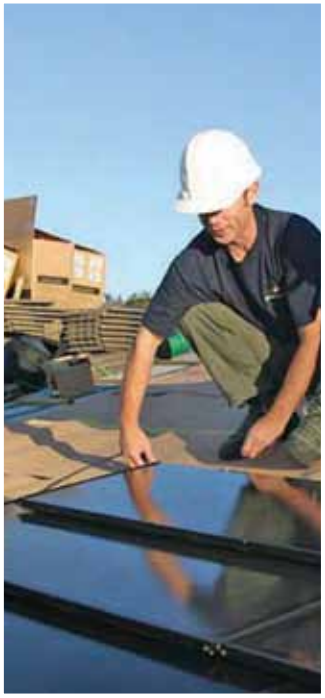
Compendium of Best Practices




SHARING LOCAL AND STATE SUCCESSES IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY FROM THE UNITED STATES

ASIA-PACIFIC PARTNERSHIP ON CLEAN DEVELOPMENT & CLIMATE

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ALLIANCE TO SAVE ENERGY
Creating an Energy-Efficient World

ACORE
American Council On Renewable Energy

Compendium of Best Practices

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AND RENEWABLE ENERGY FROM THE UNITED STATES

APRIL 2010

A COLLABORATIVE REPORT BY:

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ABOUT REPORT COLLABORATORS

REEEP is an active, global partnership that works to reduce the barriers limiting the uptake of renewable energy and energy efficiency technologies, with a primary focus on emerging markets and developing countries. REEEP's mission is to facilitate the transformation of energy systems by accelerating the uptake of renewable and energy efficiency technology as a means of reducing carbon emissions, increasing energy security, and improving access to sustainable energy for the poor worldwide. REEEP is comprised of 300 partners including private companies, international organizations and 46 governments, and has a network of Regional Secretariats around the globe.

The Alliance to Save Energy is a non-profit coalition of business, government, environmental and consumer leaders. The Alliance supports energy efficiency as a cost-effective energy resource under existing market conditions and advocates energy-efficiency policies that minimize costs to society and individual consumers. It undertakes research, educational programs, and policy advocacy; designs and implements energy-efficiency projects; promotes technology development and deployment; and builds public-private partnerships. The Alliance to Save Energy strives to achieve a healthier economy, a cleaner environment, and greater energy security.

ACORE, a 501(c)(3) membership nonprofit organization headquartered in Washington, D.C., is dedicated to bringing renewable energy into the mainstream of the US economy and lifestyle through information and communications programs. ACORE provides a common platform for the wide range of interests in the renewable energy community including renewable energy industries, associations, utilities, end users, professional service firms, financial institutions and government agencies. ACORE serves as a forum through which these parties work together on common interests.

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EXECUTIVE SUMMARY

This Compendium of Best Practices is the result of extensive outreach, data gathering, and analysis conducted to identify leading state and local-level best practices in energy efficiency and renewable energy in the United States. The report describes more than 20 practices and includes examples of their effective implementation in states or cities. Policies, financing mechanisms, and other initiatives are highlighted for their success in creating favorable market conditions for energy efficiency and renewable energy, as well as for their replicability, relative ease of implementation, measured energy savings, ability to offset the need for conventional energy, cost effectiveness, greenhouse gas emissions reduction, and job creation. Exemplary local governments from across the United States share the key elements of their programs, their lessons learned, and the factors in their programs' successes.

The selected practices are not intended to be a comprehensive overview of all the successful, existing policies and initiatives in the United States, but rather a selection of those that are the most applicable to emerging economies involved in expanding their energy efficiency and renewable energy markets. As described in Chapter One (Introduction), the Compendium is designed as a tool to share successful program and policy models that may be easily replicated or to provide ideas that may be adapted for implementation in these emerging markets. Each best practice includes the key program elements, benefits, and examples of successful implementation. The report is organized in such a way to also be of use for states and localities within the United States and in other developed markets.

Chapter Two focuses on local policies, rules, and regulations. Discussion begins with regulatory mandates, such as Renewable Portfolio Standards and Energy Efficiency Resource Standards, which require energy utility companies to incorporate specific amounts of renewable energy and energy efficiency as part of their total resource portfolio. The chapter then describes Public Benefit Funds, which allow states and municipalities to assess a small, fixed fee to customers' electricity bills each month to provide dedicated streams of funding for state energy efficiency and renewable energy initiatives. Energy code implementation is discussed as an important step in reducing energy use in buildings, and two local governments share their code enforcement strategies that have educated the local construction industry and improved buildings in their communities

Chapter Three highlights proven and innovative approaches to financing commercial, residential, and public energy efficiency and renewable energy projects. The chapter describes financing mechanisms such as municipal bonds, government loan programs, and property-assessed clean energy; tax incentives and subsidies; performance based incentives such as feed-in

tariffs; and commercial methods such as power purchase agreements and the use of energy services companies. These approaches are defining new ways to make clean energy projects not only viable but potentially profitable.

Chapter Four discusses practices that address utility regulation and transmission issues. Net metering, interconnection standards, and the use of renewable energy zones improve the effectiveness of renewable energy production and consumption across the grid. Utility revenue stability mechanisms, also known as decoupling, are being adopted with increasing frequency by state and local utility regulation commissions in order to remove the financial disincentive that exists for utility companies to encourage energy efficiency investments.

Chapter Five focuses on actions state and local governments are taking to increase their own use of energy efficiency and renewable energy, and to effectively "lead by example" in their public facilities, operations, and fleets. Some local governments are adopting formal policy commitments for energy efficiency and renewable energy in publicly funded buildings and facilities; others wield their purchasing power to procure "green" energy for public operations; others invest in more efficient transportation systems by optimizing traffic signals and "greening" their fleets; yet others are increasing efficiency in wastewater treatment facilities. When local governments invest in energy efficiency and renewable energy, it demonstrates fiscal responsibility with public dollars by reducing the state or local government's energy costs and greenhouse gas emissions.

Chapter Six identifies three examples of exemplary, low carbon cities—San Francisco, California; Austin, Texas; and Seattle, Washington. These cities have taken a robust, whole- systems approach to addressing climate change by adopting multiple best practices via comprehensive climate action and clean energy plans. The chapter analyzes what steps these local governments have taken to become domestic leaders in innovative and comprehensive approaches to mitigating climate change. Their actions demonstrate a commitment to fiscal responsibility and environmental stewardship while increasing demand for efficient and clean energy products and services.

CHAPTER I: INTRODUCTION

In response to the increasing stresses of global climate change and energy supply and security issues, nations around the globe are developing innovative strategies for changing the way energy is used. It is on the sub-national level—within states, provinces, cities, and municipalities—that much of this innovation is occurring and many of these strategies are being successfully implemented. These state and local governments possess tremendous power and potential for leading regions, nations, and indeed the world toward a lower-carbon lifestyle.

Over the last century, the urban population grew rapidly, and the next several decades will see unprecedented further urban growth, particularly in developing countries (UNFPA 2007). More than half the world's population now lives in urban areas and almost all new future population growth is projected to occur in or gravitate to cities (UNFPA 2009). This increasing population density adds tremendous demand and strain on outdated electric grids. Building new fossil fuel power plants is costly and increases greenhouse gas (GHG) emissions to the atmosphere. Energy efficiency and renewable energy hold tremendous potential to reduce GHG emissions, lower energy costs, create long-term sources of revenue, and improve energy security. Communities worldwide that apply new and creative solutions to create markets for energy efficiency and renewable energy will profit from their numerous benefits.

In the United States, it is at the state and local level that many key lessons are being learned regarding innovative and successful energy efficiency and renewable energy practices. Increasing numbers of states and municipalities are using their regulatory authority to forge ahead with dedicated funding and strategic policies that have been instrumental in creating and strengthening the market for energy efficiency and renewable energy.

State and local-level leadership plays an important role in proving the effectiveness of new initiatives by testing, incubating, and fine-tuning innovative practices on a smaller scale. Achievements demonstrate to other states and municipalities, as well as to federal governments that a practice can work successfully; this increases the confidence of higher levels of government for adoption of similar polices or practices.

Local governments can also be major catalysts for change, by educating citizens and engaging businesses that can transform the market for energy efficiency and renewable energy. Likewise, state governments can make it easier for local governments to adopt such policies or practices by encouraging local action. For example, a statewide Renewable Energy Portfolio Standard provides a goal that local governments across the state can contribute to by implementing local initiatives.

Governments that have adopted leading-edge initiatives are experiencing increased market demand for renewable

energy and energy efficiency, which - especially when adopted with a comprehensive energy and climate plan - boosts the local economy by attracting new industries, creating new jobs, and bringing in revenue associated with new renewable energy capacity.

We hope that this Compendium of Best Practices from the United States and future reciprocal reports from other nations will promote the sharing of best practices by state, provincial and municipal governments and will result in accelerated adoption of energy efficiency and renewable energy worldwide.

CHAPTER II.
POLICIES, RULES AND REGULATIONS

2A RENEWABLE PORTFOLIO STANDARD

OVERVIEW

A Renewable Portfolio Standard (RPS) typically requires that a specified percentage of electricity supply, often increasing over time, be from renewable energy. More specifically, RPS policies require that retail electricity suppliers must procure a minimum quantity of eligible renewable energy by a specific date, in percentage, megawatt hour, or megawatt terms. The United States does not currently have a national RPS; however, many states and some municipalities enact RPS policies within their own jurisdictions.

RPS policies are one of the most widely-used policy mechanisms to increase renewable energy production. Over 60% of the [non-hydro] renewable energy capacity additions in the United States from 1998 to 2008 occurred within states with RPS requirements (EPA 2009a). As of January 2010, RPS requirements or goals have been established in 29 states plus the District of Columbia and Guam.

