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Innovative Financing for Renewable Energy

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Abstract

Carbon pollution from fossil-fuel combustion is the largest contributor to climate change worldwide.[i] Renewable energy can materially help to reduce greenhouse gas (GHG) emissions and their principal cause, worldwide dependence on carbon fuels.[ii] If our goal is to remain at or below 1990 numbers, then fossil fuels must be phased out of the global energy portfolio.[iii] While other factors such as energy inefficiencies in buildings, appliances and transportation, for example; deforestation, farm animal excretion, pipeline leakage, hydrofluorocarbons (HFCs) for refrigeration, black soot and changes in land use also contribute to increased emissions, finding new, innovative ways to empower people to seize the opportunities presented by clean, renewable electricity present an invaluable path to reduce carbon emissions.

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[i] Global Emissions by Gas, U.S. EPA, http://www.epa.gov/climatechange/ghgemissions/global.html (last visited June 10, 2014) citing B. Metz, *et al.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, Contribution of Working Group III to the Fourth Assessment of the Intergovernmental Panel on Climate Change (2007), *available at* http://www.ipcc.ch/publications_and_data/ar4/wg3/en/contents.html)..

[ii] "Renewable energy sources are defined as renewable non-fossil energy sources: wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases." *See* A. Gritsevskyi, INT'L ATOMIC ENERGY AGENCY, *Renewable v. non-renewable energy sources, forms and technologies* (2008), *available at* http://unstats.un.org/unsd/envaccounting/londongroup/meeting13/LG13_13a.pdf.

[iii] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE Fifth Assessment Report OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2013), *available at* http://ipcc.ch/report/ar5/wg1/.

Although renewable energy is the fastest growing medium of energy production, it still only represents a small part of total energy supply of the United States and the rest of the world. One major impediment to the penetration of renewable energy worldwide is the difficulty of financing the high initial cost of the equipment even though the lifetime cost of the installation usually is highly competitive.[iv] This is particularly true of some of the fastest growing, yet undervalued, new renewable energy resources such as solar, wind, geothermal, and biogas,[v] resources that are generally characterized by high front end but low operating costs. These resources also have the greatest potential for application in poor, rural, agricultural areas because of the high availability of feedstocks and the low-tech, low cost, of their conversion to energy.

This paper explores innovative renewable energy financing methods currently being implemented throughout the world in the poorest of rural areas as well as in more affluent communities. As part of a series of case studies, it aspires to help present new financing options that may be available to countries, municipalities and/or citizen organizations that wish to initiate renewable energy installations.

[iv] 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).

[v] *Id.*

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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:

- 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.

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]

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

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[1] *Id*. at 10.
[2] *Id.*
[3] *Id.* at 35-36.
[4] UNITED NATIONS ENV'T PROGRAMME, FIN. INITIATIVE, *Financing renewable energy in developing countries* 27 (2012); [hereinafter "UNITED NATIONS FINANCE 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/.
[5] *See generally,* HANDBOOK OF KEY GLOBAL FINANCIAL MARKETS, INSTITUTIONS AND INFRASTRUCTURE (Gerard Caprio & Doublas W. Arner, eds., 2012).

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 place for periodic payments.[11] Records may not exist to assess credit worthiness and risk.[12] Innovative financing mechanisms for renewable

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[6] *See* MARSH & MCLENNAN COS., *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, NAT'L RENEWABLE ENERGY LABORATORY, Technical Report, NREL/TP-520-40116, *Nontechnical Barriers to Solar Energy Use: Review of Recent Literature* (Sept. 2006) ("Lack of information dissemination and consumer awareness about energy and energy efficiency/renewable energy".).

[9] *See* UNEP Finance Initiative, *supra* note 4

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

[11] *See* UNEP Finance Initiative, *supra* note 4, at 42.

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

energy must contend with not only a lack of physical infrastructure, but also a potentially an underdeveloped economic, technical and political infrastructure.[13]

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]

Also, 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 first 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 owner is

[13] *See* INT'L ENERGY AGENCY, *Mind the Gap -International Energy Principal-Agent Problems in Energy Efficiency* (2007), *available at* http://www.iea.org/publications/freepublications/publication/mind_the_gap.pdf.
[14] *Id.*at 25, 33-37.
[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
[16] U.S. DEPT. OF ENERGY, ENERGY EFFICIENCY & RENEWABLE ENERGY, *Clean Energy Finance Guide for Residential & Commercial Building Improvements, Advantages of Property-Assessed Clean Energy Financing for Property Owners* (last visited June, 20, 2014, 2:59PM), *available at* http://www4.eere.energy.gov/wip/solutioncenter/finance_guide/content/advantages_property_assessed_clean_energy_financing_property_owners ("Many property owners do not want to invest in energy efficiency or renewable energy improvements if they plan to sell their property in a few years.")

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

Both these problems of leasing and of 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

The following 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

[17] *See* BEN HOEN ET AL., ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB., AN ANALYSIS OF THE EFFECTS OF RESIDENTIAL PHOTOVOLTAIC ENERGY SYSTEMS ON HOME SALES PRICES IN CALIFORNIA (2011), *available at* http://emp.lbl.gov/sites/all/files/lbnl-4476e.pdf.

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.

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.

[18] Uwe Deichmann *et al.*, *The economics of renewable energy expansion in rural Sub-Saharan Africa*, 39 ENERGY POL'Y 215 (Jan. 2011).

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, 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.

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

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[19] *What is microfinance?*, CONSULTATIVE GRP. TO ASSIST THE POOR, http://www.cgap.org/about/faq/what-microfinance (last visited June 15, 2014)

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

[21] HANDBOOK *supra* note 10. 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] *A Short History of Grameen Bank*, GRAMEEN BANK, http://grameen-info.org/index.php?option=com_content&task=view&id=19&Itemid=114 (last visited June 15, 2014)

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 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

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[23] GRAMEEN BANK, A Short History of Grameen Bank, *available at* http://grameen-info.org/index.php?option=com_content&task=view&id=19&Itemid=114.

