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Emerging Law Addressing Climate Change and Water

by

Elizabeth Burleson*

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"Water shortages are on the rise, stemming from soaring demand, growing populations and rising living standards, and compounded by climate change."[1]

Abstract

The World Economic Forum recognizes that while restrictions on energy affect water systems and vice versa, energy and water policy are rarely coordinated. There is a clear challenge to craft a sound energy strategy in light of shrinking water resources and climate unpredictability. Transboundary water, energy and climate coordination can occur through international consensus building. Public participation in decision-making can sustain trust in governments and strengthen the legitimacy of legal decisions. Process and outcome are both integral to addressing water, climate, and energy challenges.

I. Introduction

Countries around the world have responded to the financial crisis by investing in water infrastructure.[2] For instance, stimulus funding to the water sector in China and the United States range between ten and fifteen billion dollars.[3] Public private partnerships are likely to address an array of infrastructure issues. For instance, IBM estimates that leaks amount to sixty percent of

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[1] Michael Szabo, *Stimulus Cash To Boost $400 Billion Water Market: Panel*, REUTERS, July 9, 2009, at 1, *available at* http://planetark.org/wen/53689.

[2] *Id*.

[3] Poornima Gupta, *IBM Sees Big Opportunity in Water Management IT*, REUTERS, Aug. 10, 2009, at 1, *available at* http://planetark.org/wen/54144 ("IBM is pushing ahead into providing technology services to manage water, a market $10 billion market that the company sees growing quickly.").

Electronic copy available at: http://ssrn.com/abstract=1592023

water delivered, at a price to water utilities worldwide of fourteen billion dollars annually.[4] IBM seeks to play a larger role in levee oversight and flood control and is currently involved in monitoring/forecasting on the Hudson River as well as assessing wave conditions and pollution levels in Ireland.[5] Emerging cost-effective technologies can facilitate smart water metering, water recycling and desalinating seawater.

This article considers ways in which multi-stakeholder coordination has achieved environmentally sound water and energy policy. Part II considers the role of public participation in desalination Environmental Impact Assessments, focusing upon the Århus Convention. Part III considers the challenge presented by desertification and biofuel production to human security. This analysis concludes that sustainable development requires greater coordination between energy, water and climate policies.

II. Environmental Impact Assessments, Public Participation, and Desalination

A new method of desalination involving microscopic molecules known as clathrates can reduce the expense of separating salt from water by ninety percent.[6] Affordable methods of desalting water has alleviated severe water stress between jurisdictions but presents challenges to avert byproduct brine disposal problems as well as greenhouse gas emissions during the desalination process.[7] Wind and solar power present promising means by which to produce fresh water from salt water in a low carbon way. Worldwide, 13,080 desalination plants produce more

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[4] *Id. See also* Scott Malone, *GE Sees Tide Coming in for Water Business*, REUTERS, Aug. 12, 2009, at 1, *available at* http://planetark.org/wen/54202; Sewell Chan & Jennifer Lee, *Water Main Break Floods Section of TriBeCa*, N.Y.TIMES, Aug. 7, 2009, at 1, *available at* http://cityroom.blogs.nytimes.com/2009/08/07/water-main-break-floods-section-of-tribeca/?partner=rss&emc=rss ("A 12-inch cast-iron water main installed in 1870 broke in Lower Manhattan early Friday morning, flooding about a dozen buildings, forcing the evacuation of several structures, and sending water gushing over the area at least three blocks in… TriBeCa.").

[5] Gupta, *supra* note 3, at 1.

[6] Szabo, *supra* note 1, at 1.

[7] *Id*.

Electronic copy available at: http://ssrn.com/abstract=1592023

than 12 billion gallons of water a day, according to the International Desalination Association.[8] In Australia, Perth's desalination facility obtains power from a wind farm.[9]

Desalination plant discharges can increase greenhouse gasses in the atmosphere and contribute to general air pollution while discharges into the ocean can impact coastal water quality and affect aquatic life.[10] By conducting Environmental Impact Assessments, the available alternatives and their costs and benefits can be factored into desalination decision-making.[11] For instance, coastal groundwater extraction can risk salt-water intrusion of aquifers while water transfers from lakes and rivers can significantly alter ecosystems and water cycles.[12] Just as in

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[8] Kathryn Kranhold, *Water, Water, Everywhere…; Seeking Fresh Sources, California Turns to the Salty Pacific, But Desalination Plants Face Criticism on Environment, Costs*, WALL ST. J., Jan. 17, 2008, at B1. *See also Peru Bets On Desalination To Ensure Water Supplies*, REUTERS, Mar. 10, 2008, at 1, *available at* http://www.planetark.com/dailynewsstory.cfm/newsid/47459/story.htm ("Peru plans to start desalinating water from the Pacific Ocean to make up for declining supplies from fast-melting glaciers affected by climate change."); s*ee also* Jane Sutton*, French Fry Oil to be Tested on Guantanamo Fleet*, REUTERS, Nov. 9, 2007, at 1, *available at* http://www.reuters.com/article/environmentNews/idUSN0923382320071109?feedType=RSS&feedName=environmentNews ("Isolation has forced the Navy to use other renewable resources at Guantanamo. The normally arid base gets all of its water from a desalinization plant that makes seawater drinkable and 5 percent of its electricity from windmills that sit on a high bluff.").

