWITCHBOARD (Oct. 12, 2010), http://switchboard.nrdc.org/blogs/jschmidt/china_clean_energy_coda-lishen.html, *archived at* http://perma.cc/T4X9-CFSS.

Expanded technological improvements and increased need for energy production require increased capital investments. The following examples look at innovative mechanisms for financing renewable energy projects in communities served by a grid or with concurrent grid development. These are in addition to the major conventional renewable energy financing resources such as venture capital investments, government grants and loans, tax incentives, bonds to pay for public installations, and international finance institution and local bank loans to finance the capital costs of private renewable energy installations.

I. On-Bill Financing

On-bill financing is one of the most promising tools for use in renewable energy finance.[124] Under on-bill-financing, the utility or municipality provides, in effect as a loan, the initial capital to install renewable energy that is so often hard to raise.[125] 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.[126] Often the energy savings from the financed energy efficiency or renewable measures can offset the repayment charges in whole or in part.

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

124. Philip Henderson, *On-Bill Financing Overview and Key Considerations for Program Design*, NRDC (2013), http://www.nrdc.org/energy/on-bill-financing-programs/files/on-bill-financing-IB.pdf, *archived at* http://perma.cc/BD99-2423.

125. Catherine J. Bell, Steven Nadel, & Sara Hayes, *On-Bill Financing For Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices*, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON. (2011), http://www.aceee.org/research-report/e118, *archived at* http://perma.cc/Z5RV-XRRM.

126. *Id.*

obligations for repayment to successor lessees or property purchasers.

The following three examples illustrate different methods for implementing on-bill financing. The costs of renewable energy and energy efficiency installations may be financed on-bill through monthly rates, property tax surcharges, and through amortized expected savings.[127] Each of these methods helps customers to finance energy investment while realizing the benefits of improved energy savings.

1. Case Study: Environmental and Energy Study Institute

South Carolina electric cooperatives developed a Rural Energy Savings Program to address the special challenges and opportunities facing rural communities to save energy, cut household utility bills, and reduce greenhouse gas emissions.[128] The program provides utility upfront finances for residential energy efficiency improvements, providing repayment through the co-op members' electric bills.[129] The Rural Energy Savings Program also supports stable, high-skilled jobs and keeps more dollars in the local economy. The "Help My House" pilot for this program produced encouraging results, including participant energy bill reductions averaging 34 percent, saving an average of $288 per home per year after payments.[130] While this program applied only to energy efficiency measures, its mechanism can be applied identically to renewable energy investments.

127. James M. Van Nostrand, *Legal Issues in Financing Energy Efficiency: Creative Solutions for Funding the Initial Capital Costs of Investment in Energy Efficiency Measures*, 2 G.W J. ENERGY & ENVTL. L. 1, 2 (2011), *available at* http://groups.law.gwu.edu/jeel/ArticlePDF/2-1-Nostrand.pdf, *archived at* http://perma.cc/Q5WG-YUFE [hereinafter Van Nostrand].

128. *On-Bill Financing for Co-ops,* ENVTL. & ENERGY STUDY INST., http://www.eesi.org/projects/on-bill-financing (last visited June 17, 2014), *archived at* http://perma.cc/ZCA9-3JSM.

129. *Id.*

130. *The Help My House Model,* ENVTL. & ENERGY STUDY INST., http://www.eesi.org/OBF/coops/helpmyhouse (last visited Feb. 3, 2015), *archived at* http://perma.cc/A6WC-5K7Z.

J. Property-tax Assessed Clean Energy Investment

On-bill financing of renewable energy up front renewable energy equipment costs can also be managed by municipalities as upfront payments repaid through property tax surcharges that run with the land.[131] Property tax assessments also can allow homeowners to repay a government loan for the equipment through a property tax surcharge.[132] Several programs, such as Property Tax Assessed Clean Energy (PACE), use this financing method.[133] In particular, the PACE programs allow municipalities or incorporated villages to incur indebtedness or otherwise finance projects relating to renewable energy with repayment through property taxes.[134] These laws are particular to specific jurisdictions, but typically require the states to delegate the authority to municipalities to incur this debt and assess the additional property tax.[135] Municipalities then become an institution for financing renewable energy projects within their districts.

Property tax assessments are an excellent tool for government participation in renewable energy investment.[136] By

131. Van Nostrand, *supra* note 127.

132. *What is PACE Financing*, PACENOW, http://pacenow.org/about-pace/ (last visited Jan. 30, 2015), *archived at* http://perma.cc/46DW-MBA2.

133. *PACE Financing*, NRDC, http://www.nrdc.org/greenbusiness/cmi/pace-financing.asp (last visited Jan 30, 2015), *archived at* http://perma.cc/X9VN-H4NF.

> "Property-Assessed Clean Energy (PACE) is a finance program designed to enable property owners to make energy efficiency improvements and install small-scale renewable energy systems. Property owners pay for these improvements over their functional life (up to 20 years) through an annual assessment on their property tax bills, thus eliminating the upfront cost barrier to implementing these improvements."

Id.

134. *Pace Financing*, DATABASE OF STATE INCENTIVES FOR RENEWABLE & EFFICIENCY (DSIRE) (Aug. 1, 2010), http://www.dsireusa.org/solar/solarpolicyguide/policyguide.cfm, *archived at* http://perma.cc/J3CA-6KH4.

135. *See id.*

136. *See* CASEY J. BELL ET AL., FINANCING FOR MULTI-TENANT BUILDING EFFICIENCY: WHY THIS MARKET IS UNDERSERVED AND WHAT CAN BE DONE TO REACH IT 16 (2013), *available at* http://www.aceee.org/sites/default/files/publications/researchreports/e13e.pdf [hereinafter ACEEE Financing Report]; *see also* PACENOW, *supra* note 132.

connecting the investment repayment to the property tax, owners/lessors can invest/lend without fear of losing the value of the investment if they sell the property. Property tax assessed loans travel with the land, equally overcoming landlord tenant and transience obstacles.[137] In addition to limiting risk of losing the value of the investment, PACE programs allow municipalities to promote renewable energy and energy efficiency agendas.

1. Case Study: Vermont PACE Program

In 2009, Vermont enacted an Energy Finance District and PACE program.[138] The state's Department of Banking, Insurance, Securities and Health Care Administration administers a clean energy financing and property tax assessment program, following a municipality's decision to create an investment district.[139] The Vermont program creates a framework for municipalities to enter into agreements with qualified property owners, based on a variety of criteria, including the participant's debt-to-income ratio, the estimated useful life of the investment, gross monthly expenses, gross monthly income, and type of improvement.[140]

Vermont classifies qualified investments based on a state characterization of renewable investments.[141] Specifically, the Vermont program marks residential dwellings (primary and vacation), manufactured homes, and condominiums as eligible if the owner is paying property taxes.[142] The program offers minimum financing of $3,500 USD, and a maximum property tax

137. *See* Van Nostrand, *supra* note 127, at 2.

138. *Local Option – Clean Energy Finance Districts*, ENERGY.GOV, http://energy.gov/savings/local-option-clean-energy-finance-districts (last visited Jan. 25, 2015), *available at* http://perma.cc/39AF-B8DV.

139. *Id.*

140. *See* VERMONT DEP'T OF BANKING, INS., SEC. & HEALTH CARE ADMIN., BANKING BULLETIN #34, PACE ASSESSMENT UNDERWRITING CRITERIA AND STANDARDS (2012), *available at* http://www.dfr.vermont.gov/sites/default/files/BankBull_34_Revised_April_2012.pdf, *archived at* http://perma.cc/AJ69-TUSR.

141. *See* VT. STAT. ANN. tit. 30, §§ 209(d), 3267 (WEST 2014).