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

[26] *Introduction*, GRAMEEN BANK, http://www.grameen-info.org/index.php?option=com_content&task=view&id=16&Itemid=112 (last updated Jan. 1, 2013).

[27] Grameen Bank reported a 97.28% recovery rate in its May 2014 monthly update. GRAMEEN BANK, 2014-04 Issue 412 BDT, (May 06, 2014) http://www.grameen-info.org/index.php?option=com_content&task=view&id=1285&Itemid=422

[28] *The* Nobel Peace Prize *2006*, NOBELPRIZE.ORG, (last visited June 15, 2006) http://www.nobelprize.org/nobel_prizes/peace/laureates/2006/.

million borrowers, 97 per cent of whom are women.[29] The bank's services cover 97 per cent 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 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]

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[29] Introduction, GRAMEEN BANK, http://www.grameen.com/index.php?option=com_content&task=view&id=16&Itemid=112 (last visited June 15, 2014)
[30] *Id.*
[31] Grameen Shakti, http://www.gshakti.org/
[32] *Grameen Shakti Evolving as a Social Business to Meet the Energy Needs of the Rural People*, GRAMEEN SHAKTI, http://www.gshakti.org/index.php?option=com_content&view=article&id=57&Itemid=77 (last visited June 15, 2014).
[33] *Id.*
[34] *Id.*
[35] *Id.*
[36] *Id.*

Through microfinance, Grameen Bank was able to effectively fund several types of development, 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.

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 United Nations Development Programme (UNDP)[39] and United Nations Environment Programme (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. They are not considered at length here because they already well known and established.

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[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] GLOBAL ENVT. FACILITY, http://www.thegef.org/gef/ (last visited June 16, 2014).
[39] UNITED NATIONS DEV. PROG., http://www.undp.org/content/undp/en/home.html (last visited June 16, 2014).
[40] UNITED NATIONS ENVT. PROG., http://www.unep.org/ (last visited June 16, 2014).

Margin Money Finance

The traditional loan structure typically includes a down payment requirement, also known as margin money.[41] 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 generally 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. 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 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.

[41] *See* Chris Groobey et al., Wilson Sonsini Goodrich & Rosati, Project Finance Primer for Renewable Energy and Clean Tech Projects (2010), http://www.wsgr.com/PDFSearch/ctp_guide.pdf.
[42] *Id.*

Case study: SELCO Margin Money Finance, Chitradurga, India

The village of Doddaullarthi has a small handloom weaver community. Silk weaving requires meticulous attention and concentration.[43] Bright light is essential to this concentration and detail, making the weaver's work and economic livelihood dependent on a steady power supply.[44] The Solar Electric Light Company (SELCO), based in Bangalore, India, aimed to provide solar power as a solution to this requirement. SELCO has run as a commercial entity with social objectives, providing a variety of innovative finance and financial incubation services throughout India since 1995.[45] 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.[46] Regional Rural Banks are a specific type of financial institution created through an ordinance passed by the Indian government.[47] In its incubation handbook, SELCO states, "Regional Rural Banks (RRBs) are the best suited and most reliable financial linkage in remote regions."[48] SELCO has worked with many

[43] SELCO, *Access to Sustainable Energy Services via Innovative Financing*: *7 Case Studies* (2008), *available at* http://www.selco-india.com/pdfs/selco_booklet_web.pdf.
[44] *Id.*
[45] SELCO Incubation Centre, *Financing for Off-Grid Solar Home Lighting Systems*, http://www.selcoincubation.org/sites/default/files/Financing_for_off-grid_solar_home_lighting_systems.pdf#overlay-context=publications.
[46] SELCO, *Financing*, *available at* http://www.selco-india.com/finance.html; *See* Ramon Magsaysay Award Foundation, Harish Hande Citation, *available at* http://www.rmaf.org.ph/newrmaf/main/awardees/awardee/profile/52
[47] Regional Rural Banks Act, No. 21 of 1976, INDIA CODE (1993).)
[48] SELCO, *supra* note 43.

RRBs to provide financing for solar electric lighting. These efforts promoted increased working hours and income to rural weavers.

In addition to financing through RRBs, SELCO expanded its efforts at solar electric lighting through "Mission Projects." These projects typically fall outside mainstream financing, and require first-time bridges to financial institutions. SELCO facilitates these bridges through several mechanisms. These mechanisms include Risk Guarantees, Margin Money Financing, Interest Subsidy and Partial Contributions.[49]

Under SELCO's margin money Mission Financing program,[50] the margin finance is bundled into the loan. The down payment often amounts to as much as 15% of the loan.[51] 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.

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

[49] *Id.*
[50] SELCO Incubation, Approach, *available at* http://www.selcoincubation.org/approach
[51] SELCO, *supra* note 43.

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.

Case study: ToughStuff

ToughStuff supplies durable solar powered lighting, radios and mobile chargers.[52] 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 their own business.[53] Due to the nature of this relationship, ToughStuff operations are often called micro-franchises.

Many rural households rely on kerosene or oil lighting. These kerosene or candle lighting are more expensive than solar, result in harmful fumes and create a risk of fire.[54] In addition, fuel-based lighting produces carbon dioxide, carbon monoxide and harmful particulate pollution.[55] Renewables help to address these environmental issues associated with candles and kerosene lamps.[56] Off-grid

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

[53] *Id.*

[54] Peter Alston, *et al.*, *High Life Cycle Efficacy Explains Fast Energy Payback for Improved Off-grid Lighting Systems*, J. INDUS. ECOLOGY 1 (2014), *available at* http://evanmills.lbl.gov/pubs/pdf/Alstone-etal-2014-jie-c12117.pdf

[55] *Id.*

[56] *Id.* Candles and kerosene lamps provide little light; produce noxious fumes, and contribute 24.2 million tones of CO_2 per year.