RPS requirements are set anywhere from 4% to 30% by a certain year (such as 20% by 2020), and often include incremental targets to ensure that appropriate progress is being made in order to achieve the end target. Sixteen states in the United States have solar or distributed generation set-asides[1] within their RPS. RPS policies may also include tiers, with one tier intended for new and emerging renewable energy technologies and another tier for existing renewable energy capacity.[2]

RPS policies are most frequently established through specific legislation and are overseen by state utility regulatory agencies (public utility commissions). There are typically three ways in which electricity suppliers can comply with RPS targets: (1) owning a renewable energy facility and its output generation; (2) purchasing the renewable energy attributes and electricity generated from a renewable energy facility as a bundled renewable energy purchase; or (3) purchasing renewable energy credits (RECs) separate from electricity.

A common design has not yet emerged for RPS programs. Programs vary in eligibility, compliance mechanisms, resource categories and program administration. Barriers to renewable energy development, such as availability of transmission and long-term contracts, may need to be addressed for RPS requirements to be met.

Many states have realized a number of benefits after implementing RPS policies, including:

- Increased market demand for renewable energy, which, especially when combined with complementary practices such as tax credits, REC trading and feed-in

1 The term "set-aside" refers to a provision that requires utilities to use a specific renewable resource (such as solar photovoltaics) to account for a certain percentage of their electricity sales or generating capacity within a specific timeframe.

2 An RPS policy may also include an energy efficiency target (see section 2B for additional details).

tariffs, boosts the local economy by attracting new industries, creating new jobs, and bringing in revenue associated with new renewable energy capacity.

- More competition among renewable developers to meet targets in the least-cost fashion.
- The achievement of policy objectives at a relatively modest cost, spreading compliance costs among all customers (ratepayer impacts are often less than a 1% increase).
- Increased developer confidence in renewable energy prospects, due to clear and long-term support for the industry (EPA 2009a).

KEY PROGRAM ELEMENTS

According to research on RPS programs carried out by the Environmental Protection Agency, the National Renewable Energy Laboratory, and Lawrence Berkeley National Laboratory, effectively designed RPS policies practicing the identified key program elements below can create a sustainable renewable energy market, while poorly designed and implemented efforts have little impact

- **Administration and first steps:** It is imperative to secure strong political and regulatory support throughout the duration of the RPS program. Facilitated discussions should be held among key stakeholders to establish the program's design. The most appropriate lead agency to implement the RPS should then be selected. It is recommended that stakeholders reconvene for mid-performance reviews throughout the duration of the program (EPA 2009a).
- **Planning:** Prior to setting targets, it is important to clarify the goals of the program; model the expected impacts; and determine how much renewable energy is desired, given the available resources, transmission constraints, interconnection barriers, complementary policies, and potential siting challenges (Doris et al. 2009). Interactions between state RPS policies and a potential national RPS need to be anticipated in policy design to avoid potential policy failure and inadvertent outcomes.
- **Technology eligibility:** When determining which technologies are eligible toward compliance, the following topics should be addressed: what renewable resources are available and whether existing sources can count toward compliance; which geographic territories are covered; and whether central and distributed generation systems are treated differently (EPA 2009a). An assessment of the social benefits of each particular resource should be made to ensure that the goals and agenda for the RPS program are met (Doris et al. 2009). If the existing supply exceeds the standard itself, the RPS will not facilitate new renewable energy development. Eligible resources should also include proven technologies which are not already widely used, unless necessary to maintain the existing renewable energy capacity that is already in place.
- **Target setting:** Targets should be clear and achievable.
  - Compliance should be monitored and requirements should ramp up periodically to allow for all eligible technologies to participate and be counted in the RPS requirement, particularly those which produce more electricity during certain seasons.
  - Targets can be grouped into tiers for different renewable technologies and/or applications. Tiers are often used to ensure that technologies with higher upfront costs (such as solar photovoltaics), receive the same market advantage as the least-cost technologies (such as wind and landfill gas), which have a natural advantage in the non-tiered RPS framework, or to maintain quantities of existing renewable energy generation (CEG 2008).
  - The duration should be long enough to allow for long-term financing and contracting (Doris et al. 2009). RPS policies are most successful where long term contracts are available, rather than where short-term trade in RECs dominates (Martinot 2005). Long-term contracts may need to be required or incentivized if not commonly available (such as in restructured electric markets).
- **Compliance and cost control provisions:** RPS policies should establish a credible and automatic compliance accounting system, which is transparent and easy to

use for regulators. For example, regulators may charge the utility an Alternative Compliance Payment (ACP) fee for every MWh below the annual RPS requirement. Payments are generally made to the state's Renewable Energy Fund, which finances renewable energy programs in the state. If enforcement rules are too vague or lenient, electricity suppliers will not comply with the RPS, and developers will have little incentive to build renewable energy power plants.

- **Tradable Renewable Energy Credits (RECs):** RECs are tradable, non-tangible energy commodities that represent proof that 1 megawatt-hour of electricity was generated from an eligible renewable energy resource. These certificates can be sold and traded or bartered, and the owner of the REC can claim to have purchased renewable energy. Many states allow RECs to be used for RPS compliance, thereby providing contract flexibility, minimizing compliance costs, reducing administrative tasks and simplifying verification for RPS programs. REC trading may interact unfavorably with other policies, such as cap and trade.
- **Complementary practices:** The success of RPS is highly dependent on complementary policies such as:
  - Resource assessment: Mapping out the location of the best resources, transmission availability, and existing development with GIS analysis. See section 4A of this report.
  - Transmission access: There must be sufficient transmission capacity between load centers and renewable energy resources. Infrastructure expansion policies may need to be enacted to ensure this.
  - Financing support: Many RPS programs require minimum financial support to ensure that new projects can secure financing. Some states require load-serving entities to sign long term contracts to reduce financial risks and to make it easier for the state to attract investors.

RESOURCES

The Union of Concerned Scientists' Renewable Electricity Standards Toolkit. URL: http://go.ucsusa.org/cgi-bin/RES/state_standards_search.pl?template=main

The Environmental Protection Agency's Renewable Portfolio Standard Fact Sheet. URL: http://www.epa.gov/chp/state-policy/renewable_fs.html

Example of Successful Implementation: Texas Renewable Portfolio Standard

HIGHLIGHTS

Texas has experienced the greatest increase in renewable energy capacity expansion and use of any state (Hurlbut 2008a).

The RPS target in Texas has always been intended as a minimum, not a maximum, allowing renewable energy development in Texas to grow.

OVERVIEW

Texas was one of the first states to adopt rules for a renewable energy mandate, establishing a Renewable Portfolio Standard (RPS), a Renewable Energy Credit (REC) trading program, and renewable energy purchase requirements for competitive retailers in the state. The current standard calls for 5,880 MW by 2015, about 5% of the state's electricity demand, including a target of 500 MW of renewable energy capacity from resources other than wind. The target also calls for 10,000 MW of renewable energy capacity by 2025 (DSIRE 2009b). Current installed renewable energy capacity in Texas is about 9,500 MW as of the end of 2009. Qualifying resources include: solar, wind, geothermal, hydroelectric, wave or tidal, biomass, and biomass-based waste products.

As part of the renewable energy mandate, the Public Utility Commission of Texas (PUCT) established a renewable energy credit (REC)-trading program, which began in 2001 and will continue through 2019. One REC represents one megawatt-hour of qualified renewable energy that is generated or metered in Texas. Electricity suppliers that do not own or purchase

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enough renewable energy capacity may purchase RECs to meet their RPS requirement. A "compliance premium" is offered for each non-wind REC generated after December 31, 2007, doubling the compliance value of renewable resources other than wind. The REC market is administered and monitored by ERCOT, the Texas electric grid operator (SECO 2009).

The success of the Texas RPS requirement can be attributed to a number of factors (EPA 2006):

- High-quality renewable energy resources in the state, particularly wind energy;
- High renewable energy requirements that triggered market growth in the state;
- The use of RECs for meeting targets;
- Credible penalties for noncompliance;
- Inclusion of all electricity providers if they have opted into retail competition; and
- Relative ease of building transmission in Texas as compared to other states, with costs assigned to all ratepayers.

KEY DATES

1999 – RPS is introduced as a capacity goal, requiring 2 GW of new capacity by 2009.

2005 – After the original goal was met within six years, the RPS was adjusted as a capacity goal for 5,880 MW by 2015.

FUNDING SOURCE AND COSTS

No comprehensive study on the actual costs of the RPS has been completed to date. Current REC costs are in the range of $1-2 per megawatt hour, or 10 to 20 cents per kilowatt hour.

LESSONS LEARNED

- Renewable energy outcomes for Texas have been constrained by transmission. The initial wave of wind power development in 2001-2002 was more than existing transmission lines could handle. Texas devised its Competitive Renewable Energy Zones (CREZ) policy to respond to the transmission challenges. The Texas Public Utility Commission (PUCT) approved a CREZ transmission development plan in July 2008 that would accommodate up to 18.5 GW of wind power (Hurlbut 2008a).
- To diversify the state's renewable generation portfolio, Texas Senate Bill 20 includes a requirement that the state must meet 500 MW of the 2025 target with non-wind renewable generation. The state also offers REC compliance premiums for technologies besides wind (SECO 2009).

MONITORING AND EVALUATION

Texas was the first state to adopt the use of RECs to determine compliance with RPS targets and develop an efficient renewable energy market (EPA 2006).

Texas law authorizes Alternative Compliance Mechanisms (ACMs) for RPS compliance, and the PUCT has pursued administrative penalties as a means of enforcement. ACMs are used if insufficient renewable energy is available to meet RPS targets or if the price of RECs is high; ACMs may operate as price caps to control overall compliance costs. The Texas law caps enforcement penalties at $50/MWh or 200% of the average cost of credits traded during the year, effectively balancing price protection and investment stimulation by setting their various cost-limiting safeguards (Katofsky 2007).

RESULTS

As of July 2008, the Texas RPS added 5.5 GW of new renewable capacity since it began in 2002, and net generation from renewable sources was increasing at a rate of more than one terawatt hour per year. Texas has managed to increase renewable energy's share of the state's fuel mix from 0.6% in 2001 to 2.3% in 2007 (Hurlbut 2008a). By the end of 2009, the renewable capacity in Texas was about 9,400 MW, and the annual energy production exceeded 20 million MWh.