[9] Patrick Barta, *Salt Free: Amid Water Shortage, Australia Looks to the Sea*, WALL ST. J., Mar. 11, 2008, at A1 ("Most modern facilities use a process known as reverse osmosis. This involves pushing water under high pressure through porous membranes that filter out the salt. Energy is needed to raise the pressure and then force the water through the membranes."). *See also Cheaper Desalination*, ECONOMIST, Oct. 29, 2009, at 1, *available at* http://www.economist.com/sciencetechnology/displaystory.cfm?story_id=14743791&fsrc=rss ("Existing desalination plants work in one of two ways. Some distil seawater by heating it up to evaporate part of it. They then condense the vapour—a process that requires electricity. The other plants use reverse osmosis. This employs high-pressure pumps to force the water from brine through a membrane that is impermeable to salt. That, too, needs electricity. Even the best reverse-osmosis plants require 3.7 kilowatt hours (kWh) of energy to produce 1,000 litres of drinking water.").

[10] UNITED NATIONS ENV'T PROGRAMME, DESALINATION: RESOURCE AND GUIDANCE MANUAL FOR ENVIRONMENTAL IMPACT ASSESSMENTS 4 (2008), [hereinafter DESALINATION: RESOURCE AND GUIDANCE] *available at* http://www.unep.org/Themes/Freshwater/PDF/Resource&GuidanceManualforEIAs.pdf.

[11] *Id*.

[12] *Id*.

assessing the pros and cons of wind power, the disadvantages of desalination may be outweighed by the greater negative effects of alternatives.[13]

As *Desalination: Resource and Guidance* explains, Environmental Impact Assessments "identify, evaluate and mitigate the environmental effects of a proposed project prior to major decisions and commitments being made. It usually adopts a broad definition of 'environment' considering socio-economic as well as environmental health effects as an integral part of the process."[14] Environmental Impact Assessments highlight the consequences of proposed developments and promote sustainability by weighing alternatives and mitigation measures.[15] The first step is to determine environmental, socioeconomic, and public health baseline data before construction commences, then an assessment of the status quo (without project construction) is considered. Environmental Impact Assessments evaluate direct and indirect environmental, socio-economic, and public health impacts of all life-cycle stages of a given project.[16] Optimal geological conditions for desalination ensure a stable geologic foundation as well as minimizing impacts upon soil and sediment stability.[17] Biological factors to consider when locating a desalination plant include: avoiding unique ecosystems and those that are fragile: coral reefs, mangroves, and other special aquatic habitats are crucial to biodiversity, food security and storm protection.[18] Oceanographic conditions should enable the byproduct brine to sufficiently dilute, disperse, and degrade chemicals.[19] Thus, careful assessment of water circulation, water depth, currents, tides, and surf are important to evaluate.[20] Often sheltered,

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[13] *Id*.
[14] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 5.
[15] *Id*.
[16] *Id*.
[17] *Id*. at 10.
[18] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 10.
[19] *Id*. at 11.
[20] *Id*.

shallow locations do not have enough water flow and should be avoided in favor of exposed rocky/sandy coastal conditions that have strong currents and surf.[21]

Individuals conducting Environmental Impact Assessments should facilitate early and genuine public participation. *Desalination: Resource and Guidance* explains that the "overall goal is the involvement of the public in decision-making. This is based on fundamental premises of democratic societies, such as transparency of decision-making and equity among the affected populations in terms of ethnic background and socio-economic status."[22] Public participation is particularly important in the context of: religious and cultural site impact, existing negative environmental impacts, equity aspects of proposed location, general awareness raising about the pros and cons of the proposed project, and conflict resolution/consensus building among stakeholders.[23] Public participation in implementation can include stakeholder-monitoring committees.[24] Involving directly and indirectly affected individuals in decision-making facilitates trust and can establish partnerships.[25] It also helps ensure that vital considerations are not bypassed. Providing the public with information and the opportunity to become educated about the proposed project includes a full explanation of environmental, socio-economic and public health implications.[26] For instance, desalination's capacity to increase access to clean water can help women transition from daily water collection to other activities.[27] On the other hand, desalination is an energy-intensive process.[28]

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[21] *Id*.
[22] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 11.
[23] *Id.* at 12.
[24] *Id*. at 19.
[25] *Id*.
[26] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 22.
[27] *Id*. at 23.
[28] WORLD WATER ASSESSMENT PROGRAMME, UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 3: WATER IN A CHANGING WORLD 117 (2009), *available at* http://webworld.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3_Water_in_a_Changing_World.pdf.