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.[57] 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.[58]

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.[59] ToughStuff's solar chargers enable off-grid users to avoid this process, while further 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.[60]

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[57] Michelle W. L. Fong. *Technology Leapfrogging for Developing Countries*, Encyclopedia of Information Science and Technology 3707 (2009).
[58] *Id.*
[59] *Id.* One resident operates a makeshift charging service. She travels 20 miles by bus to a gas station to charge her battery.
[60] ANDREW TANSWELL, TOUGHSTUFF INT'L, CASE STUDY SUMMARY: TOUGHSTUFF INTERNATIONAL, UK AND AFRICA (Apr. 2011), *available at* http://www.ashden.org/files/ToughStuff%20winner.pdf [hereinafter 'TOUGHSTUFF AWARD'].

Many micro entrepreneurs purchase their equipment using a microfinance loan, and on some occasions, ToughStuff has entered microfinance agreements directly.[61] 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 microentreprenuers also greatly expand the reach of the products into more remote areas.[62]

ToughStuff plans on expanding from Business-in-a-Box to Company-in-a-Container. 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.

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 attract larger investors. With larger scale

[61] TOUGHSTUFF, *supra* note 52.
[62] TOUGHSTUFF AWARD, *supra* note 60.

installations, community projects with micro grids become feasible and advantageous.

Community Microgrid Projects

Community renewable energy projects at the village level with micro grid 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.[63] Frequently, such critical infrastructure receives at least some government support. The larger institution anchors help to support electricity for residential use.[64]

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

[63] Daniel Schnitzer, et al., UNITED NATIONS FOUNDATION, *Microgrids for Rural Electrification,* (Feb. 2014).
[64] *Id.*

may also make collecting payments on debt easier, including the fact that some stakeholders and investors may be the same people. Increased scale and greater numbers of users requires a more complex billing infrastructures that may not be otherwise affordable. Non-payment risks may even be less than in large grid communities due to peer pressures in intermediate village communities.[65]

Community scale electric generation usually requires investment in a distribution infrastructure.[66] The decision to invest in community renewable energy dictates planning for mini grids or ordinary grid expansion. Providing for grid financing, however, can increase costs, and the complexity of these arrangements requires more and higher qualified staff. On the other hand, the scale and efficiency of such projects may result in lowering of costs.[67]

Microgrids[68] 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.[69] The local nature of a microgrid encourages economic opportunities to spring up around the

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[65] Kale Seagraves, *How Grameen Bank uses peer pressure*, POVERTY NEWS BLOG (Aug. 06, 2010), *available at* http://povertynewsblog.blogspot.com/2010/08/how-grameen-bank-uses-peer-pressure.html, *citing* Rana Foroohar, *A Bank from Bangladesh Brings Microlending to U.S.*, NewsWeek (July 19, 2010 11:33AM), *available at* http://www.newsweek.com/bank-bangladesh-brings-microlending-us-74333.

[66] Daniel L. Bond, Daniel Platz & Magnus Magnusson, *Financing small-scale infrastructure investments in developing countries*, DESA Working Paper No. 114, UNITED NATIONS, DEPT. OF ECONOMIC & SOCIAL AFFAIRS (May 2012), *available at* http://www.un.org/esa/desa/papers/2012/wp114_2012.pdf.

[67] *Id.*

[68] "A group of interconnected loads and distributed energy resources with 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 connected or island mode." 2012 DOE MICROGRID WORKSHOP REPORT, U.S. DEP'T OF ENERGY 1 (2012), *available at* http://energy.gov/sites/prod/files/2012%20Microgrid%20Workshop%20Report%2009102012.pdf.

[69] *See* TECHNAVIO, Global Microgrid Market 2012-2016 (July 26, 2013), *available at* http://www.technavio.com/report/global-microgrid-market-2012-2016 ("TechNavio's analysts forecast the Global Microgrid market to grow at a CAGR of 25.7 percent over the period 2012-2016").

grid. Innovative companies have capitalized on this synergy to build renewable energy power grids that work in tandem with entrepreneurial programs.[70] The following section will discuss physical improvements, billing strategies and financial tools that can help to spur investment in intermediate scale renewable energy infrastructure.

Case Study: Husk Power Systems

Husk Power Systems (HPS),[71] an India based company, specializes in the design, installation and operation of biomass-based power plants.[72] 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 micro-grid system.[73] Plants range from 25-kW to 100-kW and serve up to 4000 inhabitants on a pay-for-use basis.[74]

Frequently, this local source and distribution model provides a better quality, cheaper way to meet the community need for energy.[75] HPS biomass systems embody the organic microgrid model by creating an "ecosystem" that provides income opportunities for local farmers and entrepreneurs.[76] Since 2008, HPS has successfully installed more than 80

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[70] *Id.*
[71] HUSK POWER SYSTEMS, http://www.huskpowersystems.com/ (last visited June 16, 2014).
[72] *Id.*
[73] *Id.*
[74] *Id.*
[75] *Id.*
[76], *Community Impact*, HUSK POWER SYS. *available at* http://www.huskpowersystems.com/innerPage.php?pageT=Community%20Impact&page_id=81; *see also* PBS Newshour, *How Social Entrepreneurs Use Rice Husks to Fuel Micro Power Girds in*

plants in Bihar, providing electricity to over 200,000 people across 300 villages and hamlets."[77]

Distributed Finance – Internet Lending

The Internet is rapidly creating new avenues for fundraising and investment. Individual borrowers can now present their ideas directly to individual lenders, circumventing traditional financial institutions. Direct connections between lenders and 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),[78] has potential to expand renewable energy in novel ways to developing settings.

Peer-to-Peer Funding

India, (Jan. 17, 2013), *available at* http://www.pbs.org/newshour/bb/world-jan-june13-india_01-17/

[77] *Community Impact*, HUSK POWER SYS., http://huskpowersystems.com/innerPage.php?pageT=About%20Us&page_id=76 (last visited June 17, 2014).
http://huskpowersystems.com/innerPage.php?pageT=About%20Us&page_id=76

[78] *Crowdfunding*, MERRIAM-WEBSTER ONLINE, http://www.merriam-webster.com/dictionary/crowdfunding (last visited June 16, 2014).