As of 2005, the tax base in the rural west has grown as a result of more than $1 billion of new wind development. The RPS has also supported hundreds of manufacturing jobs and other opportunities related to the wind industry across the state. Updated numbers are likely to be available (EPA 2006).

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The initial 10-year goal was met in just over six years, and wind power development in Texas has more than quadrupled since the RPS was established, and the 2025 goal will be met in 2010 (SECO 2009).

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RESOURCES

Union of Concerned Scientists' Summary Information on the Texas RPS. URL: http://www.ucsusa.org/assets/documents/clean_energy/texas.pdf

Full text of Senate Bill 20 (SB 20). URL: http://www.puc.state.tx.us/rules/subrules/electric/25.173/25.173ei.cfm

2B ENERGY EFFICIENCY RESOURCE STANDARD

OVERVIEW

An Energy Efficiency Resource Standard (EERS) is a regulatory mechanism that encourages more efficient generation, transmission, and use of electricity and natural gas. An EERS ensures that utilities adopt energy efficiency as a clean, cost-effective energy resource by establishing an explicit, numerical target for incorporating energy efficiency into the power source mix. An EERS can be used independently or in combination with a Renewable Portfolio Standard (RPS), which requires that a percentage of electricity generation be from renewable sources (see section 2A of this report), or a state may have both an RPS that includes energy efficiency and have a separate EERS. An EERS requires that retail electric (and sometimes natural gas) utilities meet a specific portion of their electricity demand through energy efficiency.

Like an RPS, an EERS is a performance-based mechanism that requires electricity and natural gas distributors to achieve a percentage of energy savings relative to a baseline. A baseline can be the utility's prior year's energy sales, an average of energy sales in the preceding two or three years, or energy sales for a specific year, like 2005. Depending on the state, savings can be achieved by:

- Energy efficiency programs that reduce customers' energy use;
- Reducing energy waste in a utility's distribution systems; or
- Purchasing energy savings from other utilities or third-party efficiency service providers.

The United States does not currently have a national RPS or EERS. As a result, many states and some municipalities enact RPS and EERS policies within their own jurisdictions.

The benefits of having an EERS in place include:

- EERS creates market demand for energy efficiency which, especially combined with complementary practices such as tax credits, can boost the local economy by attracting new industries, creating new, local jobs and bringing in revenue associated with energy efficiency projects;
- Energy efficiency replaces the need for fossil fuel generation, improving the environment by avoiding emissions, reducing pollutants including sulfur oxides (SO_x), nitrogen oxides (NO_x), and carbon dioxide;

- Energy efficiency investments are significantly less expensive than fossil fuel sources, helping consumers save money;
- Energy efficiency programs can be implemented quickly and begin saving energy immediately;
- Energy efficiency is the only "resource" that reduces overall energy demand; reduced demand saves consumers money, and makes renewable energy targets easier and less expensive to meet; and
- EERS functions in both regulated and unregulated electricity markets.

As of December 2009, 22 states have enacted an EERS (ACEEE 2010a). Savings targets range typically between 1% and 20% within a certain time frame (for example 20% by 2020).[3] Most states also include annual or interim targets which ramp up the level of savings over time. Although many of these states are just beginning to implement an EERS, a number of states have proven track records for implementing successful energy efficiency programs.

HOW IT IS FUNDED

EERS is a policy, and is therefore not a funded program.

KEY PROGRAM ELEMENTS

A common design has not yet emerged for EERS programs, and programs vary in eligibility, compliance mechanisms, resource categories and program administration.

- **Administration and first steps:** It is imperative to secure strong political and regulatory support throughout the duration of the EERS program. Facilitated discussions should be held among key stakeholders to establish program designs. The most appropriate lead agency to implement the EERS should then be selected. Utilities may be in the best position to implement energy efficiency programs because they have an established relationship with consumers. However, third-party administrators or state agencies have also been used in a number of states with success.[4]
- **Planning:** Planning should be undertaken to determine the level of potential energy savings available through energy efficiency in each sector. Across the United States., most states have the potential to reduce their energy use by about 20-30% by 2025.[5] It is also imperative to determine the method that will be used to measure and verify energy savings under an EERS.
- **Target setting:** Targets do not need to be high in order to be effective. Setting lower energy efficiency targets in earlier years allows energy efficiency programs to slowly develop as utilities gain experience, though targets must be set at levels above what would have been undertaken in the absence of such a regulation. Targets should increase over time to allow for expanded program development, adoption of new energy efficient technologies, and long-term energy savings.
- **Compliance and cost control provisions:** EERS policies should establish a credible and automatic non-compliance accounting system that is transparent and easy to use for regulators. In lieu of achieving energy savings, a utility could make alternative compliance payments for the amount of under- or non-compliance with the standard. Payments are generally made to a state's energy fund, which finances energy efficiency efforts in the state. If enforcement rules are too vague or lenient, electricity suppliers will not comply with the EERS.

3 Ibid.
4 See, for example, Efficiency Vermont at www.efficiencyvermont.com, and the New York State Energy Research and Development Authority at www.nyserda.org.
5 See, for example, the links to reports on Florida, Texas, and Maryland available in the Resources section.

Example of Successful Implementation: Connecticut Energy Efficiency Resource Standard

HIGHLIGHTS

Connecticut allows all cost-effective energy efficiency measures to count as an eligible resource toward their Renewable Energy Portfolio Standard goals.

OVERVIEW

Connecticut's Renewable Portfolio Standard (RPS) originally required that a minimum of 7% of the state's electricity come from Class I renewable resources.[6] As of 2004, at least 3% more of the state's electricity was required to come from Class II renewable resources.[7]

In 2005, the RPS was expanded to incorporate a Class III requirement that includes energy efficiency and Combined Heat and Power (CHP). Under the Class III requirements, by 2007, electricity suppliers had to meet 1% of their demand by using energy efficiency and CHP, and the target increased 1% each year up to a total of 4% by 2010.[8] In order to meet the state EERS goals, utility-led energy efficiency programs are used, but the resulting energy savings are not high enough to achieve the state goals through the utility programs alone. Therefore, suppliers must buy certificates representing real energy efficiency savings from third-party providers, such as an energy service company, to make up the difference. These certificate values can range in cost between $0.01 and $0.031 per kWh of savings (ACEEE 2010b).

The state supports utility efficiency and conservation efforts by providing expert guidance and assistance via the Energy Conservation Management Board (ECMB), an entity that also manages the Connecticut Energy Efficiency Fund (CEEF).[9] The ECMB meets annually with the utility company to develop their energy efficiency plans.

CEEF administers a suite of programs that help homeowners and renters, small and large businesses, and state and local governments reduce their energy usage.

Private energy service providers are used to supplement the utility's energy program savings in order to achieve the energy efficiency target goals in Connecticut. Private companies must first propose their projects and have the projects qualified by the Connecticut Department of Public Utility Control (DPUC), which will assign a specific numeric credit for each qualified project. Upon completion of the project, the energy service provider can then sell that credit to electricity suppliers to fill the gap between the suppliers' required target energy savings for the year and the amount not provided by its own energy efficiency programs (Quinlan 2010).

KEY DATES

1998 - Connecticut legislature adopted a law that created the Energy Conservation Management Board (ECMB) and the Connecticut Energy Efficiency Fund (CEEF), funded by utility ratepayers.

2005 - The EERS requirement was incorporated into the RPS mechanism.

2007 - The Electricity and Energy Efficiency Act (H.B. 7432) strengthened these requirements by enacting complementary policies, including policies covering energy savings from waste heat recovery. These policies help achieve greater levels of energy efficiency in Connecticut. The law also requires electric

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6 Class I resources include: solar, wind, fuel cells, low impact hydro, and low emissions biomass.
7 Class II resources include other hydro, municipal solid waste, and higher emissions biomass.
8 Class III resources include: (1) customer-sited Combined Heat and Power (CHP) systems, with a minimum operating efficiency of 50%, installed at commercial or industrial facilities in Connecticut on or after January 1, 2006; (2) electricity savings from conservation and load management programs that started on or after January 1, 2006,; and (3) systems that recover waste heat or pressure from commercial and industrial processes installed on or after April 1, 2007.
9 The ECMB advises and assists utility *distribution* companies in the development and implementation of comprehensive and cost-effective energy conservation and market transformation plans (they do not, however, assist third-party providers). The CEEF is primarily funded by a small charge on customers' bills (see Public Benefit Funds, section 2c) to help state and local governments, homeowners and renters, and businesses reduce their energy usage with energy efficiency. http://www.ctsavesenergy.org/about/index.php. The CEEF is administered by the two main electricity *distribution* utility companies in Connecticut.

distribution utilities to procure all cost-effective energy efficiency as their first-priority resource.

2008 - Major utilities and the Energy Conservation Management Board submitted a combined 2009 Conservation and Load Management Plan to the DPUC. The DPUC accepted the plan, and ordered that the 2010 plan establish broader, longer-term goals.

2009 - Utility programs are responding accordingly in the 2010 plan with goals to achieve around 1.5% savings (of total sales) each year.

FUNDING SOURCE AND COSTS

Most funding for CEEF and the ECMB comes from a small charge on utility customers' bills.

- Funding for utility-led energy efficiency programs is paid for as part of the customer's rates.
- In addition, revenues derived from the sales of energy-saving credits purchased by distributors from the conservation and management programs run by the CEEF are added to CEEF's funding for future projects.
- Private energy efficiency service companies charge their customers for making improvements, and earn additional revenue by selling credits to the utility suppliers.

LESSONS LEARNED

Challenge: *Existing utility programs would not be able to achieve the energy efficiency target goals that were set for the state.*

Solution: The DPUC put in place a requirement that, in addition to a utility company's own efficiency programs, they must purchase a set amount of energy efficiency (called "Class III") from a qualified third party source. The DPUC qualifies projects to receive credits that can then be purchased by the utility. This allows the state to meet its target efficiency goals and also creates a market demand for energy efficiency programs that generate jobs.