Atmospheric emissions and local air conditions are important considerations when deciding to proceed with desalination.[29] UNEP Global Mercury Partnership and other initiatives gather partners and stakeholders including governments, representatives of industry and environmental organizations to address the impact of chemical concentrations on humans and the environment.[30] Renewably powered desalination plants can substantially minimize the impact of proposed projects.[31]

Water and energy policy should be coordinated. The Wall Street Journal notes that

> [t]he electric-power industry accounts for nearly half of all water withdrawals in the U.S., with agricultural irrigation coming in a distant second at about 35%. Even though most of the water used by the power sector eventually is returned to waterways or the ground, 2% to 3% is lost through evaporation, amounting to 1.6 trillion to 1.7 trillion gallons a year that might otherwise enhance fisheries or recharge aquifers, according to a Department of Energy study. The study concluded that a megawatt hour of electricity produced by a wind turbine can save 200 to 600 gallons of water compared with the amount required by a modern gas-fired power plant.[32]

While renewable energy can mitigate air pollution and climate impacts of desalination, disposal of brine remains a concern. It is important to evaluate chemical usage and properties for pretreatment of the intake water to prevent scaling, corrosion, cleaning equipment to minimize

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[29] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 29.

[30] UNITED NATIONS ENV'T PROGRAMME, UNITED NATIONS ANNUAL REPORT 78-79 (2009), *available at* http://www.unep.org/PDF/AnnualReport/2008/AnnualReport2008_en_web.pdf. *See also* William Howarth, *Water Pollution: Improving The Legal Control's In Retrospect*, 20 J. ENVTL. L. 3, at 4 (2008) ("[T]he REACH (Regulation concerning the registration, evaluation, authorisation and restriction of chemicals) (Reg. 1907/2006) may be even more effective than the Water Framework Directive (2000/60/EC) since product-orientated chemicals legislation can limit marketing of dangerous substances before they reach the aquatic ecosystem . . . Action based upon life-cycle thinking about products has the potential to be more effective than trying to address diffuse pollutants through land use regulation and is certainly more effective than regulation of end-of-pipe emissions.").

[31] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 43.

[32] Rebecca Smith, *Water Worries Shape Local Energy Decisions*, WALL ST. J., Mar. 26, 2009, at 1, *available at* http://online.wsj.com/article/SB123802383042842123.html.

biofilms, as well as disinfect/stabilize product water.[33] Total loads should be available to the general public,[34] and tests should include long-term sediment toxicity evaluations for heavy metals as well as bottom feeding aquatic life that may be disproportionately impacted by accumulated chemicals.[35]

A. The Århus Convention and the Human Right to a Clean Environment

Increasing the flow of information to and the thoughtful analysis by ordinary citizens avoids policy stagnation in a rapidly changing world. While scientists provide valuable technical expertise, civil society must be consulted regarding such value judgments as the appropriate level of governmental intervention. The Århus Convention has codified a human right to a clean environment, granting citizens access to environmental information, participation in decision-making in environmental matters, and judicial redress.[36] The Convention recognizes the need to protect the environment for both present and future generations.[37] Including citizens in environmental protection increases the effectiveness of that protection since people often have a deep interest and are affected by the state of their surrounding environment.[38] This rights-based approach prohibits discrimination on the basis of citizenship, nationality, or domicile. While the Convention is not focused on the private sector, when environmental regulation has been devolved to privatized bodies, these entities are covered under the definition of public

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[33] *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters*, 38 I.L.M. 517 (1999), *available at* http://www.unece.org/env/pp/documents/cep43e.pdf.

[34] UNITED NATIONS ENV'T PROGRAMME, DESALINATION, *supra* note 10, at 29.

[35] *Id*. at 30.

[36] *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice regarding Environmental Matters (Århus Convention)*, June 25, 1998, 38 I.L.M. 517 (1999) (entered into force Oct. 30, 2001), *available at* http://www.unece.org/env/pp/documents/cep43e.pdf. The convention was negotiated among the Member States of the United Nations Economic Commission for Europe (UNECE). On June 25, 1998, the convention was adopted at a pan-European meeting of environment ministers in Århus, Denmark. All of the member states of the European Union and the EU itself signed. The convention entered into force on October 30, 2001.

[37] *Id.* at 517.

[38] *Id.*

authorities.[39]

Public authorities must generate and provide basic environmental information, access to which will facilitate informed participation in decision-making. By increasing government accountability and transparency, better decisions can be reached. Having a stake in the process should enhance people's willingness to implement decisions. Public authorities have both a passive responsibility to respond to requests for information and an active responsibility to collect, update and distribute information. Article 4 sets forth a presumption in favor of access, leaving a finite list of exemptions that are to be interpreted restrictively.[40] Both individuals and nongovernmental organizations may request environmental information without proving that they are interested parties.[41] The Convention brings together human rights and environmental law. Access to information is a prerequisite to public participation in environmental decision-making.[42] The Convention grants the public with a right to be heard in the law making process and a right to seek judicial remedies when there has been a breach of environmental law.[43]

B. Public Participation in Water Management

Water management can become a model for good governance.[44] The rational for treating

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[39] *Id.* at 518.