Peer-to-Peer (P2P) lending allows individuals and companies to invest without going through a traditional intermediary such as a bank.[79] 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.[80]

Peer-to-Peer Funding Case Study

Zidisha is a P2P lending website that connects lenders and borrowers directly across international borders.[81] 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 directly, including reviewing applications, loan disbursements, and repayments.[82] Using this methodology, Zidisha achieves an average interest and fee rate between 5 and 9 percent.[83] Zidisha's P2P model also implements an online social element allowing lenders to post questions to entrepreneurs, while entrepreneurs can post progress and reports.[84] A successful example of Zidisha's loan program applied to solar energy is W. Aldophe Kabre, in Koudougou,

[79] 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.
[80] *Id.*
[81] ZIDISHA, https://www.zidisha.org/ (last visited June 16, 2014).
[82] *See Frequently Asked Questions,* ZIDISHA, https://www.zidisha.org/microfinance/microfinance/faq.html (last visited June 16, 2014).
[83] *Id.*
[84] *Id.*

Burkina Faso. Kabre received a loan of $414 USD, at 4.21% interest. Kabre used the loan to buy solar panels and a two-wheeled cart for water to intensify production on his poultry farm. [85] The possibility of online social lending opens a new individually motivated investor –class, who may support otherwise untended projects.

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

Crowd Funding Case Study – Mosaic

Mosaic, is a US based company[87] that uses Mosaic Notes as a written promise for money owed over a fixed term, and each payment account is FDIC-insured.[88] Mosaic has successfully funded several solar projects of varying scales including different generation capacities, returns on investments, yields, and

[85]. *See* ZIDISHA, W. Adolphe Kabre, *available at* https://www.zidisha.org/microfinance/loan/ka.dolph@yahoo.fr/1600.html
[86] About *Mosaic*, MOSAIC, https://joinmosaic.com/about-mosaic (last visited Apr. 22, 2014).
[87] MOSAIC, https://joinmosaic.com/ (last visited June 16, 2014).
[88] *How It Works*, MOSAIC, https://joinmosaic.com/how-it-works (last visited Apr. 22, 2014).

terms.[89] Mosaic projects range from just a few kilowatts to well over a megawatt.[90] Most present Mosaic investments, however, are currently limited to California. Guaranteed returns are created through the use of power purchase agreements.[91] 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.

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.[92] 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.[93] Cloud solutions connect home Internet servers with other Internet servers programmed to perform specific services, including billing

[89] Browse Investments, MOSAIC, https://joinmosaic.com/browse-investments (last visited Apr. 22, 2014).
[90] *Id.*
[91] 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 discussion, see *infra,* "Existing Utility Programs."
[92] UNEP FINANCIAL INITIATIVE, *supra* note iv.
[93] *See generally Final Version of NIST Cloud Computing Definition Published,* NAT'L INST. OF STANDARDS & TECH. (Oct. 25, 2011), *available at* http://www.profsandhu.com/cs6393_s13/nist-SP800-145.pdf.

services.[94] Cloud solutions enable companies to rely on remotely located servers to host software services, enabling a more complicated, secure, technological solution at lower cost.

Village-scale power providers particularly can benefit from these services. Cloud billing enables a greater variety of pricing options. Also, 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.[95] Cloud billing and smart meters can tailor billing to suit the needs of energy customers.[96] The result is more secure and effective economic financing for renewable energy projects.

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

[94] *See* Rene Sotola, *Billing in the cloud: The missing link for cloud providers,* 3 J. OF TELECOMM. MGNT. 313 (Feb. 2011).
[95] *See, e.g., Power Theft…a Blow on Consumer,.* ELECTRICITY CRISIS IN INDIA (July 17, 2008), http://www.electricityinindia.com/2008/07/power-thefta-blow-on-consumer.html (power theft in India may result in an overall loss of nearly 30 percent of power generated).
[96] *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.

have meters, and may instead be forced to pay onerous flat rates.[97] Mafia-style organizations often spring up around illegal grid access, leading to social and political instability.[98] 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.[99] 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.

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[97] *See* Kim Jansen, *Nigeria to fast track prepaid meters to 6.4 m customers*, METERING.COM (Apr. 4, 2014), http://www.metering.com/nigeria-to-fast-track-prepaid-meters-to-6-4m-customers/.
[98] *Ashok Bharti,* ASHOKA INDIA, http://india.ashoka.org/fellow/ashok-bharti (last visited June 17, 2014).
[99] R. Rejikumar, *Prepaid Electricity Meters and Issues related to implementation of Prepaid Metering Systems*, ENERGYCENTRAL (JULY 26, 2005), http://www.energycentral.net/article/05/07/prepaid-electricity-meters-and-issues-related-implementation-prepaid-metering-systems; *see, e.g., Prepaid Electricity*, LUMETER NETWORKS, http://www.lumeter.net/index.php/pre-paid-off-grid-electricity (last visited June 17, 2014).

Prepaid Meter Case Study: Lumeter Networks

Prepaid meters have been deployed in several electricity markets as elements of a greater overarching strategy.[100] For example, Lumeter Networks is a company that developed an affordable prepaid off-grid electricity meter.[101] Using prepaid 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 countries.[102] 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. The company plans rapid growth to approximately half a million houses planned to be electrified by 2016.[103] The main benefit of prepaid meters and cloud accounting software is to enable renewable energy providers to access customers who were previously perceived as too great a financial risk. Prepaid meters are analogous to pre-paid credit cards.[104] The prepaid meters also allow energy producers to know in advance how much money

[100] Jansen, *supra* note 97..
[101] *See Prepaid Electricity*, LUMETER NETWORKS, http://www.lumeter.net/index.php/pre-paid-off-grid-electricity (last visited June 17, 2014).
[102] *Id.*
[103] *Lumeter Networks, Inc.,* ENERGY MAP, http://energymap-scu.org/lumeter-networks-inc/ (last visited June 17, 2014).
[104] Daniel Soto, *A Prepaid Architecture for Solar Electricity Delivery in Rural Areas*, ICTD '12 Proceedings of the Fifth Int'l Conference on Info. & Commc'ns Tech. & Dev., ACM (Mar. 2012)

they have available prior to providing the service.[105] 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."[106]

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.[107] Meters have a payment mechanism where customers can use their cell phone's text message service to buy electricity credit.[108] Lumeter specifically offers a solution that can be integrated across different generation sources and between customers attached to a common microgrid.[109] Lumeter itself will take approximately 10% of payments, with 5% to local companies, and the remaining ~85% payment going to the renewable energy partner.[110] Through this partnership, Lumeter helps to insure stable customer-side payments where they otherwise may be unachievable.