142. EFFICIENCY VERMONT, 2012 VERMONT PACE ELIGIBLE MEASURES 1 (2012), *available at* http://www.efficiencyvermont.com/docs/about_efficiency_vermont/initiatives/PACE_eligible_measures.pdf, *archived at* http://perma.cc/2WN2-WDLE.

surcharge of 15% of property value capped at $30,000.[143] PACE financing available through Vermont's program may be used for eligible solar electric systems, solar hot water systems, small wind systems, and micro-hydro systems, as well as a full portfolio of energy efficiency measures.[144]

Originally passed in 2009, Vermont amended its PACE law in 2011 to include several key features.[145] First, the 2011 amendment specifies that PACE liens are subordinate to existing liens and first mortgages, but are superior to any other liens on the property recorded after the PACE lien is recorded.[146] The amendments also create a PACE reserve fund to reduce risk for potential investors interested in investing in a PACE municipal district.

143. *Id.* at 1.

144. *See id.* at 4.

145. Peter Adamczyk, *"Not Dead Yet!" Moving Forward with Residential PACE*, 2012 ACEEE SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS 6-1, 6-2 (2012), *available at* http://www.aceee.org/files/proceedings/2012/data/papers/0193-000188.pdf, *archived at* http://perma.cc/NYW3-LKJA.

> Vermont legislators passed amendments to its existing PACE legislation in 2011 that made liens on PACE assessments subordinate to existing mortgages. Because this junior position [made] PACE assessments more likely to incur a loss in the event of default, Vermont enacted 24 V.S.A. § 3269 and § 3270, effective January 2012, to create to loss reserve accounts:
>
> • Participating property owners pay into one account a one-time nonrefundable amount equal to 2% of their assessment. These funds are available to cover 100% of losses in a foreclosure.
>
> • If the first reserve account cannot cover actual losses from a default, the second account, administered by the State Treasurer, can be used to cover additional losses, up to 90%. The fund will hold an amount equal to 5% of the total assessments on participating properties, up to a total of %1 million. Revenue from Vermont's participation in the Regional Greenhouse Gas Initiative and ISO New England's Forward Capacity Market fund this second reserve.
>
> In addressing this opposition with a market-based approach, Vermont has conceptually turned the controversy into a working solution, although at a cost, and has paved the way for homeowners to take advantage of affordable energy improvements.

Id.

146. U.S. DEP'T OF ENERGY, *supra* note 76, at 5.

2. Pay As You Save (PAYS) Programs

Pay As You Save or PAYS, is a variant of bill financing in which the customer agrees to pay a monthly surcharge which is lower than the independently verified, estimated savings. Money-saving energy efficiency products are purchased with no upfront cost or debt obligation to the consumer.[147] Instead, the customer pays a tariff charge on the utility bill proportionate to efficiency savings.[148] Typically this applies to energy efficiency installations, but the principle could be applied to renewable energy installations.

PAYS systems circumvent traditional barriers to finance by providing the upfront capital requirements. Participants do not take on any debt obligation for energy installations; making PAYS an attractive option for residential and business customers who may not be in a position to obtain a loan to pay for the upfront capital costs of the installed measures.[149] As an independent system, PAYS does not require credit checks or liens. Here, all obligations are attached to the meter, and dependent upon efficiencies.[150]

The system functions based on efficiency measures performing as-advertised. Because of this, commissions or jurisdictions implementing PAYS systems must screen products for eligibility. Utilities function as collectors in PAYS systems, imposing the charges as they would any other tariff charge.[151] PAYS systems have been applied to both energy efficiency investments, as well as a growing number of renewable energy projects.

147. Clean Energy States Alliance, *Developing an Effective State Clean Energy Program: Clean Energy Loans*, BRIEFING PAPER NO. 4 (Mar. 2009), *available at* http://www.cesa.org/assets/Uploads/Resources-pre-8-16/CESA-cleanenergy-Loan-Programs-March09.pdf, *archived at* http://perma.cc/L7SF-C6E2.

148. *Pay-As-You-Save*, ENERGY EFFICIENCY INST., INC. (Mar. 8, 2005), http://www.eeivt.com/DTEpres.pdf, *archived at* http://perma.cc/3T33-TRLW.

149. CHARLES KUBERT & MARK SINCLAIR , STATE SUPPORT FOR CLEAN ENERGY DEPLOYMENT: LESSONS LEARNED FOR POTENTIAL FUTURE POLICY 46 (2011), *available at* http://www.nrel.gov/docs/fy11osti/49340.pdf.

150. *Id.*

151. *Id.* at 45.

3. PAYS Case Study: Aspiration Energy

Aspiration Energy is an India-based energy service company (ESCO), which designs, installs, and operates solar water heating systems for industrial process heating.[152] Aspiration Energy finances its solar energy installations through a monthly performance-based energy charge model – a PAYS system.[153] The Aspiration Energy system received the 2013 Parivartan award for Innovation in Business Model Category.[154] The company delivers solar hot water heating for industrial processes based on an "energy as a service model" requiring no initial capital expenditure.[155] Solar water heating can displace a variety of fuel needs in industrial processes including pasteurization in the milk industry, pretreatment and degreasing in the automobile and electroplating industries, food industry applications such as the sugar industry, fruit juice concentration, and the drying of spices; chemical industry heating; and the tea industry.

One Aspiration Energy installation, Wheels India, used solar water heating to replace oil boiler displacing nearly 7 million Indian rupees (INR) worth of fuel oil in the first eighteen months of operation.[156] This translated to actual fossil fuel avoidance of 360 liters of fuel oil per day.[157] This economic and environmental success inspired the wheel producer to expand solar water

152. *Pay-as-you-save: Solar Energy for Industrial Heating*, UNITED NATIONS DEVELOPMENT PROGRAMME, http://www.in.undp.org/content/india/en/home/ourwork/environmentandenergy/successstories/pay-as-you-save--solar-energy-for-industrial-heating/ (last visited Feb. 16, 2015), *archived at* http://perma.cc/XM5N-ZMLR [hereinafter *Pay-as-you-save*].

153. *Id.*

154. *2013 Award Winners, Innovation in Business Model Category*, PARIVARTAN AWARDS, INC., http://parivartanawards.in/2013/application/process (last visited Feb. 13, 2015), *archived at* http://perma.cc/G7TK-K5YJ.

155. *Id.*

156. *Aspiration Energy,* GLOBAL SOLAR THERMAL ENERGY COUNCIL, http://solarthermalworld.org/companies/aspiration-energy (last visited Feb. 6, 2015), *archived at* http://perma.cc/R6WR-S2EZ.

157. *Aspiration Energy – World's Largest Industrial Heater on Factory Shed Rooftops, Energy* ALTERNATIVES INDIA, http://www.eai.in/news-and-media/pr/worlds-largest-industrial-heater-on-factory-shed-rooftops (last visited Feb. 6, 2015), *archived at* http://perma.cc/9KY4-NYBT.

heating to its factories across India.[158] In addition to solar thermal systems, Aspiration has also operated as a PAYS ESCO for solar battery backup systems and solar power for telecommunication networks.[159]

K. Alternative Stock Trading Markets

Pioneering stock markets have taken a role in creating sources of capital for renewable energy projects. In addition to basic listing requirements, several stock markets have added requirements for social responsibility including environmental practices.[160] This allows the growing number of ethical investors to buy stock with confidence in the company's virtues.[161] In an era where there are a growing number of large funds divesting from fossil fuel investments, social value stock markets could streamline changing reinvestment patterns and spur investment in renewable energy.[162]

158. *Id.*

159. *Company Overview of Aspiration Energy Private Limited*, BLOOMBERG BUSINESS (Feb. 16, 2015, 6:51 PM), http://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=196064672, *archived at* http://perma.cc/SNQ2-E3KF.