[40] *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, supra* note 36, at 520 ("[G]rounds for refusal shall be interpreted in a restrictive way, taking into account the public interest served by disclosure and taking into account whether the information requested relates to emissions into the environment.").

[41] *Id.* at 519 ("The public concerned' means the public affected or likely to be affected by, or having an interest in, the environmental decision-making; for the purposes of this definition, non-governmental organizations promoting environmental protection and meeting any requirements under national law shall be deemed to have an interest.").

[42] *Id.* at 517.

[43] *Id.* at 524.

[44] UNITED NATIONS EDUC., SCIENTIFIC & CULTURAL ORG., THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2: WATER A SHARED RESPONSIBILITY 418-19, *available at* http://www.unesco.org/water/wwap/wwdr2/table_contents.shtml (noting that contracting-out services, operation and management of the water supply, allows the public sector to take advantage of private sector technology and skills, while maintaining the ability to ensure equity of water availability). *See also* Denise Lach, Helen Ingram, and Steve Rayner, *Maintaining the Status Quo: How Institutional Norms and Practice Create Conservative Water Organizations*, 83 TEX L. REV. 2027, 2032 (2005) ("Water managers

water as a public good stems from the fact that often fresh water can be used multiple times before flowing into the sea. Furthermore, water falls in inconsistent, seasonal patterns that do not evenly distribute the resource to those who depend upon it for survival. Given the weight of water, it is not easily transported across large distances. While drinking water often must be transported and filtered, generally water can be used in its natural form without further development. All of these factors lead communities to recognize public rights of use to water and to invoke the public trust with regard to water management. Water transfers are on the increase, but these factors also lend credence to arguments that water should be protected in its original location.[45]

Integrated Water Resources Management involves considering ecological and socio-economic issues together within an ecosystem approach.[46] Increasing access to basic water data can facilitate water governance. The second World Water Report notes that

> [i]f citizens cannot access basic information on water quantity and quality, it seriously curtails their chances of halting environmentally unsound water projects or to hold relevant government agencies accountable . . . water provision is often

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at all levels and in all organizations we interviewed consistently described a common hierarchy of values for managing water resources: reliability, quality, and cost. Reliability for these managers means meeting several, often conflicting, demands: (1) water that is always there when the customer turns on the faucet; (2) water for crops on the most critical days of the growing season; (3) water for fish at the lowest stream flow; (4) water to generate hydroelectricity when demand is at peak; and (5) no substantial loss of life or property in the worst flood.").

[45] UNITED NATIONS DEV. PROGRAMME, HUMAN DEVELOPMENT REPORT 2006: BEYOND SCARCITY: POWER, POVERTY AND THE GLOBAL WATER CRISIS 117 (2006) [hereinafter HUMAN DEVELOPMENT REPORT], *available at* http://hdr.undp.org/hdr2006.

[46] UNITED NATIONS EDUC., SCIENTIFIC & CULTURAL ORG., THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2, *supra* note 44, at 185. *See also* Lach et al., *supra* note 44, at 2027; UNITED NATIONS EDUC., SCIENTIFIC & CULTURAL ORG., FROM POTENTIAL CONFLICT TO COOPERATION POTENTIAL: WATER FOR PEACE PREVENTION AND RESOLUTION OF WATER RELATED CONFLICTS 3 (2003); HUMAN DEVELOPMENT REPORT, *supra note* 45, at 10, 14; UNITED NATIONS DEP'T OF ECON. AND SOCIAL AFFAIRS ET AL., GOVERNING WATER WISELY FOR SUSTAINABLE DEVELOPMENT 372 (2007), *available at* http//www.unesco.org/water/wwap/wwdr/pdf/chap15/pdf; UNITED NATIONS EDUC., SCIENTIFIC, AND CULTURAL ORG., KNOWLEDGES OF NATURE 2: WATER AND INDIGENOUS PEOPLES 12 (Rutgerd Boelens et al., eds., 2006), *available at* http://portal.unesco.org/science/en/files/4938/11437249191WATER_complete_LR.pdf/WATER%2Bcomplete_LR.pdf.

> less a question of available water resources than of properly functioning institutions and proper infrastructure management.[47]

Given the natural monopoly features of the water sector, governments should assess public-private partnerships with a commitment to equity and meaningful oversight.[48] The United Nations Development Programme (UNDP) notes that "[t]he debate on privatization has sometimes diverted attention from the pressing issue of public utility reform."[49] UNDP calls upon states to provide access to water and to measure success upon performance rather than public/private status.[50] UNDP explains that, "[a]ll governments should prepare national plans for accelerating progress in water and sanitation, with ambitious targets backed by financing and clear strategies for overcoming inequalities."[51] Beyond such supply-side policies as dams and desalination, decision makers at all levels need to implement such demand-side policies as increased efficiency of water use through transfer of sustainable technologies and sensible subsidies.[52]

Public participation ranging from information sharing to decision-making remains central to equitable and effective water management.[53] The water governance shift towards integrated water resources management is bringing principles of equitable distribution, efficiency, and environmental sustainability into the limelight.[54] Water governance involves finding equilibrium

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[47] UNITED NATIONS EDUC., SCIENTIFIC & CULTURAL ORG., THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2, *supra* note 44, at 50.