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

[105] 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://www.iae.edu.ar/pi/Documentos%20Investigacin/Working%20Papers/DT%20IAE01_2009.pdf.
[106] *See id.*.
[107] *See* Lumeter Networks, *supra* note 101.
[108] *Id.*
[109] *Id.*
[110] ENERGY MAP, *supra* note 103..

absence of economic storage technology, the availability of solar and wind resources in particular fluctuate with the availability of adequate sunshine and wind, requiring backup power when the resources are not adequate and sophisticated management to assure that electricity availability is smoothly available and not disrupted.[111] 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.[112] 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.[113]

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

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

[112] *Id.*

[113] 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 law: 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; 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.

installations, and international finance institution and local bank loans to finance the capital costs of private renewable energy installations.

On-Bill Financing

On-bill financing is one of the most promising tools for use in renewable energy finance.[114] Under on-bill-financing the utility or municipality provides, in effect as a loan, the hard to raise up front initial capital to install renewable energy.[115] 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.[116] 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 obligations for repayment to successor lessees or property purchasers.

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[114] NATURAL RESOURCES DEF. COUNCIL, *On-Bill Financing Programs*, *Overview and Key considerations for program design* (July 2013), *available at* http://www.nrdc.org/energy/on-bill-financing-programs/files/on-bill-financing-IB.pdf

[115] CASEY J. BELL, STEVEN NADEL, & SARA HAYES, ON-BILL FINANCING FOR ENERGY EFFICIENCY IMPROVEMENTS: A REVIEW OF CURRENT PROGRAM CHALLENGES, OPPORTUNITIES, AND BEST PRACTICES, (Dec. 8, 2011), *available at* http://www.aceee.org/research-report/e118.

[116] *Id.*

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.[117] Each of these methods helps customers to finance energy investment while realizing the benefits of improved energy savings.

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.[118] The program provides utility upfront finances for residential energy efficiency improvements, providing repayment through the co-op members' electric bills.[119] 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.[120] While this program applied only to energy

[117] James M. Van Nostrand, *Legal Issues in Financing Energy Efficiency: Creative Solutions for Funding the Initial Capital Costs of Investment in Energy Efficiency Measures*, J. ENERGY & ENVTL. L. 1, 2 (Winter 2011) *available at* http://groups.law.gwu.edu/jeel/ArticlePDF/2-1-Nostrand.pdf. [hereinafter "VAN NOSTRAND"].
[118] *Rural Energy Savings Program,* ENVTL. & ENERGY STUDY INST., http://eesi.org//projects/rural-energy-savings-program (last visited June 17, 2014).
[119] *Id.*
[120] *Id.*

efficiency measures, its mechanism can be applied identically to renewable energy investments.

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.[121] Property tax assessments also can allow homeowners to repay a government loan for the equipment through a property tax surcharge.[122] Several programs, such as Property Tax Assessed Clean Energy (PACE) use this financing method.[123] 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.[124] 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 addition property tax.[125] Municipalities then become an institution for financing renewable energy projects within their districts.

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[121] VAN NOSTRAND, *supra* note 117.
[122] *About PACE,* PACENow.ORG, http://pacenow.org/about-pace/ (last visited June 17, 2014).
[123] *PACE Financing,* NRDC, http://www.nrdc.org/greenbusiness/cmi/pace-financing.asp (last visited June 17, 2014). 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.
[124] DATABASE OF STATE INCENTIVES FOR RENEWABLE & EFFICIENCY (DSIRE), *Pace Financing* (Aug. 1, 2010), *available at* http://www.dsireusa.org/solar/solarpolicyguide/policyguide.cfm
[125] *See id.*

Property tax assessments are an excellent tool for government participation in renewable energy investment.[126] By 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.[127] In addition to limiting risk of losing the value of the investment, PACE programs allow municipalities to promote renewable energy and energy efficiency agendas.

Case Study: Vermont PACE Program

In 2009, Vermont enacted an Energy Finance District and PACE program.[128] The State Banking Division administers a clean energy financing and property tax assessment program, following a municipality's decision to create an investment district.[129] 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

[126] Casey J. Bell et al., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., *Financing for Multi-Tenant Building Efficiency: Why This Market Is Underserved and What Can Be Done to Reach It* 1, 16 (2013), *available at* http://www.aceee.org/sites/default/files/publications/researchreports/e13e.pdf [hereinafter ACEEE Financing Report]. *See also* PACEnow.ORG, *supra* note 122.
[127] VAN NOSTRAND, *supra* note 117.
[128] *Local Option – Clean Energy Finance Districts*, U.S. DEP'T OF ENERGY, http://energy.gov/savings/local-option-clean-energy-finance-districts (last visited June 17, 2014).
[129] *Program Info, Vermont , PACE Financing*, ENERGY.GOV, http://energy.gov/savings/local-option-clean-energy-finance-districts (last visited June 16, 2014).

useful life of the investment, gross monthly expenses, gross monthly income, and type of improvement.[130]

Vermont classifies qualified investments based on a state characterization of renewable investments.[131] Specifically, the Vermont program marks residential dwellings (primary and vacation), manufactured homes, and condominiums as eligible if the owner is paying property taxes.[132] The program offers minimum financing of $3,500 USD, and a maximum property tax surcharge of 15% of property value capped at $30,000.[133] 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.[134]

Originally passed in 2009, Vermont amended its PACE law in 2011 to include several key features.[135] First, the 2011 amendment specifies that PACE

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[130] BULLETIN #34, PACE ASSESSMENT UNDERWRITING CRITERIA AND STANDARDS, Vermont DEP'T of Banking, Ins., SEC. & Health Care ADMIN. (Apr. 2, 2012), *available at* http://www.dfr.vermont.gov/sites/default/files/BankBull_34_Revised_April_2012.pdf.
[131] VT. STAT. ANN. tit. 30 § 209(d) (West 2014).
[132] *2012 Vermont PACE Eligible Measures*, EFFICIENCY VERMONT (2012), *available at* http://www.efficiencyvermont.com/docs/about_efficiency_vermont/initiatives/PACE_eligible_measures.pdf.
[133] *Id.*
[134] *See id.*
[135] "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 even 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.