Challenge: *The Connecticut EERS program has successfully increased energy efficiency in Connecticut. However, the structure of the program favors energy efficiency programs funded by the CEEF over privately-funded programs of independent third-party energy efficiency providers. Consequently, the Connecticut energy savings credit market is dominated by the two electricity distribution utilities (that administer the CEEF) while third-party energy efficiency providers have been unable to sell energy saving credits into the market.*

Suggested Solution: A public utility commission should be clear from the beginning regarding whether the intent of the RPS/EERS policy is to spur private, third-party investments in the state, or if the sole intent of the policy is to increase use of renewable energy and energy efficiency (even if this is accomplished by the utilities themselves).

Other approaches would be to cap the amount of EERS that a utility can provide to the market, or create a set-aside for third-party independent energy efficiency providers, which would send a clear market signal that would encourage private investments in energy efficiency in the state. Further, the state could create a process allowing third-party energy efficiency providers to compete against utilities for access to CEEF funding.

Challenge: *It is difficult to evaluate energy efficiency projects and determining the number of credits to assign to each project. Unlike a project that provides a measurable commodity, as in the case of Renewable Energy Credits (such as a wind turbine that creates measureable electricity), energy efficiency improvements are more difficult to measure in quantifiable amounts.*

Solution: The DPUC is working to ensure that the system includes funding for analyzing and auditing energy efficiency programs.

MONITORING AND EVALUATION

United Illuminating and Connecticut Light and Power monitor and file annual evaluations with the DPUC.

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The ECMB reports results annually to the Connecticut legislature with information about the programs and the number of customers served, and the results of all energy efficiency programs.

RESULTS

Since 1998, Connecticut's energy efficiency programs have achieved reductions equivalent to the generating capacity of a 558 MW power plant (CEEF 2009).

In 2008, CEEF program activities resulted in:

- 368 million kWh annual savings (4.2 billion lifetime savings) (CEEF 2009);
- $66 million in annual fiscal savings for Connecticut residents, businesses, and governments ($774 million lifetime savings) (CEEF 2009); and
- 2.4 million tons of carbon dioxide emissions avoided (lifetime) (CEEF 2009).

Results generated by non-utility sources (private energy service providers) are not yet available.

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RESOURCES

Alliance to Save Energy fact sheet: Energy Efficiency Resource Standard http://ase.org/content/article/detail/5562

American Council for an Energy-Efficient Economy (ACEEE) fact sheet: Energy Efficiency Resource Standard http://www.aceee.org/energy/national/eers.htm

ACEEE Report: Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demand. Available at: http://www.aceee.org/pubs/e072.htm

ACEEE Report: Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs. Available at: http://www.aceee.org/pubs/e073.htm

ACEEE Report: Energy Efficiency: The First Fuel for a Clean Energy Future—Resources for Meeting Maryland's Electricity Needs. Available at: http://www.aceee.org/pubs/e082.htm

Connecticut Energy Efficiency Fund: http://www.ctsavesenergy.org/

Connecticut Light and Power Company: http://www.cl-p.com/faq/Category.aspx?name=Energy+Efficiency

United Illuminating: http://www.uinet.com/uinet/connect/UINet/Top+Navigator/Your+Business/UI+Products+&+Services/CT+Energy+Efficiency+Incentive+Program/

2C PUBLIC BENEFIT FUND

OVERVIEW

A Public Benefit Fund (PBF) is a popular policy tool that has been adopted by many states and some municipalities in the United States. It is used to provide a cohesive strategy and long-term funding for state and city-run energy programs. It is most commonly supported by a Systems Benefit Charge (SBC), a small, fixed fee added to customers' electricity bills each month.

PBFs allow states and cities to address key technical, regulatory and market barriers, such as emerging technologies or up-front installation costs. A variety of renewable energy and energy efficiency programs can be funded through this mechanism, including direct incentives, research and development, business development, funding for renewable energy projects, industry development and public education programs (DSIRE 2009c).

SBCs are typically collected from customers of investor-owned utilities. Once the charges are collected, programs can be administrated by either a state agency, a third

party or the utility. Regardless of administrative structure, there is usually an opportunity for stakeholder input. The EPA has identified three basic funding models used to allocate the funds (EPA 2008a):

- The **investment model** uses state loans and equity to provide initial investment in clean energy companies and projects.
- The **project development model** directly promotes clean energy project installation by providing production incentives and grants/rebates.
- The **industry development model** uses business development grants, marketing support programs, research and development grants, resource assessments, technical assistance, consumer education and demonstration projects to facilitate market transformation.

Some states implement a combination of these funding models.

HOW IT IS FUNDED

Public Benefit Funds are commonly supported by a SBC, which is a small, fixed fee added to customers' electricity bills each month. Some states carry forward excess annual contributions to help obtain consistent funding levels and protect against the diversion of funding to other state needs.

KEY PROGRAM ELEMENTS

The EPA has identified a number of best practices for PBFs based on state experiences (EPA 2008a):

- **Administration and first steps:** It is important to solicit the opinions of interested stakeholders on the design and administration of the PBF throughout the planning process. A utility, state agency or third party must be selected for fund administration to ensure that investments follow the program's goals and represent public interest. If legislation is required to implement the systems benefit charge, draft legislation should be developed for the consideration of the state legislature.
- **Portfolio of activities:** Programs supported by the PBF often include support for both emerging and technically proven technologies. The state's energy goals should first be identified to determine what kinds of incentives are needed. Balanced portfolios include programs for technical assistance, load management, rebates, grants, loans, equity and subordinated debt investments, and business development grants. There should be a degree of flexibility to respond to changes in markets by creating new or modified programs.
- **Target setting and monitoring:** The program should have measurable, monitored targets, such as infrastructure development measured in MW of new capacity, and energy savings. This may be difficult to accomplish if using an industry development model.
- **Funding sources:** Funding sources should be kept consistent from year to year. Excess annual contributions should be allowed to carry forward to the next year, especially as the program is getting started. Mechanisms should be set up to ensure consistent funding levels and to prevent funds from being allocated to other state needs. The proper legislative language and public acknowledgement of the PBF's benefits help to mitigate the misallocation of funds.
- **Transparency:** State officials, office holders and the public should be made aware of the PBF, how it is being allocated, what types of technologies are eligible to apply for the funding, and what the application procedure entails. An annual budget should be set up for the fund that specifies the eligible technologies and clarifies the disbursement procedures and other criteria for eligibility (REN21 2009).
- **Complementary programs:** Programs that complement PBFs include RPS and EERS, tax credits and loan programs. It is important to coordinate with these programs to prevent developers from taking advantage of multiple incentives simultaneously.

RESOURCES

Environmental Protection Agency's State Clean Energy Funds Fact Sheet. URL: http://www.epa.gov/CHP/state-policy/funds_fs.html

Clean Energy States Alliance's "Briefing Paper No.1- Developing an Effective State Clean Energy Program: A Blueprint for Success." URL: http://www.cleanenergystates.org/Publications/CESA-Blueprint_For_Success_March09.pdf

Example of Successful Implementation: New Jersey Clean Energy Program

OVERVIEW

The New Jersey Clean Energy Program (NJCEP) is a statewide, comprehensive program promoting energy efficiency and renewable energy technologies in the state. It was created by the Electric Discount and Energy Competition Act (EDECA) in 2001 with the objective of transforming the energy marketplace in New Jersey.

The programs of the NJCEP are designed to complement the New Jersey Energy Master Plan, most recently revised in 2008. The Energy Master Plan has set three goals to be achieved by the year 2020:

- Reduce energy consumption by at least 20%;
- Reduce peak demand by 5,700 MW;
- Generate 30% of the state's electricity needs from renewable resources.

The NJCEP receives funding from New Jersey's Systems Benefit Charge, which is known as a Societal Benefits Charge (SBC) in the state. The SBC is administered by the New Jersey Board of Public Utilities (NJBPU) and managed through third parties. It has resulted in the creation of several programs designed to speed the adoption of renewable energy and energy efficiency in the state, including funding for large grid-connected renewable energy; rebate programs supporting energy efficiency and small-scale renewable energy; manufacturing incentives; efficiency in new construction and building retrofits; ENERGY STAR® products; energy audits; and support for a number of other programs and technologies.

The NJCEP is managed through an open stakeholder process of monthly meetings with energy efficiency and renewable energy businesses, public officials, electric and natural gas utilities, environmental groups, business organizations, state colleges and universities, as well as other interested parties. While these groups do not have a voting say in the program, the stakeholders assist in developing the specific residential, commercial, and industry energy efficiency and renewable energy programs, including their budgets, and they provide feedback on what is working in the market and what needs to be improved.

KEY DATES

1999 - New Jersey's electric utility restructuring legislation created a SBC to support investments in energy efficiency and renewable energy.

2003 - The New Jersey Board of Public Utilities (NJBPU) established the Office of Clean Energy (OCE) to administer the NJCEP.

2004 - NJBPU approved total funding of $745,000,000 for the years 2005 through 2008 for its energy efficiency and renewable energy initiatives. The growth in the level of projects resulted in changes to the Customer On-site Renewable Energy (CORE) incentive program to ensure a balance between supply and demand for funds.

2007 – Management transferred from the NJBPU to third-party program managers, Honeywell Utility Solutions and TRC Energy Solutions. The NJBPU continues to act as the administrator of the NJCEP, while contracted program managers are responsible for managing and implementing its programs.

May 14, 2009 - New Jersey received $73.6 million in American Recovery and Reinvestment Act (ARRA) funds for its energy stimulus priorities, for Energy Efficiency and Conservation Block Grants to local governments and for the State Energy Efficient Appliance Rebate Program.

FUNDING SOURCE AND COSTS

The New Jersey Clean Energy Program is funded via a small surcharge on all customers' electricity bills. This Societal Benefits Charge (SBC) is collected as a charge imposed on all customers of New Jersey's seven investor-owned electric public utilities and gas public utilities, with the amount determined by the NJBPU. Six programs that benefit both residents and businesses are supported by the SBC charges:

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social programs, nuclear plant decommissioning, the Universal Service Fund, remediation of manufactured gas plant sites, consumer education and the NJCEP.