[48] *Id.* at 10, 418.

[49] HUMAN DEVELOPMENT REPORT, *supra* note 45, at 10, 14.

[50] *Id.*at 10.

[51] *Id.* at 8.

[52] *See id.* at 14 ("Over the period to 2050 the world's water will have to support the agricultural systems that will feed and create livelihoods for an additional 2.7 billion people.").

[53] UNITED NATIONS EDUC., SCIENTIFIC & CULTURAL ORG., THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2, *supra* note 44, at 421.

[54] UNITED NATIONS DEP'T OF ECON. AND SOCIAL AFFAIRS ET AL., *supra* note 46, at 372.

between ecosystem integrity and socio-economic uses of water.[55] Decision-makers include governments, civil society, and the private sector.[56] Achieving good water governance requires balancing conflicting water rights, increasing intersectoral communication, broadly agreeing upon economic incentives, and deciding what constitutes fragmentation of water management and administration versus effective local water governance.[57] Making such decisions requires mechanisms for public participation and conflict resolution.[58] Several ingredients of good water governance include: (1) broad participation through the entire decision-making process; (2) transparent flow of information; (3) equitable opportunities to increase well-being; (4) accountability from governments, the private sector and civil society; (5) coherency of water resource measures; (6) responsiveness to changing water conditions and societal factors; (7) integrative approach to water basin management; and (8) ethical principles that resonate with varying societies based upon inclusive dialogues.[59] Reasonable and equitable use of transboundary water resources can help sustain international peace and security. Achieving good governance and sustainable development requires the political will to take a long term and integrated approach to issues. Climate change is altering the scope of global insecurity as water availability becomes less predictable.[60]

Beyond agreeing to total quantities of water, stakeholders can increase their collective understanding and reach consensus on sustaining fisheries *vis a vis* hydropower.[61] Discussions

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[55] *Id.*at 372.

[56] *Id.*

[57] *Id.*

[58] UNITED NATIONS DEP'T OF ECON. AND SOCIAL AFFAIRS ET AL., *supra* note 46, at 372.

[59] *Id*. at 373.

[60] HUMAN DEVELOPMENT REPORT s*upra* note 45, at 15; *see generally* Brian E. Gray, *Global Climate Change: Water Supply Risks and Water Management Opportunities*, 14 HASTINGS W.-N.W. J. ENVTL. L. & POL'Y 1453 (2008).

[61] Stakeholders can include individuals, corporations, governmental entities (tribes, municipal, provincial, national including national parks, regional, international) non-governmental organizations, and

on multiple use-irrigation and flood control can also avert conflict. When water flows can be as crucial as how much water flows. As wet places become wetter and dry places become dryer, climate change provides a powerful impetus for collective action to sustain human security.

III. Desertification, Biofuels and Human Security

United Nations Secretary-General Ban Ki-Moon notes that "one-third of the Earth's surface is affected by desertification, endangering the livelihoods and development of up to one billion people."[62] Mr. Ban explains that "we must reconsider our agricultural practices and how we manage our water resources."[63] The agriculture sector consumes seventy percent of fresh water and is responsible for up to eighty percent of deforestation.[64] Rising demand for biofuels and animal feed is likely to increase water stress and make it more difficult to manage water sustainably.[65] Desertification threatens 1.2 billion people in more than 100 countries.[66] Scaling up good practices, raising awareness, and mobilizing resources can help avert desertification.[67] Countries such as China have begun countering desertification with tree-planting programs yet

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civil society generally. In particular, greater recognition of tribal water rights has come with the recognition that coordinated efforts to share water benefits can avert water conflicts.

[62] *Desertification Poses Security Risks, Ban Warns on World Day*, UN NEWS, June 17, 2009, at 1, *available at* http://www.un.org/apps/news/story.asp?NewsID=31171&Cr=desertification&Cr1=.

[63] *Id*.

[64] *Id.*

[65] *Id*.

[66] *Desertification Poses Security Risks, Bans Warns on World Day, supra* note 62.