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.[136] The amendments also create a PACE reserve fund to reduce risk for potential investors interested in investing in a PACE municipal district.

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 up-front cost or debt obligation to the consumer.[137] Instead, the customer pays a tariffed charge on the utility bill proportionate to efficiency savings.[138] 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

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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." Peter Adamczyk, VERMONT INVESTMENT CORPORATION, *"Not Dead Yet!" Moving Forward with Residential PACE,* 2012 ACEEE Summer Study on Energy Efficiency in Buildings, 2 (2012), *available at* http://www.aceee.org/files/proceedings/2012/data/papers/0193-000188.pdf

[136] U.S. DEP'T OF ENERGY, *supra* note 16..

[137] Clean Energy States Alliance, Developing an Effective State Clean Energy Program: Clean Energy Loanslenders Briefing Paper No. 4 (2009), http://www.cesa.org/assets/Uploads/Resources-pre-8-16/CESA-cleanenergy-Loan-Programs-March09.pdf.

[138] PAY-AS-YOU-SAVE, ENERGY EFFICIENCY INST., INC. (Mar. 8, 2005), *available at* http://www.eeivt.com/DTEpres.pdf.

upfront capital costs of the installed measures.[139] As an independent system, PAYS does not require credit checks or liens. Here, all obligations are attached to the meter, and dependent upon efficiencies.[140]

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 tariffed charge. PAYS systems have been applied to both energy efficiency investments, as well as a growing number of renewable energy projects.

PAYS Case Study: Aspiration Energy

Aspiration Energy is a U.K. based energy service company (ESCO) dedicated to providing solar solutions for industrial process heating and solar power.[141] Aspiration Energy finances its solar energy installations through a monthly performance-based energy charge model – a PAYS system.[142] The Aspiration Energy system received the 2013 Parivartan award for Innovation in Business Model Category.[143] The company delivers solar hot water heating for industrial processes based on an "Energy as a service model" requiring no initial

[139] CHARLES KUBERT & MARK SINCLAIR , NREL, STATE SUPPORT FOR CLEAN ENERGY DEPLOYMENT: LESSONS LEARNED FOR POTENTIAL FUTURE POLICY 45 (2011), http://www.nrel.gov/docs/fy11osti/49340.pdf.
[140] *Id.*
[141] ASPIRATION ENERGY, http://www.aspirationenergy.co.uk/ (last visited June 16, 2014).
[142] *Pay As You Save,* ASPIRATION ENERGY, http://www.aspirationenergy.com/index.php?option=com_content&view=article&id=79&Itemid=290 (last visited June 17, 2014).
[143] PARIVARTAN AWARDS, *2013 Winners, Innovation in Business Model Category* (2013), *available at* http://www.parivartanawards.in/2013/application/process.

capital expenditure.[144] 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.[145] This translated to actual fossil fuel avoidance of 360 liters of fuel oil per day.[146] This economic and environmental success inspired the wheel producer to expand solar water heating to its factories across India.[147] 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.[148]

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

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[144] *2013 Award Winners,* PARIVARTANAWARDS.IN, http://parivartanawards.in/2013/application/process (last visited June 17, 2014).
[145] *Aspiration Energy,* GLOBAL SOLAR THERMAL ENERGY COUNCIL, http://solarthermalworld.org/companies/aspiration-energy (last visited June 17, 2014).
[146] *Success Story,* ASPIRATION ENERGY, http://www.aspirationenergy.com/index.php?option=com_content&view=article&id=83&Itemid=448 (last visited June 17, 2014).
[147] *Id.*
[148] *Id.*

environmental practices.[149] This allows the growing number of ethical investors to buy stock with confidence in the company's virtues.[150] 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.[151]

The Social Stock Exchange trades shares of companies that contribute to social or environmental projects.[152] 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.

Case Study: Social Stock Exchange – Good Energy

Good Energy Group is a vertically integrated utility that seeks to lower UK carbon emissions by developing and distributing renewable energy within the

[149] *Our Admissions Panel,* SOCIAL STOCK EXCH., http://www.socialstockexchange.com/our-admissions-panel (last visited June 17, 2014).
[150] 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, *Deloitte's Global Millennial Survey 2013* (2013), *available at* http://www2.deloitte.com/global/en/pages/about-deloitte/articles/millennial-survey-positive-impact.html. ("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.").
[151] 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 move reflected the "availability of alternate energy sources with lower greenhouse gas emissions than coal." *See Stanford to divest from coal companies,* STANFORD REPORT (May 6, 2014), http://news.stanford.edu/news/2014/may/divest-coal-trustees-050714.html.
[152] SOCIAL STOCK EXCH., http://www.socialstockexchange.com (last visited June 17, 2014).

UK.[153] 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.[154] 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.

Good Energy's mission is to "keep the world a habitable place by offering consumers an active role in addressing climate change."[155] Through the Social Stock Exchange reporting, Good Energy shares its impact report outlining its key outcomes with the public.[156] 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.[157] As of the end of 2013, Good Energy reported a healthy cash flow and a total gross profit increase of 42%. 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.[158]

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[153] *Good Energy Group,* SOCIAL STOCK EXCH., http://www.socialstockexchange.com/members/good-energy-group (last visited June 17, 2014).
[154] *What We Do,* SOCIAL STOCK EXCH., http://www.socialstockexchange.com/what-we-do (last visited June 17, 2014).
[155] SOCIAL STOCK EXCH., *supra* note 97.
[156] *Impact Report,* SOCIAL STOCK EXCH., http://www.socialstockexchange.com/members/good-energy-group#ir (last visited June 17, 2014).
[157] SOCIAL STOCK EXCH., *supra* note 97.
[158] *Tomas Carruthers appointed CEO of Social Stock Exchange,* SOCIAL STOCK EXCH. (Dec. 8, 2013), http://www.socialstockexchange.com/media.