From 2001 through 2008, $1.227 billion was collected to support New Jersey's Clean Energy Program. An additional $1.213 billion will be collected from 2009-2012. In September 2009, NJBPU approved a 2009-2012 budget of $1.213 billion, with approximately 80% ($950 million) devoted to energy efficiency programs and 20% ($243 million) to renewable energy programs. Any unspent funds, including incentive commitments from previous years, are carried into the next year's budget.

LESSONS LEARNED

To foster the continued growth of solar energy development in the state and to help meet its aggressive RPS goal, NJCEP instituted an innovative financing pilot program in 2007, Solar Renewable Energy Credits (SRECs). SRECs are registered and traded among electricity suppliers and other buyers within an established infrastructure. Electricity suppliers are required either to buy the SRECs, or to pay a Solar Alternative Compliance Payment (SACP) instead. The SREC-only pilot program was successful, resulting in installed capacity of more than 40 MW. Meeting the state's aggressive RPS goal under a business-as-usual approach, by contrast, would have required a $10 billion rebate program.

While collected as a tariff through the SBC, NJCEP's funds are classified as a "Special Revenue Trust Fund" in the New Jersey State Budget and part of the state's Annual Appropriations Act. This prevents the money from being reallocated to other state programs.

MONITORING AND EVALUATION

Protocols have been developed to measure resource savings, including electric energy capacity, natural gas, and other resource savings; and to measure electric energy and capacity from renewable energy and distributed generation systems. Specific protocols for determining the resource savings or generation from each program are presented for each eligible measure and technology. The protocols will be used consistently statewide to assess program impacts and calculate energy and resource savings to:

1. Report to the board on program performance;
2. Provide inputs for planning and cost-effectiveness calculations;
3. Calculate lost margin revenue recovery (as approved by the NJBPU);
4. Provide information to regulators and program administrators for determining eligibility for administrative performance incentives (to the extent that such incentives are approved by the NJBPU); and
5. Assess the environmental benefits of program implementation.

For more information, please consult the New Jersey Board of Public Utilities: New Jersey Clean Energy Program Protocols to Measure Resource Savings, June 2009 (NJBPU 2009a).

RESULTS

- For 2001 through 2008, program activities resulted in lifetime energy savings of over 22.6 million MWh of electricity; 70 million dekatherms of natural gas; 7.5 million MWh of renewable generation; and 1.5 million MWh of distributed generation from combined heat and power systems (NJBPU 2009b).
- As of November 30, 2009, New Jersey's Clean Energy Program had supported the installation of 4,719 renewable energy projects across the state, providing 153.9 MW of sustainable energy, including solar, wind, biomass and fuel cell projects (NJBPU 2009b).
  - Solar energy installations account for 4,676 of those projects, producing 115 MW of power.
  - Biomass installations now provide over 25.88 MW of installed capacity through 14 projects.
  - Wind installations now provide over 7.68 MW of installed capacity through 20 projects.

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- From 2003-2009, the NJCEP reduced electricity and natural gas consumption in approximately 500,000 buildings (NJBPU 2009b).
- As of 2009, residential customers had saved about $4 for every dollar spent by the program. In the commercial and industrial sectors, customers saved about $11 for every dollar spent by the program (NJBPU 2009b).

RESOURCES

New Jersey Clean Energy Program Website. URL: http://www.njcleanenergy.com/

Example of Successful Implementation: Efficiency Vermont

HIGHLIGHTS

Efficiency Vermont is a statewide energy efficiency utility created with Public Benefit Funds.

In 2007 and 2008, the projected underlying load growth was exceeded by gains in energy efficiency—in other words, the state of Vermont achieved negative load growth.

OVERVIEW

Vermont is widely known for its successful development of the United States' first "energy efficiency utility" named Efficiency Vermont. Efficiency Vermont was created in 2000 to allow energy efficiency to be treated as a resource in meeting the state's electricity demand. Efficiency Vermont is operated by an independent, nonprofit organization, the Vermont Energy Investment Corporation (VEIC), under contract to the Vermont Public Service Board. To provide energy efficiency as a resource, Efficiency Vermont believes that buying efficiency should be as easy as pulling into a gas station to pump gas. That is, for the customer, it should be just require a phone call to begin.

In order to sell energy efficiency as a resource to utility companies, Efficiency Vermont provides technical assistance, financial incentives and programs to Vermont ratepayer households and businesses. Efficiency measures include energy-efficient equipment and lighting. In addition, expert advice is provided for new construction and retrofit projects on existing residences, among other assistance. Businesses and low-income markets are served. Efficiency Vermont works directly with homeowners and renters, business operators, colleges and universities, municipal waste and water, schools, industrial processes, state buildings, farms, hospitals and ski areas to reduce their energy costs through energy efficiency.

Since its inception in 2000, Efficiency Vermont has saved customers more than $66 million in net benefits from energy efficiency investments (Huessy 2010). Not only does this redirect $66 million that would have been spent on energy to other parts of the economy, the energy saved by the program also reduced peak load. Further, the saved energy increases the reliability of existing generation, transmission, and distribution systems and helps delay the need to build new power plants.

The five market areas where Efficiency Vermont offers programs to reduce energy demand are 1) business new construction; 2) business existing facilities; 3) residential new construction; 4) residential existing homes; and 5) retail efficient products.

Efficiency Vermont targets its largest electricity users in the commercial and industrial sectors to provide

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customized, account-managed service and expert advice to address energy efficiency improvements unique to the customer's needs. Compared to the prior year, some successful measures in 2008 included (Efficiency Vermont 2009):

- A new refrigeration initiative delivered 475 MWh in savings;
- Air conditioning improvements saved customers 45%;
- Compressed air improvements saved customers 110%;
- Motors and motor control improvements saved customers 35%;
- Other projects saved 144,425 MWh in 2008.

KEY DATES

1999 - The state of Vermont established an energy efficiency utility (EEU) to implement ratepayer-funded energy efficiency programs.

2000 - The first year of implementation, Efficiency Vermont achieved about 20,000 MWh in energy savings.

2006 – The state of Vermont achieved 55,000 MWh of savings, which equated to a yield of 40 MWh saved for each $10,000 invested in Efficiency Vermont programs. Also in 2006 the Vermont Public Service Board increased its funding to Efficiency Vermont.

As a result of increased spending on programs, energy savings jumped to 103,000 MWh in 2007, completely offsetting the underlying electric load growth rate, reducing annual statewide energy requirements by 1.74%, and yielding 53 MWh saved for each $10,000 invested in programs.

2008 - Performance was even better: Energy savings were 144,000 MWh; and annual statewide energy requirements were reduced by 2.5%.

2009 - The Vermont Public Service Board (PSB) approved a new structure for the EEU, moving from 3-year contracts to a 12-year structure.[10]

FUNDING SOURCE AND COSTS

In 2009, Efficiency Vermont spent $30.9 million on efficiency programs (Huessy 2010). Efficiency Vermont is funded via a small surcharge on customers' electric bills. The cost is a set fee of 0.67 cents per kWh (which equates to five percent of the regular average rate of 14.23 cents per kWh) and is consistent for residential, commercial and industrial customers.

Prior to the formation of Efficiency Vermont as an energy-efficiency utility, this surcharge was in place and was used by the utilities themselves to pay for their own energy efficiency services. With the formation of Efficiency Vermont, the utility companies ceased to provide their own energy efficiency services.[11]

LESSONS LEARNED

The VEIC annually reviews Efficiency Vermont's progress toward performance goals and develops or accelerates strategies to meet those goals. Recent initiatives have included targeting four geographic areas for deep energy efficiency investments, direct installation programs for lighting and developing community energy projects.

Since its inception in 2000, the structure of Efficiency Vermont as an energy efficiency utility has been modified and improved as better ways of achieving its goals are learned. In 2007, Vermont began to consider structural changes to the model because 1) the existing three-year contract model was constraining the ability of Efficiency Vermont to engage in long-term energy-saving strategies, and 2) difficulties associated with the contractual relationship with the Public Utility Board hindered the potential of Efficiency Vermont.

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10 For information about the new structure for the energy efficiency utility to a 12-year "order of appointment", see this link from the Public Service Board website: http://psb.vermont.gov/docketsandprojects/eeu/7466

11 With the exception of one utility (Burlington Electric Department) which still provides energy efficiency services within its service territory.

Therefore, in 2009, a new, regulated energy efficiency utility model was approved by the Vermont Public Service Board, moving Efficiency Vermont from a three-year contract model to a 12-year model which will be regulated more like a power utility. This change will allow the EEU to take on longer-term roles, commitments, and partnerships, including long-term resource planning.

MONITORING AND EVALUATION

Vermont law gives the Public Service Board responsibility for overseeing the energy efficiency utility. Monitoring and evaluation activities are carried out by the Department of Public Service, Vermont's agency within the executive branch of government charged with representing the public interest in matters relating to energy. The Department annually verifies Efficiency Vermont's savings claims. In addition, a triennial independent audit of Efficiency Vermont's cost-effectiveness is conducted. For more information and extensive details about the oversight activities, see http://psb.vermont.gov/utilityindustries/eeu/generalinfo/oversightactivities.

RESULTS

- In 2008 alone, Efficiency Vermont achieved savings of 144,000 MWh, a significant increase over 2007 (Efficiency Vermont 2009).
- Between July 2007 and the end of 2008, in the state's four areas targeted for accelerated savings, winter peak electricity savings were increased by 320%, and summer peak savings were increased by 680% (Efficiency Vermont 2009).
- At a cost of only 3.1 cents per kilowatt-hour, efficiency remains Vermont's least-cost resource to meet the electricity needs of homes and businesses (Efficiency Vermont 2009).
- In 2008, Efficiency Vermont and its partners lowered annual statewide electrical demand requirements by 2.5%, reducing the need for expensive new generation and transmission infrastructure to meet that demand (Efficiency Vermont 2009).