[67] *Combating Desertification Could Help Tackle Other Global Crises – UN Official*, UN NEWS, Oct. 29, 2008, at 1, *available at* http://www.un.org/apps/news/story.asp?NewsID=28756&Cr=desertification&Cr1. *See also* Aseel Kami, *Iraq To Revive Dead Farmland By Sucking Out Salt*, REUTERS, Dec. 2, 2008, at 1, *available at* http://planetark.org/wen/50743 ("Iraq imports almost all of its food, using receipts from oil to pay for it. Much of the government's budget is spent on food rations. Harmful salinity can be reversed by pumping out the groundwater beneath the soil over several years. Such projects, though costly, have helped farmers reclaim salt-deadened land in Australia").

face the problem that the new trees require large amounts of water.[68] The Desert Margins Program has established projects across nine African nations, implementing rainwater harvesting,[69] rotation grazing and other strategies to reduce desertification.[70] The *UN Guide to Climate Neutrality* explains that:

> [o]ver the past three years, global food prices have risen 83 per cent. Governmental subsidies and targets for biofuel in developed countries has created a sudden increase in demand, partly responsible for the rise. Among a number of other factors are population growth and changing diets towards more energy intensive meat consumption. Energy crops may compete for land with other uses and potentially result in increased food prices.[71]

The Food and Agriculture Organization (FAO) notes that food prices have soared as a result of demand for biofuels, climate change, population growth and emerging country demand.[72] Of the one billion people living on an income of less than one dollar per day, most depend upon such

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[68] *UN Issues Desertification Warning*, BBC NEWS, June 28, 2007, at 1, *available at* http://news.bbc.co.uk/2/hi/africa/6247802.stm.

[69] *See* Kirk Johnson, *It's Now Legal to Catch a Raindrop in Colorado*, N.Y. TIMES, June 28, 2009, at 1, *available at* http://www.nytimes.com/2009/06/29/us/29rain.html?_r=1&ref=todayspaper.

[70] *Desertification Poses Security Risks, Ban Warns on World Day*, *supra* note 62, at 1.

[71] UNITED NATIONS ENV'T PROGRAMME, KICK THE HABIT: A UN GUIDE TO CLIMATE NEUTRALITY 133 (2008), *available at* http://www.unep.org/publications/ebooks/kick-the-habit/pdfs/KickTheHabit_en_lr.pdf.

[72] Ben Hirschler, *Gore Says "Changing Light Bulbs" Not Enough*, REUTERS, Jan. 25, 2008, at 1, *available at* http://www.planetark.com/dailynewsstory.cfm/newsid/46614/story.htm. *See also* UNITED NATIONS ENV'T PROGRAMME, GREEN JOBS: TOWARDS DECENT WORK IN A SUSTAINABLE, LOW-CARBON WORLD 118 (2008), *available at* http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf (noting that an array of criteria affect the sustainability of biofuel production, "[a]mong these factors are the type of land used (rainforests, woodlands, peat forests, crop-growing areas, savannahs, wetlands), choice of feedstock, type of agricultural operation (small-scale versus large monocrop plantations), and processing methods. Some feedstocks (such as sugar cane) require substantial amounts of water, while others (jatropha) take far less, and processing of energy crops may cause dangerous agrochemical runoff. Corn-based ethanol, the dominant biofuel in the United States, appears to be particularly problematic in light of its energy and carbon balance. The complexity of circumstances produces a range of cost and benefits in pursuing biofuels projects. Environmental and human impacts also depend on such key factors as whether biofuels will be produced on large-scale plantations (that are likely to be industrialized monocultures) or smaller plots of land; whether these fuels are destined for local use or for export markets; how much influence local communities have vis-à-vis corporations and government agencies as well as how much of the income these communities can garner.").

ecosystem services as agriculture, hunting and fishing.[73] According to the World Health Organization, one dollar spent on water and sanitation translates into economic benefits of up to twelve dollars.[74]

Global population has doubled over the past forty years, with most of the growth taking place in developing countries.[75] Population growth is a strong indicator of increased water demand as is rising energy intensive standards of living. A liter of biodiesel requires 9,000 liters of water.[76] Each individual requires roughly twenty liters of water a day for drinking, washing, and cooking.[77] Rivers flowing through some of the most densely populated regions are not providing as much water as they have in the past, affecting human security along the Yellow River, Ganges, Niger, and Colorado.[78]

Water in a Changing World notes that

> The world's population is growing by about 80 million people a year, implying increased freshwater demand of about 64 billion cubic metres a year. An estimated 90% of the 3 billion people who are expected to be added to the population by 2050 will be in developing countries, many in regions where the current population does not have sustainable access to safe drinking water and adequate sanitation. Many governments lack the financial resources and institutional capacity to provide for these needs, while countries that have

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[73] UNITED NATIONS ENV'T PROGRAMME, ECOSYSTEM MANAGEMENT PROGRAMME: A NEW APPROACH TO SUSTAINABILITY 2 (2009), *available at* http://www.unep.org/Themes/Freshwater/PDF/EcosystemManagementProgramme.pdf ("Natural wetlands can process and filter pollutants such as metals, viruses, oils, excess nutrients, and sediment. Forests retain water and slowly filter it through the ground.").

[74] Deborah Zabarenko, *As Climate Changes, Is Water The New Oil?,* REUTERS, Mar. 23, 2009, at 1, *available at* http://planetark.org/wen/52137.