160. *Impact Reports*, SOCIAL STOCK EXCH., http://socialstockexchange.com/impact-reports/ (last visited Feb. 6, 2015), *archived at* http://perma.cc/BMW5-TRZM.

161. *See* WORLD ECON. FORUM, FROM THE MARGINS TO THE MAINSTREAM - ASSESSMENT OF THE IMPACT INVESTMENT SECTOR AND OPPORTUNITIES TO ENGAGE MAINSTREAM INVESTORS (Sept. 2013), *available at* http://www3.weforum.org/docs/WEF_II_FromMarginsMainstream_Report_2013.pdf ("Investment industry thrives as a result of the pursuit of investment returns and businesses are not sustained without a profitable revenue model. However, the emerging generation of investors is also likely to seek achievement of social objectives in addition to financial returns."); *see also Deloitte's Global Millennial Survey 2013*, DELOITTE (2013), *available at* http://www2.deloitte.com/us/en/pages/about-deloitte/articles/millennial-survey-positive-impact.html, *archived at* http://perma.cc/MJM6-YQE2 ("Deloitte's Millennial Survey revealed that our world's future leaders are increasingly viewing business through the lens of social impact. More than half of Millennials surveyed (52 percent) believe business, more than any other area of society, will achieve the greatest impact in solving society's biggest challenges.").

162. *See*, e.g., *Stanford to Divest from Coal Companies,* STANFORD REPORT, May 6, 2014, http://news.stanford.edu/news/2014/may/divest-coal-trustees-050714.html, *archived at* http://perma.cc/U3PN-PWT8. Stanford University resolved to divest, and stop investing in 100 publicly traded companies whose primary business is coal extraction. The school's endowment totals $18.7 billion.

The Social Stock Exchange trades shares of companies that contribute to social or environmental projects.[163] This model takes the traditional benefits of raising capital through public trading and focuses on investments in companies promoting socially beneficial values such as renewable energy production.

1. Case Study: Social Stock Exchange – Good Energy

Good Energy Group is a vertically integrated utility that seeks to lower the United Kingdom's (UK) carbon emissions by developing and distributing renewable energy within the UK.[164] The purpose of the Social Stock Exchange is to provide stakeholders with the information they need to identify and compare organizations based on their social and environmental values.[165] The exchange admissions process requires transparency, and a disclosure of values and standards. Good Energy Group is one of the companies listed on the UK Social Stock Exchange.[166]

Good Energy's mission is to "keep the world a habitable place by offering consumers an active role in addressing climate change."[167] Through the Social Stock Exchange reporting, Good Energy shares its impact report outlining its key outcomes with the public.[168] In addition to these characteristics, Good Energy shares financial information characteristic of a stock exchange. This includes price, market cap, shares issued, and information on its securities.[169] As of the end of 2013, Good Energy reported

The move reflected the "availability of alternate energy sources with lower greenhouse gas emissions than coal." *Id.*

163. *Become A Member*, SOCIAL STOCK EXCH., http://socialstockexchange.com/become-a-member/ (last visited Feb. 11, 2015), *archived at* http://perma.cc/47JP-ZLM3.

164. *Good Energy Group*, SOCIAL STOCK EXCH., http://www.socialstockexchange.com/members/good-energy-group (last visited Feb. 11, 2015), *archived at* http://perma.cc/G6LM-NPSZ.

165. *Our Mission*, SOCIAL STOCK EXCH., http://socialstockexchange.com/our-mission-history/ (last visited Feb. 11, 2015), *archived at* http://perma.cc/APD6-GPUG.

166. *Good Energy Group*, *supra* note 164.

167. *Id.*

168. *Impact Reports*, *supra* note 160.

169. *Good Energy Group*, *supra* note 164.

a healthy cash flow and a total gross profit increase of 42%.[170] This combination of renewable energy investment and corporate social responsibility promises healthy market growth in the coming years. Stock exchanges and funds, which help investors, assess these values through transparent listing principles promise to speed this market growth even further as the market for global impact investing has been estimated at $650 billion by 2020.[171]

Good Energy and the Social Stock Exchange are part of a greater overarching movement towards global sustainable economic growth. On June 2, 2014, the London Stock Exchange (LSEG) announced that it joined the United Nations Sustainable Stock Exchanges (SSE) initiative as a Partner Exchange.[172] This partnership follows a trend toward stock exchanges promoting "good governance standards, encouraging best practice non-financing reporting, pioneering sustainable investing concepts . . . providing access to capital for clean tech companies . . . and dedicated programme[s] to support the growth and development of small and medium sized businesses."[173] Within this partnership, the aforementioned Social Stock Exchange has brought over 160 listed clean tech companies to the global market.[174]

L. Existing Utility Programs

A major component of the financial packet for renewables is the stream of revenues from electric generation with which to

170. *Announcements-Preliminary Results*, GOOD ENERGY GROUP (JULY 4, 2014), http://www.goodenergygroup.co.uk/announcements/2014/04/06/preliminary-results, *archived at* http://perma.cc/E63V-2C3J.

171. *Tomas Carruthers Appointed CEO of the Social Stock Exchange*, SOCIAL STOCK EXCH. (Dec. 8, 2013), http://socialstockexchange.com/tomas-carruthers-appointed-ceo-of-the-social-stock-exchange/, *archived at* http://perma.cc/N2EJ-LPB6.

172. Press Release, London Stock Exch., London Stock Exch. Group Joining the UN Sustainable Stock Exchs. Initiative (June 2, 2014) (on file with London Stock Exchange Group), *available at* http://www.lseg.com/resources/media-centre/press-releases/london-stock-exchange-group-joining-un-sustainable-stock-exchanges-initiative, *archived at* http://perma.cc/X4Y6-XSCS.

173. *Id.*

174. *Id.*

generate a return to financial investors. There are various mechanisms in place to create these revenue streams, varying by jurisdiction, market, technology, and other factors.

In the United States, the dominant form is the power purchase agreement between the generator and the off taker of electricity. For renewable energy resources, the U.S. federal Public Utility Regulatory Policy Act creates a status for renewable energy generators—qualifying facilities—and a payment mechanism that obligates purchase of power at the avoided cost rate.[175] Several mechanisms for increasing renewable energy market participation function by expanding opportunities for a guaranteed return on investment or abatement of tax costs, while discussions continue regarding mechanisms to bring parity between the renewable and fossil fuel energy markets.[176]

175. 16 U.S.C. § 796 (2012).

176. A Master Limited Partnership (MLP) is a limited partnership that is publicly traded. *See* TIM FENN, LATHAM & WATKINS, LLP, MASTER LIMITED PARTNERSHIPS (MLPS): A GENERAL PRIMER (2014), *available at* https://www.lw.com/admin/Upload/Documents/Latham-Master-Limited-Partnership-Primer-2014.pdf. The partnership structure includes general (managing) partners and investment partners. *Id.* at 4. The MLP permits the entity the tax benefits of a limited partnership, with the capital and liquidity benefits of publicly traded securities. *Id.* at 3. The result of this favorable taxation is access to lower cost capital and greater liquidity.

Congress created the MLP in 1987 to spur investment in the energy sector and promote a critical sector. *Id.* at 11. The definition of qualifying income was expanded in 2008, to include certain renewable and alternative fuels, as well as industrial source carbon dioxide. *Id.* at 13. Because MLPs are classified as publicly traded partnerships, they avoid corporate taxation at both the state and federal levels.