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.[159] 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 program[ ]s to support the growth and development of small and medium sized businesses."[160] Within this partnership, the aforementioned Social Stock Exchange has brought over 160 listed clean tech companies to the global market.[161]

Existing Utility Programs

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

[159] Press Release, *London Stock Exchange*, London Stock Exchange *Group Joining the UN Sustainable Stock Exchanges 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).
[160] *Id.*
[161] *Id.*

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.[162] 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.[163]

Many U.S. state utility programs have been implemented that support 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

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[162] 16 U.S.C. § 796 (2012).

[163] A Master Limited Partnership (MLP) is a limited partnership that is publicly traded. The partnership structure includes general (managing) partners and investment partners. The MLP permits the entity the tax benefits of a limited partnership, with the capital and liquidity benefits of publicly traded securities. 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. The definition of qualifying income was expanded in 2008, to include certain renewable and alternative fuels, as well as industrial source carbon dioxide. 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 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. *See* U.S. Senator Chris Coons, MASTER LIMITED PARTNERSHIPS PARITY ACT (Apr. 24, 2013) *available at* http://www.coons.senate.gov/download/mlp-white-paper; *see also* Emergency Economic Stabilization Act. P.L. 110-343 (2008); 26 U.S.C. § 7704(d)(E); 26 U.S.C. §701 ("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.").

briefly outlines these electric utility structures and how they promote renewable energy investment.

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."[164] ".
> . . .
>
> 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.[165]

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.[166] Qualified projects must include 5 to 75 units within the Con Edison utility service territory.[167] Once enrolled in the program, building owners qualify for incentives for lighting upgrades; heating,

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[164] *Energy Service Agreements*, NEW YORK CITY ENERGY EFFICIENCY CORP., http://www.nyceec.com/esa/ (last visited June 18, 2014).
[165] *Id*.
[166] *Con Edison-NYCEEC: Multifamily Energy Efficiency Loan Program,* NEW YORK CITY ENERGY EFFICIENCY CORP., http://www.nyceec.com/conedison/ (last visited June 18, 2014).
[167] *Id.*

ventilation and air conditioning (HVAC) systems; compact fluorescent lighting and other projects.[168] The program also aids multi-unit buildings to convert from oil to gas, reducing carbon emissions and air pollution. Specific projects have succeeded in over energy efficiency improvements of 24%.[169]

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.[170] PPAs allow the facility owner to secure a revenue stream from the project necessary to finance the project and determine the quality of credit.[171] The terms of PPAs address issues such as the length of the agreement, the commissioning process, the purchase and sale of energy, price, curtailment, credit and insurance.[172]

PPAs are a standard financing mechanism for the grid-based power market, enabling wholesale purchasers, retailers and customers to buy and sell

[168] *Multifamily Building (5-75 Units),* CONSOL. EDISON, INC., http://www.coned.com/energyefficiency/residential_multifamily.asp (last visited June 18, 2014).
[169] *See* NYC OPENS FIELD FOR SUCCESSFUL RETROFIT FINANCINGS AT 125 MAIDEN LANE, NEW YORK CITY ENERGY EFFICIENCY CORP. 17 (May 8, 2014), *available at* http://www.nyceec.com/wp-content/pdf/NYCEEC%20Implementor%20RFP%20FINAL.pdf.
[170] *See e.g.* Exhibit C. Example of a PURCHASE POWER AGREEMENT, BONNEVILLE POWER ASSOC. (2002), *available at* http://www.bpa.gov/power/pgc/wind/EX_C_PPA_2.pdf (example of a Power Purchase Agreement, Executed by the U.S. Department of Energy acting by and through the Bonneville Power Administration).
[171] Daniel A Yarano, *The Basics of a Power Purchase Agreement*, BIOMASS MAGAZINE (last visited June 20, 2014, 12:15PM) *available at* http://biomassmagazine.com/articles/2119/the-basics-of-a-power-purchase-agreement/
[172] *Id.*

electricity through a distribution system.[173] Innovations to these contracts are providing an excellent tool to augment and encourage renewable investment.[174] 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.[175]

The U.S. E.P.A. outlines specific recommendations for some Solar Power Purchase Agreements.[176] 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.[177] The developer under the solar PPA (SPPA) arrangement is also known as a "solar services provider."[178] 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.[179]

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[173] *See* NEW YORK CITY ENERGY EFFICIENCY CORP., *NYCEEC Opens Field for Successful Retrofit Financings at 125 Maiden Lane,* http://www.nyceec.com/wp-content/pdf/125ml_casestudy.pdf
[174] *Power Purchase Agreement*, *supra* note 170.
[175] *See id.*
[176] U.S. ENVTL. PROTECTION AGENCY, Solar Power Purchase Agreements, *available at* http://www.epa.gov/greenpower/buygp/solarpower.htm
[177] *Solar Power Purchase Agreements*, U.S. EPA, http://www.epa.gov/greenpower/buygp/solarpower.htm (last visited June 18, 2014).
[178] *Id.*
[179] *Id.*

Renewable Energy Certificates

Renewable Energy Certificates (RECs), represent the "property rights to the environmental, social and other nonpower qualities of renewable electricity generation."[180] 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.[181] RECs have become a staple system to finance the production and sale of renewable power in the United States.

Renewable Energy Certificates Case Study: Green Mountain Energy

Green Mountain Energy is the United States' longest serving renewable energy retailer.[182] Green Mountain purchases Renewable Energy Certificates to assure that money intended for renewable energy actually reaches renewable energy providers.[183] RECs are instruments used to create a specific stream of revenue for renewable energy, despite electricity being purchased on an open market.[184] Green Mountain buys and sells RECs as an intermediate, channeling

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[180] Renewable Energy Certificates, U.S. EPA, http://www.epa.gov/greenpower/gpmarket/rec.htm (last visited June 18, 2014).
[181] *Id.*
[182] *See* GREEN MOUNTAIN ENERGY, http://www.greenmountain.com (last visited June 18, 2014).
[183] *Id.*
[184] Renewable Energy Certificates, *supra* note 180. www.epa.gov/greenpower/gpmarket/rec.htm. ("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

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.