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RESOURCES

Efficiency Vermont: www.efficiencyvermont.com

The Vermont Department of Public Service Web site: www.publicservice.vermont.gov. Or for regulatory information relating to the Energy Efficiency Utility: http://psb.vermont.gov/utilityindustries/eeu/generalinfo

Background on Efficiency Vermont: (Chapter 6, beginning with Page 7): http://publicservice.vermont.gov/pub/state-plans/state-plan-electric2005.pdf

Efficiency Vermont results: http://www.efficiencyvermont.com/stella/filelib/Highlights2008_Final.pdf.

Efficiency Vermont annual reports: http://www.efficiencyvermont.com/pages/Common/AboutUs/AnnualReport/

State of Vermont, current energy efficiency charge rates for the PBF: http://psb.vermont.gov/utilityindustries/eeu/generalinfo/currentEECrates

New directions for Vermont: For information about the new structure for the energy efficiency utility to an "order of appointment", see this link from the Public Service Board website: http://psb.vermont.gov/docketsandprojects/eeu/7466

2D ENERGY CODE IMPLEMENTATION

OVERVIEW

For countries and states interested in improving the energy performance of buildings, adopting an up-to-date energy code is an important first step. Equally important to achieving real energy savings is the need for strong energy code implementation. Even a well-written, model

energy code is no more than words on paper without the efforts of design professionals, builders, developers and code officials to comply with and enforce it.

Energy code implementation refers to all actions taken by government agencies, non-profit groups, the design and construction industries and other stakeholders to ensure that involved organizations have the information and tools needed to achieve compliance with the adopted code. Although often used interchangeably, compliance refers to the responsibility of the building community to comply with the code, whereas enforcement refers to the responsibility of the government or third party organization to verify that buildings meet code requirements. If either enforcement or compliance is lacking, the adopted code will not achieve its targeted energy savings.

The primary goals of comprehensive energy code training are to familiarize building professionals and code officials with the current model energy codes and convince them that energy codes are vital to their core mission of protecting life, health, and safety. Training, then, must also cover national energy goals, local government priorities, climate change, and the latest "green" technologies. Training can occur in classrooms, via the internet, and on building sites, depending on factors such as geography, demographics, funding, and other variables.

Implementation efforts determine the efficacy of codes by establishing critical infrastructure (e.g., multistage inspection procedures, permitting protocols) and providing necessary tools (e.g., educational resources, training).

- Policymakers and advocates often publicize the benefits of adopted codes. A clear implementation strategy transforms these promises into measureable energy and financial savings.
- Energy efficiency is the quickest, cheapest and cleanest way to reduce energy consumption and achieve a sustainable and energy future, and building energy codes are a critical component of that mission.

HOW IT IS FUNDED

Energy code implementation requires a significant investment of time and resources. Funding comes from a variety of sources, such as building permit fees, development fees, and state or national budget allocation, while climate change legislation might provide a new approach.

KEY PROGRAM ELEMENTS

- In order to achieve success, there must be real political support from the local government, and a truly dedicated staff championing the effort.[12]
- Compliance begins with a building design that is code-compliant.
- On the job site, builders and contractors need to understand how to install required materials and equipment in a manner that meets code requirements.
- Computer-based tools and services help to automate and streamline the permit and inspection processes:
  - ResCheck and ComCheck are used to generate field inspection checklists for on-site inspections.
  - On-site communications technology improves the efficiency of inspectors' assessments:
    - Successful energy code departments continually strive to improve code implementation by analyzing their own reports and data to determine the best practices and providing customized educational resources for their local construction industry.
    - Realistic codes and standards must be achievable with building supplies that are readily available on the market.

12 For example, in Seattle, Washington, John Hogan, the Senior Code Development Analyst for the Seattle Department of Planning and Development has been working for nearly thirty years to uphold high energy code standards for the City.

Example of Successful Implementation: Seattle, Washington

HIGHLIGHTS

- The Seattle Energy Code (SEC) was originally adopted in 1980, as mandatory for residential and nonresidential (commercial, institutional, industrial) buildings. The code is updated every three years.
- City resolution sets targets for the energy savings of non-residential buildings at 20% above the current ASHRAE Standard 90.1.[13]

OVERVIEW

Seattle, Washington has a population of 602,000 and is located in the Pacific Northwest region of the United States, about 100 miles south of the US–Canada border. While every city acknowledges their budgetary constraints, Seattle has made a concerted effort to prioritize energy efficiency. The City has recognized that without such an effort, code compliance will not occur by itself. Energy code enforcement requires a full commitment from the city, measured in labor force and resources, not just a promise of a "green initiative."

The City of Seattle's energy code addresses many different aspects of buildings, such as mechanical and electrical systems, insulation, window glazing, and lighting.

The Seattle Department of Planning and Development (DPD) is responsible for setting and enforcing the Seattle Energy Code (SEC). DPD responds to complaints, encourages questions, and is readily available to the design and construction community. The DPD conducts a multistep plan review and inspection process for energy code compliance for all construction projects. The main steps are:

1. Intake staff screen all applications for building permits and mechanical permits to ensure they are complete.
2. The energy and mechanical code plan reviewers then examine all drawings and return them to the project design team with a correction list, indicating specific areas of noncompliance and incomplete information. For complex or unusual projects, an "interpretation conference" is organized to allow the project design team to ask questions and gain a detailed understanding of the energy code requirements.
3. The electrical plan reviewers provide a comparable review for electrical permit applications, checking for energy code compliance with lighting requirements, and issuing correction lists as necessary.
4. After the design team makes the necessary corrections, DPD issues the appropriate permit: building, mechanical, or electrical.
5. On-site inspections then verify that each phase of construction corresponds with the approved plans.

KEY DATES

1974 - Seattle adopted insulation requirements for hotels, motels, apartment houses, lodging houses, dwellings and other residential buildings.

1977 - The state of Washington adopted insulation standards for residential buildings.

1980 - Seattle adopted a comprehensive Seattle Energy Code (SEC) for both commercial and residential structures, which is applicable to the altered portions of existing structures. Washington State adopted a comprehensive Washington State Energy Code (WSEC) six months later.

1985 - The state legislature passed the State Building Code Act and State Energy Code Act (SECA). The State Building Code Act gave rulemaking authority to the Washington State Building Code Council (SBCC), which oversees all building and energy codes within the state (BCAP 2010).

1986 - Seattle linked its code to the WSEC with minor

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13 In regards to energy standards, ASHRAE is a commonly used source of technical standards and guidelines.

amendments. Since that time, the WSEC is reviewed and updated at least every three years, and the SEC has either matched (in areas where state law does not allow modifications) or exceeded the WSEC.

2001 - The Seattle city council adopted a resolution to require that each subsequent update to the SEC achieve a 20% increase in energy savings beyond the current ASHRAE Standard 90.1.

2009 - The SBCC adopted the 2009 Washington State Energy Code (WSEC) on November 20, 2009. The code will take effect statewide on July 1, 2010. DPD staff has begun internal development of the 2009 SEC, which will consist of the 2009 WSEC plus Seattle amendments to the non-residential criteria. DPD is conducting public review in the first quarter of 2010. Its goal is to have the 2009 SEC take effect on a similar timeline as the 2009 WSEC.

FUNDING SOURCE AND COSTS

The DPD does not estimate the cost of energy code enforcement independently; it is incorporated into the overall cost of running the department.

DPD has five full-time staff who conduct energy code plan reviews for multifamily and nonresidential projects (structural plan reviewers determine energy code compliance for single-family projects). Its building, mechanical and electrical inspectors incorporate energy conservation into their regular work.

When the initial Seattle Energy Code took effect in 1980, Seattle established a separate energy review fee equivalent to 20% of the building permit fee. Later, the energy review fee was removed as a separate line item, and incorporated into the building permit fee.

In addition, the city's municipal electric utility, Seattle City Light, funds 3.25 FTE[14] of energy code positions at DPD to implement SEC requirements that are more stringent than the WSEC. These funds come out of Seattle City Light rates. Greater energy efficiency reduces the need to purchase or develop new power generation.

LESSONS LEARNED

Challenge: *Prior to staff being hired, for the first six months of 1980 DPD permitted architects, engineers and designers to demonstrate compliance using their own professional stamps. After examining plan revisions submitted for these projects, DPD found many cases in which the initial design did not comply with the code. For the project design teams, the issue was not of carelessness or lack of concern for energy code provisions. Rather, they lacked the necessary expertise, which led to confusion, misinterpretation and widespread compliance failure.*

Solution: While the acceptance of professional stamps in lieu of plan review was only intended as a temporary measure until staff was hired and trained, the experience validated the need for detailed plan review and inspection. The DPD reaffirmed the necessity of conducting a thorough plan review process for each project.

Challenge: *The energy code is updated periodically, and updating the building community is difficult.*

Solution: Staff members and inspectors are trained after each code update to ensure that DPD staff present consistency in enforcement and code corrections. In turn, DPD staff offer training sessions for the building community, which are organized by topic: building envelope, mechanical, and lighting. These sessions cover updates and changes to the code, as many of the attendees are accustomed to building to the existing or former Seattle Energy Code. The staff also trains local trade association chapters and other specialty groups upon request. It is important to do detailed reviews during the first six months so that designers and contractors know to update their specifications and change their standard practices. In addition, DPD staff members and inspectors meet weekly to discuss code issues as they arise.

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14 FTE stands for Full Time Equivalent; in this case meaning the equivalent number of hours worked by 3.25 full time employees in a regular week.

Challenge: *While project design teams are responsible for code compliance, they were not adequately proactively educating themselves on the requirements of the code.*

Solution: DPD supplies a variety of resources, including Client Assistance Memos (CAMs), handouts in multiple languages, and a technical hotline to clarify code requirements in order to avoid ambiguity and alleviate problems during the plan review stage. DPD believes that putting in the work upfront saves time and energy later.

MONITORING AND EVALUATION

The DPD conducts roughly 130,000 inspections per year, and most inspections cover building areas addressed by multiple city building codes, including the energy code.[15]

RESULTS

The result of Seattle's code implementation process is that the city has instilled in its building industry community a culture of acceptance of the energy code requirements and enforcement. Unlike other cities, where the industry may get away with not complying with aspects of the code, in Seattle the construction industry knows that they must comply with the energy code. From the beginning stages until the end, DPD staff works with the builders and contractors to assure that their buildings comply with the SEC.