The current definition of qualifying income for an MLP includes the income and gains derived from "exploration, development, mining or production, processing, refining, transportation (including pipelines transporting gas, oil, or products thereof), or the marketing of any mineral or natural resource (including fertilizer, geothermal energy, and timber), industrial source carbon dioxide, or the transportation or storage of any [fuel, alcohol fuel or biodiesel]," qualifies as income to a partnership, not a corporation. This income is taxed at a favorable rate. While this treatment does not actively interfere with renewable energy and energy efficiency infrastructure, oil and gas MLP access to lower cost capital and greater liquidity negatively affects the competitiveness of the developing renewable industry. 26 U.S.C. § 7704(d)(E) (2012); 26 U.S.C. § 701 (2012) ("A partnership as such shall not be subject to the income tax imposed . . . Persons carrying on business as partners shall be liable for income tax only in their separate or individual capacities."); *see* Emergency Economic Stabilization

Many U.S. state utility programs have been implemented that support the restructuring of the energy economy, and increase the availability of financing for renewable energy infrastructure. While these programs are no longer "innovative," the framework they create continues to promote and incentivize investment in renewable energy and energy efficiency. The following section briefly outlines these electric utility structures and how they promote renewable energy investment.

M. Energy Service Agreement (ESA)

In the ESA model, an investment or public authority fund pays for and installs the project. An ESA is a contract that allows the capital investment in energy projects to be paid back over time by building owners or tenants.

> An Energy Services Agreement (ESA) is a contract that permits energy efficiency to be packaged as a service that building owners pay for through savings and that generally requires no (or minimal) upfront cost to the owner. It is an alternative to using equity or a traditional loan to retrofit a building.
>
> . . .
>
> ESA providers generally assume the risk that savings will be sufficient to justify the upfront investment, and it may offer savings performance guarantees. ESA providers arrange for their own financing, a boon to owners who are concerned about using scarce borrowing capacity to [finance] energy efficiency and clean fuel conversions.[177]

Act, Pub. L. No. 110-343 122 Stat. 3765 (2008); *see also* U.S. SENATOR CHRIS COONS, MASTER LIMITED PARTNERSHIPS PARITY ACT (Apr. 24, 2013), *available at* http://www.coons.senate.gov/download/mlp-white-paper, *archived at* http://perma.cc/3PLA-FZ49.

177. *Energy Service Agreements*, N.Y.C. ENERGY EFFICIENCY CORP., http://web.archive.org/web/20141107061923/http://www.nyceec.com/esa/ (last visited Feb. 13, 2015) (accessed by searching for N.Y.C. Energy Efficiency Corp in the Internet Archive Index).

1. Case Study: Con Edison NYCEEC Multifamily Energy Efficiency Loan Program

Under this program, New York City provides funding for qualified buildings to improve energy efficiency.[178] Qualified projects must include 5 to 75 units within the Con Edison utility service territory.[179] Once enrolled in the program, building owners qualify for incentives for lighting upgrades; heating, ventilation and air conditioning (HVAC) systems; compact fluorescent lighting and other projects.[180] The program also aids multi-unit buildings to convert from oil to gas, reducing carbon emissions and air pollution.[181] Specific projects have succeeded in energy efficiency improvements of approximately twenty-four percent.[182]

N. Power Purchase Agreements (PPA)

Power Purchase Agreements are contractual arrangements in which a wholesale energy company may purchase exclusive rights to all or part of an energy provider's electricity.[183] PPAs allow the facility owner to secure a revenue stream from the project necessary to finance the project and determine the quality of credit.[184] The terms of PPAs address issues such as the "length

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178. *Con Edison-NYCEEC: Multifamily Energy Efficiency Loan Program*, N.Y.C. ENERGY EFFICIENCY CORP., http://www.nyceec.com/conedison/ (last visited Feb. 5, 2015).

179. *Id.*

180. *Multifamily Building (Five to Seventy-Five Units),* CON. EDISON, INC., http://www.coned.com/energyefficiency/residential_multifamily.asp (last visited Feb. 5, 2015), *archived at* http://perma.cc/62DB-AEMJ.

181. *Id.*

182. *NYCEEC Opens* Field for Successful Retrofit Financings at 125 Maiden Lane, SCI ENERGY, http://scienergy.com/wp-content/uploads/2014/05/sci_casestudy_125maidenlane_new_v2.pdf (last visited Feb. 16, 2015), *archived at* http://perma.cc/NF72-FYKY.

183. *See, e.g.*, EXHIBIT C. EXAMPLE OF A PURCHASE POWER AGREEMENT, BONNEVILLE POWER ADMIN. (2002), *available at* http://www.bpa.gov/power/pgc/wind/EX_C_PPA_2.pdf, *archived at* http://perma.cc/P45W-XKUY (providing an example of a Power Purchase Agreement, Executed by the U.S. Department of Energy acting by and through the Bonneville Power Administration).

184. Daniel A. Yarano, *The Basics of a Power Purchase Agreement*, BIOMASS MAGAZINE, http://biomassmagazine.com/articles/2119/the-basics-of-a-power-

of the agreement, the commissioning process, the purchase and sale of energy . . . price, curtailment, . . . credit and insurance."[185]

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 distribution system.[186] Innovations to these contracts are providing an excellent tool to augment and encourage renewable investment.[187] 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.[188]

The U.S. EPA outlines specific recommendations for some Solar Power Purchase Agreements.[189] This subset of PPAs 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.[190] The developer under the solar PPA (SPPA) arrangement is also known as a "solar services provider."[191] SPPA arrangements enable host customers (those purchasing the power) to avoid many of the traditional barriers to adoption including high capital costs, system performance risks, and design complexities.[192]

O. Renewable Energy Certificates

Renewable Energy Certificates (RECs), represent the "property rights to the environmental, social and other non-power

purchase-agreement/ (last visited Feb. 5, 2015), *archived at* http://perma.cc/4R6U-X7KV.

185. *Id.*

186. *See id.*

187. *See, e.g.*, BONNEVILLE POWER ADMIN., *supra* note 183.

188. *Id.*

189. *See Solar Power Purchase Agreements*, EPA, http://www.epa.gov/greenpower/buygp/solarpower.htm (last visited Feb. 5, 2015), *archived at* http://perma.cc/5GGY-QQZ5.

190. *Id.*

191. *Id.*

192. *Id.*

qualities of renewable electricity generation."[193] By enabling producers to sell the rights separately from the underlying physical electricity associated with renewable generation, organizations can support renewable energy development and protect the environment when green power is not locally available.[194] RECs have become a staple system to finance the production and sale of renewable power in the United States.

1. Renewable Energy Certificates Case Study: Green Mountain Energy

Green Mountain Energy is the United States' longest serving renewable energy retailer.[195] Green Mountain purchases Renewable Energy Certificates to assure that money intended for renewable energy actually reaches renewable energy providers.[196] RECs are instruments used to create a specific stream of revenue for renewable energy, despite electricity being purchased on an open market.[197] Green Mountain buys and sells RECs as an intermediate, channeling revenue to renewable energy developers. Green Mountain's finance system has become an industry fixture since its inception in 1997; the financing structure continues to drive significant investment in renewable energy infrastructure.

193. *Renewable Energy Certificates*, EPA, http://www.epa.gov/greenpower/gpmarket/rec.htm (last visited Feb. 5, 2015), *archived at* http://perma.cc/3Z2M-NEJ9.

194. *Id.*

195. *Our Mission*, GREEN MOUNTAIN ENERGY, https://www.greenmountainenergy.com/our-story/our-company-mission/ (last visited Feb. 17, 2015), *archived at* http://perma.cc/84CL-2AE5.