As part of its renewable driven focus, Green Mountain reports its environmental impact in consumer friendly terms. In the 2012, Green Mountain reported that its customer's choices for renewable energy were comparable to taking 2.3 million cars off the road for a year, or 12.7 million households turning off their lights for a year, or an equivalent of planting 2.9 million trees.[185]

Feed-in Tariffs

Feed-in tariffs (FITs) are government mandated renewable energy subsidies requiring utilities to purchase renewable energy at a subsidized rate.[186] Feed-in tariffs have played an important role in incentivizing customer uptake of renewable energy.[187] 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

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generators produce electricity, they create one REC for every 1000 kilowatt-hours (or 1 megawatt-hour) of electricity placed on the grid.").

[185] *Green Mountain – By the Numbers,* GREEN MOUNTAIN ENERGY, http://www.greenmountainenergy.com/green-mountain-numbers/ (last visited June 18, 2014).

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

[187] Germany has used feed-in tariffs to encourage a variety of renewable energy sources. *See* Matthias Lang & U. Mutschler, GERMAN *Feed-in Tariffs 2012*, GERMAN ENERGY BLOG, http://www.germanenergyblog.de/?page_id=8617 (last visited June 18, 2014).

favorable, higher-than-market rates.[188] The favorable rates assured by FITs are typically guaranteed by the government for a certain period of time.[189]

Feed-in tariffs were pioneered in Germany and have been used very successfully used there and in other jurisdictions to guarantee solar and wind energy installers a specified subsidized price.[190] The German FIT law, the Stromeinspeisungsgesetz (StrEG), helped to finance renewable energy by securing a profitable business for renewable energy ventures.[191] This subsidized rate has led to high market penetration.[192] The solar sector alone has grown to include over 40 companies and a €1.7 billion per year.[193] Favorable tariff structures, such as FITs, can greatly improve access to renewable energy financing by providing an enhanced revenue stream.

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,

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[188] Success story: Feed-In Tariffs Support renewable energy in Germany, E-PARLIAMENT (2009), *available at* e-parl.net/eparliament/pdf/080603%20FIT%20toolkit.pdf.
[189] *Id.*
[190] *See* Miguel Mendonca, *Feed-in Tariffs: Accelerating the Deployment of Renewable Energy* (2009); *see also,* POWER-TECHNOLOGY.COM, *Germany's feed-in tariffs set the example* (Nov. 21, 2008), *available at* http://www.power-technology.com/features/feature45682/ ("[Feed-in tariffs] were pioneered with great success in Germany and have now been enacted by more than 30 other countries.").
[191] 1990, BGBL I § 2633.
[192] A caution in implementing feed-in tariffs is the stress that excessive subsidies place on non-renewable customers.
[193] Success STORY, *supra* note 188.

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.

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, installing, and arranging financing for energy projects. 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.[194]

Yield Companies (YieldCos)

Yield companies, or "YieldCos," are publicly traded corporations that own and operate wind and solar power plants.[195] 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

[194] EPA & ENERGY STAR BUILDINGS, INTRODUCTION TO ENERGY PERFORMANCE CONTRACTING (2007), *available at* http://www.energystar.gov/ia/partners/spp_res/Introduction_to_Performance_Contracting.pdf.
[195] *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.

steady stream of revenue at low cost.[196] 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.[197] Selling an existing plant to a YieldCo, makes it cheaper to raise equity for subsequent plant investment.[198] 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.[199] 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.[200]

Case Study: NRG Yield, Inc.

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

[197] 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.

[198] *Id.*

[199] ANICH, *supra* note 195.

[200] INST., *A Rock that Churns out Cash: Solar YieldCos,* ROCKY MOUNTAIN INSTITUTE, (July 17, 2013), http://blog.rmi.org/blog_2013_07_17_a_rock_that_churns_out_cash_solar_yieldcos.

Renewable energy power production company, NRG Energy,[201] created NRG Yield, Inc.,[202] as a subsidiary company to own, operate and acquire renewable and conventional electricity generation.[203] Since its initial public offering (IPO) in July 2013, NRG Yield has had a sales/revenue growth of 78.86 percent, with a 2013 value of $267 million USD.[204] 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.[205] On June 4, 2014, NRG Yield acquired the largest wind farm in North America, Alta Wind thereby adding 947 MW worth of renewable energy to its portfolio.[206] Acquisition of the wind farm brought it 21 years of long-term power purchase agreements.[207]

NRG Yield closed a $450 million secured revolving credit facility with RBC Capital Markets in April of 2014.[208] 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.

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[201] NRG ENERGY, http://www.nrgenergy.com/ (last visited June 16, 2014).
[202] NRG YIELD, http://investor.nrgyield.com/phoenix.zhtml?c=251846&p=irol-irhome (last visited June 16, 2014).
[203] *Id.* ROCKY MOUNTAIN INST., *supra* note X.
[204] NRG YIELD STOCK INFO, *supra* note 196.
[205] *Corporate Profile,* NRG YIELD, INC., http://investor.nrgyield.com/phoenix.zhtml?c=251846&p=irol-irhome (last visited June 19, 2014).
[206] *Press Release: NRG Yield, Inc. to Aquire Largest Wind Farm in North America*, NRG YIELD, INC. (JUNE 4, 2013), http://investor.nrgyield.com/phoenix.zhtml?c=251846&p=irol-newsArticle&ID=1937203&highlight=.
[207] *Id.*
[208] *Id.*

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 the 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 finance becomes more readily available, renewable energy will become a more viable force in helping to bring global emissions from the power sector within safe and sustainable levels. The progress being made, as described in this presentation, is very encouraging.