[75] UNITED NATIONS ENV'T PROGRAMME, ECOSYSTEM MANAGEMENT PROGRAMME: A NEW APPROACH TO SUSTAINABILITY, *supra* note 73, at 2 ("An expanding population may increase demand for land (land use change), leading to more consumption of wild foods (resource extraction) and more intensive agriculture (external inputs like fertilizers), require more transport to and within sprawling cities (emissions), and result in experiments with fast growing alien organisms in an attempt to increase productivity for people and for goods (modification and movement of organisms).").

[76] Hirschler, *supra* note 72, at 1.

[77] Richard Black, *Water - Another Global 'Crisis'?*, BBC NEWS, Feb. 2, 2009, at 1, *available at* http://news.bbc.co.uk/2/hi/science/nature/7865603.stm.

[78] Maggie Fox, *Climate Change Drying Up Big Rivers, Study Finds*, REUTERS, Apr. 22, 2009, at 1, *available at* http://planetark.org/wen/52548.

> experienced gains in the number of people with access to water supply and sanitation services since 1990 may see these gains eroded by population growth. The demographics of the global population are changing, with important implications for water resources… [T]he world will have substantially more people in vulnerable urban and coastal areas in the next 20 years. In areas with already-scarce water resources water managers will have to look beyond the water sector for solutions.[79]

Energy and water are both impacted by demographic, economic, social and technological developments.[80] The pace of greening water law has been affected by the global economic crisis, increased food and energy prices, and climate change.[81] These cross-cutting issues continue to impact human security and development.[82] Increased trade, private/public funding, water transfers and technology have altered the water debate in many regions.[83] While global freshwater is finite, distribution is impacted by natural cycles that are becoming less predictable. Natural disruptions in climate and precipitation have been accompanied by human activities that alter water systems. Development has led to large-scale storage and transfer projects.[84] Each day, five thousand children die from diarrhea.[85] Communities have come to rely on increasingly polluted and over pumped aquifers.[86] Subsidized rural electrification has increased the intensity of groundwater extraction.[87] Economic development has also led to an increased demand for meat and dairy products, in turn impacting water availability.[88] Biofuel production also impacts land and water resources management.[89]

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[79] WORLD WATER ASSESSMENT PROGRAMME, *supra* note 28, at 29-30.
[80] WORLD WATER ASSESSMENT PROGRAMME, *supra* note 28, at xxiii.
[81] *Id*. at 3.
[82] *Id*. at vii.
[83] WORLD WATER ASSESSMENT PROGRAMME, *supra* note 28, at x.
[84] *Id*. at xi.
[85] *Id*. at 8.
[86] WORLD WATER ASSESSMENT PROGRAMME, *supra* note 28, at xxiii.
[87] *Id*.
[88] *Id*. at xxii.
[89] *Id*. at xxiii.

> Balancing equity and economic efficiency is core to effective water/energy decision-making. The World Commission on Dams has established a multi-stakeholder process that has brought environmental sustainability to water development decisions.[90] Water has gained visibility as an international issue thanks to such agreements as the United Nations Convention to Combat Desertification, the United Nations Convention on Biodiversity, and a growing body of international water law.[91]

While physical water scarcity exists and will be exacerbated by climate change, many regions face economic rather than natural water shortages. Amartya Sen notes that there has never been serious famine in a country with a democratic government and a free press.[92] Countries can reduce economically based water scarcity where agricultural drought occurs in the absence of meteorological or hydrological drought. This occurs where there is plentiful precipitation but restricted access to water benefits. In some regions of Africa, women spend a third of their calories collecting water.[93] Rain-fed agriculture in Africa may be cut in half by 2020 because of shifting rainfall.[94] Children are at greater risk of dehydration than adults due to their higher turnover of electrolytes and water as well as their smaller body weights.[95] Elderly people and

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[90] *Id*. at 12.

[91] *Id*.

[92] Vikram Odedra Kolmannskog, FUTURE FLOODS OF REFUGEES: A COMMENT ON CLIMATE CHANGE, CONFLICT AND FORCED MIGRATION 16 (2008) NORWEGIAN REFUGEE COUNCIL, *available at* http://www.nrc.no/arch/_img/9268480.pdf.

[93] Richard Black, *Rain Capture Answer to Water Woe*, BBC NEWS, Nov. 13, 2006, at 1, *available at* http://news.bbc.co.uk/2/hi/science/nature/6143746.stm. *See also East Africa's Drought: A Catastrophe is Looming*, ECONOMIST, Sept. 24 2009, at 1, *available at* http://www.economist.com/world/middleeast-africa/displaystory.cfm?story_id=14506436&fsrc=rss ("This year's drought is the worst in east Africa since 2000, and possibly since 1991. Famine stalks the land. The failure of rains in parts of Ethiopia may increase the number needing food handouts by 5m, in addition to the 8m already getting them, in a population of 80m. The production of Kenyan maize, the country's staple, is likely to drop by one-third, hitting poor farmers' families hardest. The International Committee of the Red Cross says famine in Somalia is going to be worse than ever. Handouts are urgently needed by roughly 3.6m Somalis, nearly half the resident population (several million having already emigrated during years of strife). In fractious northern Uganda cereal output is likely to fall by half. Parts of South Sudan, Eritrea, the Central African Republic and Tanzania are suffering too.").