196. *Our Business*, GREEN MOUNTAIN ENERGY, https://www.greenmountainenergy.com/our-story/our-company-mission/our-business/ (last visited Feb. 17, 2015), *archived at* http://perma.cc/9BKU-2T33.

197. *Renewable Energy Certificates, supra* note 193. ("At the point of generation, both product components can be sold together or separately, as a bundled or unbundled product. In either case, the renewable generator feeds the physical electricity onto the electricity grid, where it mixes with electricity from other generation source. Since electrons from all generation sources are indistinguishable, it is impossible to track the physical electrons from a specific point of generation to a specific point of use . . . As renewable generators produce electricity, they create one REC for every 1000 kilowatt-hours (or 1 megawatt-hour) of electricity placed on the grid.").

As part of its renewable driven focus, Green Mountain reports its environmental impact in consumer friendly terms. In the 2013, Green Mountain reported that its customer's choices for renewable energy were comparable to taking 2.9 million cars off the road for a year, or 17.6 million households turning off their lights for a year, or an equivalent of planting 3.6 million trees. [198]

P. Feed-in Tariffs

Feed-in tariffs (FITs) are government mandated renewable energy subsidies requiring utilities to purchase renewable energy at a subsidized rate.[199] Feed-in tariffs have played an important role in incentivizing customer uptake of renewable energy.[200] These subsidized rates incentivize market participation from individual customers to add renewable electricity to the grid. FITs legally obligate utilities to purchase electricity from renewable energy producers at favorable, higher-than-market rates.[201] The government, for a certain period of time, typically guarantees the favorable rates assured by FITs.[202]

Feed-in tariffs were pioneered in Germany and have been used very successfully in other jurisdictions to guarantee solar and wind energy installers a specified subsidized price.[203] The German FIT law, the Stromeinspeisungsgesetz (StrEG), helped to

198. *Green Mountain – By the Numbers*, GREEN MOUNTAIN ENERGY, http://www.greenmountainenergy.com/green-mountain-numbers/ (last visited Feb. 13, 2015), *archived at* http://perma.cc/3LB2-M9KT.

199. *See* UNEP, FEED-IN TARIFFS AS A POLICY INSTRUMENT FOR PROMOTING RENEWABLE ENERGIES AND GREEN ECONOMIES IN DEVELOPING COUNTRIES (2012), *available at* http://www.unep.org/pdf/UNEP_FIT_Report_2012F.pdf.

200. *See* Matthias Lang & Ulrich Mutschler, *Feed-in Tariffs 2012*, GERMAN ENERGY BLOG, http://www.germanenergyblog.de/?page_id=8617 (last visited Feb. 13, 2015), *archived at* http://perma.cc/GRV3-4W2. Germany has used feed-in tariffs to encourage a variety of renewable energy sources. *Id.*

201. *Success Story: Feed-In Tariffs Support Renewable Energy in Germany,* E-PARLIAMENT (2009), *available at* e-parl.net/eparliament/pdf/080603%20FIT%20toolkit.pdf, *archived at* http://perma.cc/Q4SL-U4UG.

202. *Id.*

203. *See* MIGUEL MENDONCA, FEED-IN TARIFFS: ACCELERATING THE DEPLOYMENT OF RENEWABLE ENERGY 26 (2009); *see also Germany's Feed-in Tariffs Set the Example*, POWER-TECHNOLOGY.COM (Nov. 21, 2008), http://www.power-technology.com/features/feature45682/, *archived at* http://perma.cc/Z3YA-ALYW ("[Feed-in tariffs] were pioneered with great success in Germany and have now been enacted by more than 30 other countries.").

finance renewable energy by securing a profitable business for renewable energy ventures.[204] This subsidized rate has led to high market penetration.[205] The solar sector alone has grown to include over forty companies and a €1.7 billion per year.[206] Favorable tariff structures, such as FITs, can greatly improve access to renewable energy financing by providing an enhanced revenue stream.

Q. Legal Structures Supporting Renewable Energy Investment

Certain corporate entities are expanding their purpose to capture emerging opportunities in renewable energy, while other novel corporate structures surface to realize the financial potential of the market. Flexibility in the corporate form, combined with the potential for raising capital through publicly traded securities, is allowing renewable energy to grow into a legitimate competitor to fossil fuel energy. The following legal structures demonstrate the potential for corporate forms and contract law to enhance channels for renewable energy finance.

R. Energy Service Companies (ESCO)

Energy Service Companies or ESCOs have also emerged as viable market participants supporting investment in renewable energy. ESCOs can serve a variety of functions. They can actively participate in the electricity generation market by developing,

204. *See* Uwe Büsgen & Dr. Wolfhart Dürrschmidt, *The Expansion of Electricity Generation from Renewable Energies in Germany: A Review Based on the Renewable Energy Sources Act Progress Report 2007 and the New German Feed-In Legislation*, 37 ENERGY POL'Y 2536, 2536-45 (2009), *available at* http://www.enklip.de/publications_2_270929791010.pdf ("Since the EEG entered into force in 2000, the share of renewable energies in total gross electricity in Germany has almost doubled, from 6.3% in 2000 to approximately 11.7% in 2006 . . . .").

205. A caution in implementing feed-in tariffs is the stress that excessive subsidies place on non-renewable customers. *See Germany's Electricity Market Out of Balance*, INST. FOR ENERGY RES. (Aug. 22, 2014), http://instituteforenergyresearch.org/analysis/germanys-electricity-market-balance-must-pay-flexible-back-power/, *archived at* http://perma.cc/4NNN-QEZJ.

206. E-PARLIAMENT, *supra* note 201.

installing, and arranging financing for energy projects.[207] An ESCO essentially arranges the project, while the tenants or owners pay the project costs, usually over a seven to twenty year term. The ESCO arrangement helps to catalyze renewable investment by shifting qualification for financing on to an ESCO specializing in renewable energy or energy investment installations.[208]

S. Yield Companies (YieldCos)

Yield companies, or "YieldCos," are publicly traded corporations that own and operate wind and solar power plants.[209] 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.[210] The steady revenue stream helps the Yieldco buy new plants from developer partners at favorable terms. The relationship between a YieldcCo and a renewable energy developer allows developers to "recycle" their capital.[211] Selling an existing plant to a YieldCo,

207. *See* ICF INT'L & NAT'L ASS'N OF ENERGY SERV. CO., INTRODUCTION TO ENERGY PERFORMANCE CONTRACTING (2007), *available at* http://www.energystar.gov/ia/partners/spp_res/Introduction_to_Performance_Contracting.pdf, *archived at* http://perma.cc/8S2Q-VXBN.

208. *Id.* at 24.

209. *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, *archived at* http://perma.cc/AE63-RQGT.

210. *See NRG Yield, Inc.*, *Company Overview*, MARKETWATCH.COM, http://www.marketwatch.com/investing/stock/nyld (last visited Feb. 12, 2015), *archived at* http://perma.cc/C9R9-EREH [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. It 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. NRG YIELD, INC., http://investor.nrgyield.com/phoenix.zhtml?c=251846&p=irol-irhome (last visited Feb. 20, 2015), *archived at* http://perma.cc/T958-BEXR.

211. 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, *archived at* http://perma.cc/N7PG-HHVB.

makes it cheaper to raise equity for subsequent plant investment.[212] Because the YieldCo owns a variety of renewable energy plants, investors are able to reduce risks by benefiting from diversification.