According to the Market Progress Evaluation Report for the Northwest Energy Efficiency Alliance, total compliance with the energy code exceeds 75% (NEEA 2008). The city does not release the certificate of occupancy until requirements are met.

As a result of the DPD staff working closely with building developers to ensure that they meet each permit requirement, the city achieves close to 100% permit closure rate (Lorimer 2009).

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Example of Successful Implementation: Dakota County, Minnesota

HIGHLIGHTS

- Dakota County designed and adopted the Dakota County's Design, Construction, and Sustainability Standards ("the standards") for new county facilities and major renovation projects.
- The standards include sustainability standards and post occupancy evaluations.
- Twelve buildings have been built so far, and five public buildings have been remodeled or upgraded. At 680,000 square feet, this represents 46% of the county's owned space.

OVERVIEW

Dakota County encompasses 593 square miles, has a population of 400,000 and is located just south of Minneapolis, Minnesota (Burrows 2010). Its land use is equally split between urban, suburban and rural/agricultural uses. Rather than creating guidelines or a rating system to provide incentives for the implementation of sustainability principles, the Dakota County Board of Commissioners has gone one step further and incorporated sustainability principles into its design and construction standards. Further, as new

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15 This number decreased significantly in 2009 because of the global economic downturn that slowed construction throughout the United States

successes are achieved, the standards are modified for continuous improvements. The standards provide a level of quality and durability that meet the vision and goals of the Dakota County Board of Commissioners through the design of county government buildings to a minimum life expectancy of 100 years.

Dakota County recognizes that current energy and building codes are just "minimum standards" and it strives to build high quality buildings that protect taxpayer capital investments and the environment.[16] While the standards are only a requirement for Dakota County government buildings, the County Board of Directors has made them available free of charge to others, and neighboring counties have used them as a basis for developing and adopting their own standards.

Dakota County currently owns and maintains 1.5 million square feet of space including office buildings, courtrooms, libraries, highway shops and detention facilities. Dakota County is committed to providing long-term value to the citizens of Dakota County. To achieve this, the County has developed building standards, training and evaluation to precisely define the county's standards of quality which include that all new buildings and major renovation projects are designed with a high level of energy efficiency. Specifically, their target is to set standards that are 30-40% better than the Minnesota state energy code.

Project design consultants (engineers, architects, and others) are informed of the requirement to use the construction, design, and sustainability standards in the county's requests for proposals and must attend a half-day seminar in order to qualify for selection on county projects. The county communicates its expectations to the building contractor with regard to quality and sustainability via its *bid document*.

A firm's experience with sustainable design is a key criterion for selecting architects. The building *standards document* is provided to the selected design team at the initiation of the project. County staff meets with the design team to discuss the project approach and specifically how the standards will be applied to the individual project.

Throughout the building process, Dakota County staff, the project design consultants, project design team and county owner or quality assurance consultants, such as mechanical, electrical, civil and structural engineers, meet to inspect construction and to ensure compliance with the standards. A checklist is used and is organized into four project phases: (1) planning, (2) design, (3) construction documents and (4) construction. The checklist and sustainability standards are built on the following principles:

- Energy conservation, initial and throughout the life of the building;
- Water conservation;
- Respect for the unique characteristics of each site;
- Use of environmentally responsible materials that are nontoxic, made with recycled materials, manufactured with low-embodied energy and come from renewable, sustainable sources;
- Reduced consumption and elimination of waste by reusing materials and recycling; and
- Use of nontoxic building materials and proper ventilation to provide healthier work environments.

A quality check is performed at the end of each phase of the design process to ensure that the design meets the standards. It is the responsibility of county staff, the project architect, and quality assurance consultants to inspect the construction and ensure compliance with the standards.

KEY DATES

Although the standards were formally adopted in January 2001, the standards have been in use for all county facility projects since early 1999.

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16 Property taxes are based on the county's operational expenses. That is, they are set so that they cover the costs of operating the Dakota county government-owned buildings, and part of that are energy costs. Dakota County staff sites the comparable national average operating cost per square foot of public space as $2.10, and their own costs are $1.23 per square foot, lowering taxes.

FUNDING SOURCE AND COSTS

All costs associated with implementing the standards are included in the annual county operating and capital improvement budgets. The initial standards development cost was $50,000. Ongoing revision costs are approximately $25,000 per year.

LESSONS LEARNED

Challenge: *Many in the construction industry perceive sustainability and energy efficiency initiatives to be unnecessary.*

Solution: Competent Dakota County project managers fully understand and are able to effectively communicate the standards to project designers and contractors. They are able to communicate a strong business argument for conserving energy and resources with all construction project team members.

Frequent communication is key: At the design consultant selection phase of the project, the county requires all prospective design teams to attend a training session as a condition to constructing or remodeling public buildings in the county. The staff communicates frequently with architects and construction teams throughout the project, and reminds them of the importance of following high-performance sustainability standards.

Government support and excellent communication are essential to success. It is critical to have a champion at the highest possible levels of county government and to formally adopt standards at the highest level of the government.

Challenge: *There was a perception that sustainable and energy efficiency design and construction increases building costs.*

Solution: County office buildings are designed as Class A space[17], and the cost per square foot for construction is no greater for county buildings completed with the sustainability standards than those completed prior to adoption of the new standards. A striking difference is that the new buildings are much more energy efficient. In order to overcome the perception of higher costs, Dakota County:

1. Created a strong business argument to prove or disprove the cost of sustainable building design and construction;
2. Solicited an independent construction estimate cost at the end of each phase of design through completion of bid documents with focus on cost per square foot for construction only, then compared the independent cost estimate to the cost of similar completed facilities in the geographic area;
3. When first introducing the new standards, Dakota County completed one building with the new sustainable and high performance standards for the purpose of measuring the improved energy efficiency and corresponding reduced annual energy operating costs. This served as an example for subsequent new building project construction teams; and
4. Communicated results widely to other professionals and building owners.

MONITORING AND EVALUATION

A systematic, independent examination and review is conducted on all major projects to determine whether quality activities and related results comply with stated project objectives and criteria and whether they are implemented effectively and responsibly to achieve planned outcomes. These include a recommissioning process[18] for mechanical and electrical systems within the first 5 years of project completion.

"Post-occupancy inspections" are performed annually or more often as conditions warrant for critical structural areas, including building envelope and roofs. Written verification is established that all design and

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17 Class A Office Space refers to the highest quality office space locally available.

18 Recommissioning process is used to determine if the system continues to function as it was designed – i.e. whether all pieces are working as designed and intended.

sustainability requirements have been achieved and maintained. The U.S. Environmental Protection Agency (EPA)'s ENERGY STAR program[19] is used to benchmark and track energy efficiency beginning at county occupancy of the facility.

County project managers, architects and engineers verify and confirm compliance with the standards by completing these six forms:

- Compliance Summary
- Statement of Energy Performance
- Site and Water
- Energy and Atmosphere
- Indoor Environmental Quality
- Materials and Waste

RESULTS

Twelve new buildings have been completed since 2001, including these types of buildings: office, court, jail, shop, vehicle maintenance garage warehouse, park visitor's centers and library. In addition, three existing libraries and one existing court building were remodeled using the standards. One notable example is the county's Northern Service Center, the largest capital project undertaken by Dakota County. This building achieved the EPA ENERGY STAR[20] certification rating of 97 on a scale of 1-100 and is saving the county $288,000 annually (Burrows 2010). Specific results include:

- In 2009, the county saved about $1.3 million in energy costs (Burrows 2010).
- This savings equates to 10,335 metric tons of CO_2 per year in avoided greenhouse gas emissions (Burrows 2010).
- Dakota County average annual energy use is 39% lower than the national average (Burrows 2010).

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RESOURCES

Overview of Seattle's energy code: http://www.seattle.gov/dpd/Codes/Energy_Code/Overview/

Overview of Seattle's code inspections: http://www.seattle.gov/dpd/Permits/Inspections/default.asp

Dakota County, Minnesota information: http://www.dakotacounty.org

Energy Star: https://www.energystar.gov/index.cfm?c=government.bus_government or http://www.energystar.gov/index.cfm?c=business.bus_bldgs

2E APPLIANCE STANDARDS

OVERVIEW

Appliance and equipment standards help states meet energy policy objectives while lowering energy bills for consumers and reducing energy-related emissions. Such standards are a straightforward way to formalize a preference for and increase the demand for equipment that uses less energy.

In states with appliance and equipment efficiency standards, sales of equipment that use more energy

19 According to the United States Environmental Protection Agency's ENERGY STAR program, benchmarking your buildings' energy performance is a key first step to understanding and reducing energy consumption and your carbon footprint. All buildings can assess their energy performance, water efficiency, and carbon emissions using Portfolio Manager at http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

20 According to the United States Environmental Protection Agency's ENERGY STAR website, an ENERGY STAR qualified facility meets strict energy performance standards set by EPA. To determine the performance of a facility, EPA compares energy use among other, similar types of facilities on a scale of 1-100; buildings that achieve a score of 75 or higher may be eligible for the ENERGY STAR. The EPA rating system accounts for differences in operating conditions, regional weather data, and other important considerations.

than the state standard are prohibited. When states lead by example by establishing such rules, they provide a credible, proven example that can pave the way to federal policy. Indeed, many federal appliance standards in effect today have been the direct result of state leadership.[21] Such standards limit the growth of national energy consumption and are cornerstones for meeting national GHG reduction goals.

It is important for local governments and consumers to understand the two main costs associated with appliances and equipment:

1. The initial purchase price; and
2. The lifetime energy costs to operate the equipment.

While the initial purchase price for a more efficient product may be higher, the cost, energy and carbon savings that result from appliance efficiency standards are enormous. According to the American Council for an Energy-Efficient Economy (ACEEE), between 1990 and 2000, standards already in place in the United States have reduced consumer energy bills by approximately $50 billion, and in 2000, standards reduced peak generating needs by approximately 21,000 MW—the equivalent of displacing seventy 300 MW power plants.