[94] *Protecting Displaced Africans*, ECONOMIST, Oct. 29, 2009, at 1, *available at* http://www.economist.com/world/middleeast-africa/displaystory.cfm?story_id=14770151&fsrc=rss.

[95] *Dehydration*, N.Y. TIMES, Sept. 13, 2008, at 1, *available at* http://health.nytimes.com/health/guides/disease/dehydration/overview.html?inline=nyt-classifier.

individuals with illnesses also have increased susceptibilities to dehydration.[96] The Nepali government has subsidized seventy-five percent of the cost of solar-powered drinking water pumps used by families.[97]

Rainwater harvesting can also enhance water security. Water, hunger and poverty are integrally related. Rainwater harvesting can reduce the hunger-poverty-water nexus.[98] While rainwater harvesting can sometimes affect water availability downstream,[99] it has also reduced migration to cities.[100] In urban centers, rainwater harvesting lowers flooding downstream.[101] Tucson, Arizona and Santa Fe County, New Mexico exemplify two jurisdicitons that now require rainwater harvesting for new development.[102] Similarly, Patricia Salkin explains that, low impact development can reduce stormwater runoff damage via optimizing natural vegetative cover as well as collecting water.[103] Rainwater harvesting is less expensive than engineered

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[96] *Id*.

[97] UNITED NATIONS ENV'T PROGRAMME, GREEN JOBS, *supra* note 72, at 58.

[98] UNITED NATIONS ENV'T PROGRAMME & STOCKHOLM ENV'T INSTITUTE, RAINWATER HARVESTING: A LIFELINE FOR HUMAN WELL-BEING 26 (2009), *available at* http://www.unep.org/Themes/Freshwater/PDF/Rainwater_Harvesting_090310b.pdf ("Rainfed agriculture produces, and will continue to produce, the bulk of the world's food. It is practised on 80% of the world's agricultural land area, and generates 65-70% of the world's staple foods, but it also produces the most food for poor communities in developing areas. In Sub-Saharan Africa more than 95% of the farmland is rainfed, while almost 90% in Latin America, 60% in South Asia, 65% in East Asia and 75% in the Near East and North Africa are rainfed. In India, 60% of water use in agriculture originates from directly infiltrated rainfall.").

[99] *Id*. at 15.

[100] *Id*. at 20.

[101] *Id*. at 49.

[102] See generally Patricia E. Salkin, Sustainability and Land Use Planning: Greening State and Local Land Use Plans and Regulations to Address Climate Change Challenges and Preserve Resources for Future Generations, 34 WM. & MARY ENVTL. L. & POL'Y REV. 121 (2009). See Tucson, Ariz., Code §§ 6-182 to 6-184 (2008) (requiring new commercial development to plan for rain water harvesting); Tucson, Ariz., Ordinance No. 10597 (2008) (mandating new single and double family homes to plan for gray water reuse equipment). See also Sante Fe County, N.M., Ordinance 2003-6 (2003) (mandating development permit applicants to submit water harvesting plans).

[103] Salkin, *supra* note 102 at 121.

public water supply infrastructure projects.[104] The United Nations Environmental Programme (UNEP) notes that

> [r]ainwater harvesting is one effective water technology for adaptation to increased variability in water supply and rainfall. Its decentralized nature allows the owners to benefit from direct management of demand as well as supply. With support technologies (modern and indigenous), rainwater harvesting is cost effective, and can release capital needed in times of disasters of surprising magnitudes. There also are savings of costs related to rainwater harvesting using simple processes and therefore infrastructure, including the pumps and energy inputs needed. This also reduces greenhouse gas emissions related to water supplies. Rainwater harvesting technology can therefore contribute to both climate change mitigation and adaptation."

Rainwater harvesting already provides cost efficient adaptation to variable supplies of water.[105] While rainwater harvesting cannot solve the global water crisis, it can play an important role in water management particularly in water-stressed regions. As a local intervention with local benefits, public participation can be facilitated without undue administrative hassle. It is important to integrate special measures to aid land-poor/landless members of communities.[106] Community water projects can provide a scale upon which water security can be sustained.

IV. Conclusion

Public participation in siting decisions exemplifies the means by which good governance can transcend geopolitical natural resource scarcity challenges. Nascent measures to address the water intensity of energy production and the energy intensity of water management can become more robust by coordinating energy, water, and climate policy through an ongoing multi-

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[104] UNITED NATIONS ENV'T PROGRAMME & STOCKHOLM ENVIRONMENT INSTITUTE, *supra* note 86, at 52, (referencing Achim Steiner, *Preface to the Second Volume* of K.W. KING, A GUIDE FOR LOCAL AUTHORITIES AND PLANNING AGENCIES 3 (2008)).

[105] *Id*. at 57, 61.

[106] *Id*. at 66.

stakeholder commitment to implementing environmentally sound decisions. Transboundary consensus building and genuine cooperation can sustain water, energy and climate coordination.