The YieldCo stimulates investment in renewable energy by avoiding risk through portfolio diversification, providing wider access to capital through public investors, and ultimately capturing the benefits of the zero-fuel cost of solar energy.[213] In many ways, the YieldCo represent the realization of a mature renewable energy market, providing the investor with the possibility of steady and solid yields.[214]

1. Case Study: NRG Yield, Inc.

Renewable energy power production company, NRG Energy,[215] created NRG Yield, Inc.,[216] as a subsidiary company to own, operate and acquire renewable and conventional electricity generation.[217] Since its initial public offering (IPO) in July 2013, NRG Yield has had a sales/revenue growth of 86.3 percent, with a 2014 value of $539 million USD.[218] Within its diversified portfolio, NRG Yield owns eight utility-scale solar and wind generation facilities and two distributed solar facility portfolios representing 1,324 megawatts (MW) of renewable generation capacity.[219] On June 4, 2014, NRG Yield acquired the largest wind farm in North America, Alta Wind thereby adding 947 MW

212. *Id.*

213. *See* Anich, *supra* note 209.

214. Roy Torbert & Dan Seif, *A Rock that Churns out Cash: Solar YieldCos,* ROCKY MOUNTAIN INST., (July 17, 2013), http://blog.rmi.org/blog_2013_07_17_a_rock_that_churns_out_cash_solar_yieldcos, *archived at* http://perma.cc/Q6DX-8CZ8.

215. NRG ENERGY, http://www.nrgenergy.com/ (last visited Feb. 13, 2015), *archived at* http://perma.cc/2982-DBK3.

216. NRG YIELD, INC., *supra* note 210.

217. *Id.*; Torbert & Seif, *supra* note 214.

218. *NRG Yield, Inc., Profile*, MARKETWATCH.COM, http://www.marketwatch.com/investing/stock/nyld/profile (last visited Feb. 17, 2015), *archived at* http://perma.cc/B9P8-PM79.

219. *NRG Yield, Inc. Reports Full-Year and Fourth Quarter Results*, NRG YIELD, (Feb. 28, 2014), http://investor.nrgyield.com/mobile.view?c=251846&v=203&d=1&id=1904747, *archived at* http://perma.cc/TD86-2V7F.

worth of renewable energy to its portfolio.[220] Acquisition of the wind farm brought it twenty-one years of long-term power purchase agreements.[221]

NRG Yield closed a $450 million secured revolving credit facility with RBC Capital Markets in April of 2014.[222] The size of NRG Yield's revolving credit structure reflects the promise of large-scale renewable energy power purchase agreements, and the strength of a maturing, diversified renewable energy market.

T. The Next Grid: Utility 2.0

In order to truly flourish, renewable energy requires a full system upgrade, including a smart-grid infrastructure capable of managing a diverse set of energy resources. The grid in the United States is currently composed of a network of transmission and distribution lines with relatively little communication infrastructure.[223]

The upgraded grid infrastructure, colloquially referred to as "utility 2.0," is composed of traditional transmission and distribution wires, enhanced by an advanced communication, information, and control network.[224] A more sophisticated communication and information architecture makes it possible for electricity providers to support additional energy resources of different sizes and scales, including better management of intermittent renewable energy resources.

In addition to the technical upgrades necessary to manage the intermittent system loads from renewable sources, there must

220. Press Release, NRG Yield, NRG Yield, Inc. to Acquire Largest Wind Farm in North America, (June 4, 2013), *available at* http://investor.nrgyield.com/phoenix.zhtml?c=251846&p=irol-newsArticle&ID=1937203&highlight=, *archived at* http://perma.cc/K4X2-T2WU.

221. *Id.*

222. Press Release, NRG Yield, NRG Yield, Inc. Increases Revolving Credit Facility to $450 Million, (Apr 28, 2014), *available at* http://investor.nrgyield.com/phoenix.zhtml?c=251846&p=irol-newsArticle_print&ID=1922876, *archived at* http://perma.cc/L4MK-VF8D.

223. U.S. DEP'T OF ENERGY, NATIONAL TRANSMISSION GRID STUDY 2-3 (May 2002), http://www.ferc.gov/industries/electric/indus-act/transmission-grid.pdf.

224. *See* ENERGY FUTURE COALITION, UTILITY 2.0: PILOTING THE FUTURE OF MARYLAND'S ELECTRIC UTILITIES AND THEIR CUSTOMERS (Mar. 15, 2013), http://cleanenergytransmission.org/uploads/Utility%202-0%20Pilot%20Project-reduced.pdf, *archived at* http://perma.cc/Q5UL-PL8S.

be significant uptake in financial support for the system. Many jurisdictions in the United States are currently grappling with the issue of sustainable financial support for renewable energy.[225] While many of the overarching system upgrades are financed through conventional ratepayer funding, distributed and renewable energy resources still face barriers to financing such as high upfront costs and sometimes long payback periods.

New energy resources come in great variety, and continue to emerge as advanced grid infrastructure is built. In terms of both economic and carbon efficiency, utility-scale renewables and rooftop solar installations represent an increasingly important component of energy portfolios. In addition to the actual installation and management of renewable energy, advance grid function will allow for new methods of aggregating energy consumers and creating new venues for financing.[226]

Utility 2.0 advances financing by providing greater and simpler access for market penetration. Previous technological barriers to mass-market penetration made renewables less attractive to traditional financial industry investment. Innovations in system control and load management make it possible for more renewables to be deployed in a service area. With such advances, costs of interconnections decrease, permitting other "soft" transactional costs to be reduced, and information on investment return to become more readily available. Taken in total, converting the distribution infrastructure to a more advanced system speeds adoption and return while reducing transaction costs and creates a more favorable environment for finance. It also supports the return on investment structures created by renewable energy projects.

1. Surcharges and Direct Investment

Many states operate on a surcharge collection for renewable energy.[227] Surcharge systems typically operate on a volumetric

225. DATABASE OF STATE INCENTIVES FOR RENEWABLES & EFFICIENCY, http://www.dsireusa.org/ (last visited Feb. 20, 2015), *archived at* http://perma.cc/VRN5-FZHJ.

226. *See* ENERGY FUTURE COALITION, *supra* note 224, at 2-4.

227. *See Connecticut Clean Energy Fund*, DATABASE OF STATE INCENTIVES FOR RENEWABLES & EFFICIENCY, http://dsireusa.org/incentives/incentive.cfm?

charge, in which utilities collect money, which is then directed, to a state authority for the procurement of environmentally beneficial energy resources.[228] While these surcharges have been effective at generating significant investment in the renewable energy and energy efficiency, they are frequently criticized as being less than effective tools for promoting actual, sustainable market growth.[229]

In response to this critique, as well as a desire to advance the overall support for renewable energy, several states are moving away from a central distribution model towards market-based systems. Such market-based systems rely on a premise that an electric rate design that properly captures the benefits of "distributed energy resources" will spark private sector investment and lead to an ongoing, sustainable market.

2. Transition to a Sustainable Market for Renewables – Case Study: New York Reforming the Energy Vision and the Clean Energy Fund

Many jurisdictions are currently facing the issue of developing "utility 2.0" and a robust set of assets to populate the 21st century energy portfolio.

New York State is one of several states at the forefront of developing a market-based system for new energy resources. In late 2013, the New York State Public Service Commission initiated a "Reforming the Energy Vision" (REV) policy to

Incentive_Code=CT03R&re=0&ee=0 (last visited Feb. 20, 2015), *archived at* http://perma.cc/BRP5-5D85; *New York Renewable Portfolio Standard*, DATABASE OF STATE INCENTIVES FOR RENEWABLES & EFFICIENCY, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY03R (last visited Feb. 20, 2015), *archived at* http://perma.cc/8TSV-NTTS; *Rhode Island Renewable Energy Fund*, DATABASE OF STATE INCENTIVES FOR RENEWABLES & EFFICIENCY, http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=RI04R&re=0&ee=0 (last visited Feb. 20, 2015), *archived at* http://perma.cc/78NA-WJ7V.

228. *See, e.g.*, *Renewable Portfolio Standard*, DATABASE OF STATE INCENTIVES FOR RENEWABLES & EFFICIENCY, http://programs.dsireusa.org/system/program/detail/93 (last visited Feb. 20, 2015), *archived at* http://perma.cc/A6ZH-RVE6.

229. *See, e.g.*, *Surcharge Will Cause 'Total Collapse' of German Solar Industry, AS Solar Chief Claims*, PV-TECH (Feb. 4, 2014, 12:23 PM), http://www.pv-tech.org/news/eeg_surcharge_will_cause_total_collapse_of_germanys_solar_industry_as_solar, *archived at* http://perma.cc/2M4V-GQ3P.

establish an overall market structure and specific rate designs for electricity.[230] Through the proceeding, the Public Service Commission aims to address the legal, technological, and financial aspects of developing a truly 21st century electric system.

"Distributed Energy Resources" (DERs), are electricity generation resources separate from a grid and are essential to the concept of the new energy market.[231] The idea of a DER is to create a class of resources apart from the central generation and transmission model.[232] The purpose of DER is to provide a suite of energy tools aimed at diversifying and customizing the overall energy portfolio to include more renewable energy, energy efficiency measures, load management technologies, and demand response programs.[233] Under REV, a DER would create enhanced value due to increased environmental and reliability benefits. These benefits may include reductions to carbon emissions, decreased environmental impacts, reduced energy requirements, resiliency to major storm events, and advanced management options to respond to specific customer circumstances.[234]

In particular, a DER will advance a variety of renewable energy technologies and will promote the market in several ways. First, creating a class of DERs will directly induce a market for renewable energy. Financing for customer-sited renewable energy, such as rooftop solar panels, will directly benefit from a market for the resources, as the internalized benefits of the resources will expedite the return on the investment.[235] In short, customers will get more money for installing renewables on their property. Second, a DER market will also promote new market participants in the renewable energy sector because the rate

230. *See* N.Y. STATE DEP'T OF PUB. SERV., REFORMING THE ENERGY VISION: STAFF REPORT AND PROPOSAL 1 (2014).

231. *See id.*; *see also* N.Y. STATE DEP'T OF PUB. SERV., DEVELOPING THE REV MARKET IN NEW YORK: DPS STAFF STRAW PROPOSAL ON TRACK ONE ISSUES (Aug. 22, 2014) [hereinafter DEVELOPING THE REV MARKET IN NEW YORK].

232. *Id.* at 17.

233. *Id.* at 1.

234. DEVELOPING THE REV MARKET IN NEW YORK, *supra* note 231, at 44, 50.

235. *See id.* at 15.

structure will induce more traditional financing.[236] Third, the reorganized market created by REV and the DER classification will allocate detrimental environmental effects to traditional generation sources.[237] Here, the true costs of burning coal, for instance, will be included in the power stream revenue. In addition to the state policy changing market structure to better include the benefits and costs of particular energy sources in their price, federal carbon regulations will also help drive prices toward renewable energy.

The categorization and valuation of DER as a separate resource from traditional generation is an essential component to building a 21st century infrastructure. The clear delineation of the type of resources suitable for DER will better inform the financial sector and provide certainty in the market.

3. Clean Energy Fund

In addition to changing classification of energy resources to produce a more favorable environment for distributed energy and renewable energy resources, New York is also restructuring its public programs for funding energy efficiency and renewable energy, with the prospect of developing a sustainable market attractive to traditional financial entities.

The Clean Energy Fund aims to revolutionize financing for renewable energy in New York. The Clean Energy Fund is expected to gradually replace two programs—the Energy Efficiency Portfolio Standard and the Renewable Energy Portfolio Standard—with a suite of programs designed to catalyze private investment.[238]

The existing programs, the Energy Efficiency Portfolio Standard and the Renewable Energy Portfolio Standard, rely on retail level direct investment.[239] For example, the New York State Energy Research and Development Authority collects funds from customers, and uses the funds to purchase replacement

236. *Id.* at 31.
237. *See id.* at 43-49.
238. N.Y. STATE DEP'T OF PUB. SERV., CASE 14-M-0094, ORDER COMMENCING PROCEEDING 2 (May 8, 2014).
239. *Id.* at 2-3.

compact fluorescent light bulbs.[240] Other projects include spending surcharge dollars on discounted new appliances.[241] Overall, New York's energy efficiency and renewable energy programs have provided and aim to continue to provide significant reductions in greenhouse gases.[242] The Clean Energy Fund proposes replacing the existing programs with new portfolios aimed at reducing market friction to open new venues for traditional sources of capital to flow into the clean energy sector.

4. Market Development Portfolio

One of the key elements of the Clean Energy Fund is the creation of a Market Development Portfolio.[243] The Market Development Portfolio targets upstream and downstream market interventions that can speed the penetration of distributed renewable energy resources. Specifically, this portfolio is designed to attack many of the soft costs and transaction costs that may negatively impact the financial viability of an energy project.[244] Such upstream costs may include education and consumer awareness programs, while downstream costs include things such as siting and permitting costs.[245] Aiming governmental intervention funds at these costs supports the overarching goals of the 21st century grid deployment with the aim of stimulating mainstream financial sector participation in a self-sustaining distributed energy market.

240. *See* NMR GROUP, INC. & APEX ANALYTICS, LLC, MARKET EFFECTS, MARKET ASSESSMENT, PROCESS AND IMPACT EVALUATION OF NYSERDA STATEWIDE RESIDENTIAL POINT OF SALE LIGHTING PROGRAM 2010-2012, http://www.neep.org/sites/default/files/resources/2014-EMEP-pos-lighting-program.pdf.

241. *NYSERDA Announces $1.1 Million Equipment Rebate Program to Help Small Municipal Governments Reduce Energy Use*, N.Y. STATE (Sept. 9, 2012), http://www.nyserda.ny.gov/About/Newsroom/2012-Announcements/2012-09-19-NYSERDA-Announces-Equipment-Rebate-Program, *archived at* http://perma.cc/9WPG-34Q8.

242. *See* *Energy/Climate Programs*, N.Y. DEP'T OF CONSERVATION, http://www.dec.ny.gov/energy/43384.html (last visited June 2, 2015), *archived at* http://perma.cc/5ZL2-ZVT4.

243. *See* NYSERDA, CLEAN ENERGY FUND PROPOSAL 21 (2014).

244. *Id.* at 26.

245. *Id.* at 24.

5. Technology and Business Innovation Portfolio

Within the Clean Energy Fund, New York will create and administer a technology and business innovation portfolio.[246] The state will use the portfolio funds to invest in near market ready opportunities as well as potential innovations that present an opportunity for transformative change.[247] The latter tool mimics venture capital financing, allowing the state to specifically invest in opportunities that may fundamentally reshape the renewable energy landscape, but may yet not be attractive for traditional finance.

As with other elements of the Clean Energy Fund, the technology and business innovation portfolio represents a large shift towards building a renewable energy system equipped to consistently overcome the traditional issues facing a nascent energy market. Instead of directly funding projects, the program aims to attract private funding, catalyze innovation and diffuse risks associated with research and development.[248]

6. NY-Sun

New York created the NY-Sun initiative as another component of the Clean Energy Fund.[249] NY-Sun is specifically aimed to increase the number of solar electric systems in the state by stimulating the marketplace to reduce system costs. The initiative redesigns solar programs using a "Megawatt Block" system to provide transparency and certainty, while sending a market signal that the state intends to eventually eliminate cash incentives to the solar sector.[250] The Megawatt Block system assigns megawatt solar energy targets to specific regions at

246. *Id.* at 33.
247. *See id.* at 34.
248. *Id.*
249. N.Y. STATE DEP'T OF PUB. SERV, CASE 03-E-0188, ORDER AUTHORIZING THE EXPANSION OF THE SOLAR PHOTOVOLTAIC AND GEOGRAPHIC BALANCE PROGRAMS FROM 2012 THROUGH 2015 AND THE REALLOCATION OF MAIN-TIER UNENCUMBERED FUNDS (Apr. 24, 2012).
250. *NY-Sun Initiative Frequently Asked Questions*, N.Y. STATE, http://ny-sun.ny.gov/About/NY-Sun-FAQ (last visited Jan. 30, 2015), *archived at* http://perma.cc/C6KD-REC5.

certain incentive levels.[251] Once the target is reached, another block with new targets and incentives opens.[252] Block funding is novel compared to previous grant-making activities because it provides a narrowly tailored incentive structure aimed at building a self-sustaining market with measured goals rather than just overarching megawatt production goals.[253]

7. Green Bank

As part of the larger transition from surcharges and public programs to a sustainable market, New York is implementing a novel Green Bank to catalyze private sector financing in renewable energy.[254] The proposed Bank will target renewable energy and energy efficiency investments. The Bank is part of the overall portfolio of new programs working in concert to break the traditional mold of renewable-averse energy financing.[255]

Governor Andrew Cuomo announced the Green Bank and capitalized the program with $1 billion as part of the larger Clean Energy Fund program.[256]

While the outcome of New York's Clean Energy Fund is not yet proven, it represents a sweeping shift toward innovative, market-based, financing for renewable energy, energy efficiency, and distributed generation. By attempting to "foster new investment opportunities to attract private capital to invest in clean energy" the Clean Energy Fund represents a move away from direct investment of public funds toward a new, integrated, self-sustaining clean energy market.

251. *Id.*
252. *Id.*
253. *See id.*
254. *Governor Cuomo Launches New York Green Bank Initiative to Transform the State's Clean Energy Economy*, N.Y. STATE, (Sept. 10, 2013), http://www.governor.ny.gov/news/governor-cuomo-launches-new-york-green-bank-initiative-transform-states-clean-energy-economy, *archived at* http://perma.cc/XXF4-Z3UW.
255. *See id.*
256. *Id.*

8. 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.[257] In a CCA program, municipalities pass an ordinance that allows a municipality to aggregate its customers and act as a market participant.[258] 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.[259] The most basic CCA programs aggregate customers and initiate programs on an opt-out basis, acquire their information and bundle their purchasing capacity. Traditional ESCOs then bid on a program for the group and bundle the purchases necessary for the program for the customers.[260]

Next generation CCAs function more like a municipal power authority, allowing the CCA municipality to acquire and manage energy resources serving its customers. Through the CCA the 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.[261]

CCA allows communities to control the choice of their energy supply, while working through existing delivery systems.[262] The newest CCAs use this potential to design community wide

257. *What is CCA?*, LEAN ENERGY U.S., http://www.leanenergyus.org/what-is-cca/ (last visited Mar. 15, 2015), *archived at* http://perma.cc/928G-8LB5.

258. *See* CITIZENS FOR LOCAL POWER, TAKING CONTROL OF OUR ENERGY SUPPLY: COMMUNITY CHOICE AGGREGATION FOR MUNICIPALITIES 2 (2014), *available at* http://www.citizensforlocalpower.com/community-choice--cca-.html, *archived at* http://perma.cc/43YP-GHGD.

259. *See* PAUL FENN & SAMUEL GOLDING, COMMUNITY CHOICE AGGREGATION 2.0, at 4 (2004), *available at* http://localpower.com/whitepaperCopyright2011byLocalPowerInc.pdf, *archived at* http://perma.cc/Y74T-U5L4.

260. *See id.*

261. *See generally id.*

262. *See* CITIZENS FOR LOCAL POWER, TAKING CONTROL OF OUR ENERGY SUPPLY: COMMUNITY CHOICE AGGREGATION FOR MUNICIPALITIES 2 (2014), *available at* http://www.citizensforlocalpower.com/community-choice--cca-.html, *archived at* http://perma.cc/43YP-GHGD.

electricity load reduction through investments in energy efficiency and renewable energy.[263] 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. This manifests as financial support for renewable energy, by directing funds towards renewable energy projects by aggregating customers who recognize benefits of renewables beyond a strict "bottom line." While CCA frequently results in lower bills, the benefit of choice goes beyond that. By empowering individuals in a community to select local renewable power, CCAs sidestep the pitfalls of traditional financing for renewables.

9. Community Choice Aggregation: Case Study – Sonoma Clean Power

Sonoma Clean Power (SCP) is the new, locally controlled electricity provider in Sonoma County, California.[264] SCP provides residential and business customers across the county with the option of using environmentally friendly power generated by renewable sources at competitive rates.[265]

SCP worked with a federal laboratory to see how far and fast renewable energy load could reach the grid without triggering a rise in rates, and then negotiated the rate with customers.[266] SCP projects eighty-five percent coverage of county customers within a six-year period.[267] A key focus of SPC is the development and implementation of local energy programs, including energy efficiency programs, distributed generation programs and other energy programs responsive to community

263. *Id.*

264. *About SCP: Who is Sonoma Clean Power?*, SONOMA CLEAN POWER, http://sonomacleanpower.org/about-scp/ (last visited Jan. 30, 2015), *archived at* http://perma.cc/B78X-KBZX.

265. *Id.*

266. SONOMA CLEAN POWER, SONOMA CLEAN POWER RESOURCE 2014 – 2018 PLAN DRAFT V0.4 (2014), *available at* https://sonomacleanpower.org/wp-content/uploads/2014/08/SCP-Resource-Plan-Draft-v0.4-clean.pdf, *archived at* http://perma.cc/8T93-Y3WU.

267. *Id*. at 3.

interests.[268] SCP emphasizes community aggregation in support of several key policies including: increasing the use of renewable energy resources and reducing fossil-fuel electric generation, investment in local infrastructure, and management of a diverse resource portfolio.[269] The objective of these policies is to provide an energy resource mix of fifty percent renewable energy by 2018.[270]

SCP is a functioning model of CCA, demonstrating the potential for a community to select its energy resources to suit its own policy goals. In addition, it demonstrates how a community can establish rates manifesting the policy goals that produce reliable financial stability for distributed renewable energy.

III. REFLECTIONS ON INNOVATIVE FINANCING

Renewable energy resources are an essential element of a global response to climate change and health-threatening power plant pollution. The sun and wind are free, and the lifecycle cost of the equipment needed to convert these resources to electricity is competitive with traditional electricity resources, even more so if the huge subsidies to traditional energy resources are eliminated and if the externality costs of the traditional resources and traditional energy subsidies were included.

The discussed examples include many active innovative financing mechanisms spurring investment in renewable power generation. Ranging from microfinance in off-grid rural applications, on bill financing of community renewable energy programs, to YieldCos acquiring increasingly larger scale generation capacity, new models for finance are rapidly aiding growth in the renewable energy market. As the cost of infrastructure decreases and access to cheap financing becomes more readily available, renewable energy will become an even more viable force in helping to bring global emissions from the

268. SONOMA CLEAN POWER, SONOMA CLEAN POWER COMMUNITY CHOICE AGGREGATION IMPLEMENTATION PLAN AND STATEMENT OF INTENT 20 (2013), *available at* https://sonomacleanpower.org/wp-content/uploads/2013/12/Sonoma-Clean-Power-CCA-Implementation-Plan-2013-08-20.pdf.

269. *Id.*

270. *Id.*

power sector within safe and sustainable levels. The progress being made, as described in this paper, is extremely encouraging.