As older, inefficient appliances and equipment are replaced with newer, more efficient ones, the demand for electricity goes down, reducing peak demand and improving electric grid reliability while delaying the need to build costly new power plants. Adopting a policy of higher standards increases demand for more energy-efficient products. This helps move the market toward innovations that often include improved equipment performance.

Example of Successful Implementation: California

HIGHLIGHTS

- California has been reducing statewide energy demand since 1976 by implementing appliance standards.
- California often leads other states, in developing new appliance standards and in developing mechanisms for manufacturers to demonstrate compliance. It was the first state to adopt appliance standards and for decades has been the driving force in pushing for standards on new products.
- Most, if not all, of the appliance standards covered under federal legislation or in other states began in California (Alliance 2009).
- In California, the per capita energy use is roughly 50% less than the per capita average for the rest of the United States (Garcia T. 2010.).

OVERVIEW

California is a recognized leader in energy efficiency standards, beginning with the passage of the Warren-Alquist Act in 1974, which served as the impetus for creating the California Energy Commission (CEC).[22] The Act mandated that the CEC create energy efficiency standards based on life-cycle cost effectiveness for equipment and appliances. The first standards were established in 1976 and have been updated more than two dozen times since.

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21 The first standards were enacted at the state level in California in 1974, and were so successful that in 1986 product manufactures negotiated with energy efficiency advocates and states and reached consensus on national efficiency standards covering many major appliances that would preempt the individual state standards. The resulting agreement formed the basis for a new federal law, the National Appliance Energy Conservation Act of 1987. The United States Department of Energy is tasked with reviewing and periodically revising federal standards to ensure they include updated technological developments

22 The California Energy Commission was created by the state legislature in 1974 and has five major responsibilities for the state of California: (1) Forecasting future energy needs and keeping historical energy data; (2) Licensing thermal power plants 50 megawatts or larger; (3) Promoting energy efficiency through appliance and building standards; (4) Developing energy technologies and supporting renewable energy; and (5) Planning for and directing state response to energy emergencies. The Commission's role includes overseeing funding programs that support public interest energy research; advance energy science and technology through research, development and demonstration; and provide market support to existing, new and emerging renewable technologies.

The first standards applied only to refrigerators, freezers, room air conditioners and central air conditioners. The scope then grew to include space heaters, water heaters, plumbing fittings, flourescent ballasts and large air conditioners. The program now includes more than 50 classes of products.[23]

Appliance standards adopted in California apply only to appliances sold or offered for sale in the state, not to appliances sold wholesale in California for final retail sale outside of the state. In order for an appliance to be sold in the state it must be certified by the CEC and must be listed in the CEC's database to demonstrate that the standard is met. The state requires that appliances be marked in specific ways to show that they have complied with standards, but does not require a specific label to show compliance.

The California regulations specify (1) required energy efficiency levels; (2) testing and labeling requirements; (3) data collection procedures; and (4) the rules for enforcing both federal and state standards.

California continues to develop new standards and refine existing ones. The state considers three factors when deciding whether to adopt a new appliance standard. According to the California statute, all standards that the state adopts must:

1. Be considered only for "appliances whose use, as determined by the commission, requires a significant amount of energy on a statewide basis";
2. Be feasible and attainable;
3. Be cost effective, meaning that the standard "shall not result in any added total cost to the consumer over the designed life of the appliances concerned (CEC 2010)."

California identifies new appliances for consideration via the CEC, through the CEC's Public Interest Energy Research Program or on the basis of suggestions from national advocacy and research organizations or a California utility company.[24]

Utility companies in California actively participate in appliance standard setting via a program known as Codes and Standards Enhancement (CASE) and their participation is funded through the California goods charge.[25] The California Public Utilities Commission (CPUC)[26] requires utilities to meet a certain level of energy savings and financially rewards utilities that exceed the targets. Utilities can count their contributions toward the energy savings generated from appliance standards as achievements toward their required energy efficiency targets.

The process of researching, identifying and adopting new state standards requires an investment of time and money. While several other states have statutes that allow state agencies or the public utility commission to develop new standards of their own, these states generally rely on updates in California and proposals from the Appliance Standards Awareness Project (ASAP) for suggestions of new standards.

California requires that product manufacturers certify directly or through a third party[27] that their product complies with a standard by submitting information that documents testing procedures and results. Currently, California has standards that cover approximately 50 classes of appliances and a database of over 230,000 active appliance models. The database includes another 650,000 models no longer on the market (Brown, M. 2010).

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23 The most recent regulations were adopted by the California Energy Commission in December 2008, and approved by the California Office of Administrative Law in July, 2009, replacing all previous versions of the regulations.

24 More information about the Public Interest Energy Research Program is available at: http://www.energy.ca.gov/research/index.html

25 The Public Goods Charge is another name for a Public Benefit Funds (see chapter two).

26 According to the CPUC website at www.cpuc.ca.gov/puc/, the CPUC regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies. The CPUC serves the public interest by protecting consumers and ensuring the provision of safe, reliable utility service and infrastructure at reasonable rates, with a commitment to environmental enhancement and a healthy California economy.

27 For example, a certified laboratory may submit data demonstrating product testing results and compliance with the regulation.

Other states are building onto this large database. In fact, Connecticut's regulations require that manufacturers certify that they have submitted data and testing results to the California database, and several other states have begun using the common database system to simplify product tracking in their state.

For enforcement, manufacturers self-certify regulated products, and the CEC occasionally visits retailer stores and conducts random product testing to ensure compliance. The CEC also educates manufacturers about the standards. Competing manufacturers have, at times, notified the CEC that their competitors' products do not appear to comply (Ibid).

KEY DATES

1974 - California enacted the first appliance standards; then-Governor Ronald Reagan signed the State Energy Resource Conservation and Development Act. California remained the only jurisdiction—state or federal—with appliance standards for a decade and a half. Since then, other states have enacted standards for equipment not covered by federal standards.

2005 - CEC Commissioner Art Rosenfeld prepared Draft Emerging Technologies whitepaper stating that the state was not currently maximizing its energy savings potential, and that it will need to promote more innovation in emerging energy efficiency technologies.

2006 - The Global Warming Solutions Act of 2006 was passed (Assembly Bill 32, "AB 32"), which requires the state to cap its GHG emissions at 1990 levels by 2020. It requires the State Air Resources Board to establish a program for GHG emissions reporting and to monitor and enforce compliance with this program (Pew Center).

2007 - The California Legislature and Governor enacted Assembly Bill 1109 (Huffman and Feuer, Chapter 534, Statutes of 2007), the California Lighting Efficiency and Toxics Reduction Act. Among other things, AB 1109 directed the CEC to adopt minimum efficiency standards for all general purpose lights on a schedule specified in the regulations. The regulations, in combination with other programs and activities affecting lighting use in the state, shall be structured to reduce average statewide electrical energy consumption by not less than 50% from the 2007 levels for indoor residential lighting and not less than 25% from the 2007 levels for indoor commercial and outdoor lighting by 2018 (Singh, H. 2010).

FUNDING SOURCE AND COSTS

- California is the only state with several staff members devoted to appliance standards development and enforcement. As of early 2010, its staff consisted of five full-time staff, one part-time staff and a program manager at the California Energy Commission. Other states typically have one full-time or part-time staff member devoted to appliance standards.
- The California Energy Commission and all work related to appliance standards are funded by rate payers via a Public Benefit Charge. These funds are collected by electricity and natural gas ratepayers. It is estimated that the program costs less than $1 million annually to operate (Singh 2010).
- Energy utility companies provide research and funding support as necessary to meet their quota of energy efficiency to California State regulators.

LESSONS LEARNED

Challenge: *In general, states which had set standards prior to federal action may enforce their own standards until the federal mandates take effect, at which point the state standards are preempted by federal standards. It was a challenge to replace the efforts and expenses that California accrued by the federal government standards.*

Solution: Most states now do not attempt to set their own standards, but rather use either California's standards for appliance or equipment not covered under federal standards or simply rely on the federal government standards. The federal government has

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updated appliance efficiency standards through several legislative acts, and now has standards in place or under development for 30 classes of products.

As new appliances and equipment come on the market, California continually strives to put in place standards which may or may not be later preempted by the federal government.

Challenge: *When new standards are considered, they are challenged by concerns about the impact such standards will have on local economies, businesses and jobs. For example, in the previous two rulemakings, a significant amount of time was spent responding to questions regarding the potential loss of retail sales to lower-cost products sold over the Internet. There was general fear of disturbing the market balance.*

Solution: No major impacts or problem have occurred, but addressing concerns is a challenge. It is important to communicate to those concerned that regulations will bring innovative technologies to the market.

Challenge: *It is difficult to communicate standards to and receive information from overseas manufacturers.*

Solution: This poses compliance enforcement challenges and is an issue California is striving to improve.

Challenge: *California appliance regulations can only partially drive increased demand for more efficient and advanced technologies. When a more efficient product is new on the market and unknown to consumers, the cost for that product may be higher than one manufactured in large quantities and not as in-demand.*

Solution: When a standard setting program is combined with a rebate and reward program for products, a system can be created where incentives grow market share for efficient technologies. Eventually, standards can be set at the new efficiency level and the incentives can then progress to even more efficient products. This approach allows for better market transformation.

Challenge: *Energy utility companies tend to resist efficiency regulations as it is not in the financial and political interest of electricity generators to reduce demand for their product (energy).*

Solution: To address this problem, California incorporated efficiency into utility revenues. In California, utilities are penalized for inefficiency, allowed to retain profits if they are moderately efficient, and rewarded if they are exceptionally efficient. The result is that utilities that were once major opponents to appliance regulations have become important allies.

MONITORING AND EVALUATION

Every year, the California Energy Commission publishes an Integrated Energy Policy Report, which analyzes and measures the impact of each program.

The appliance program produces reports and information for the governor's office and state legislature for specific appliance sets. These are typically in response to a particular bill or political interest.

The California Public Utility Commission also evaluates the energy savings and impacts of the program to determine credit for involvement of utility companies.

RESULTS

According to staff at the CEC Appliance Efficiency Program and the 2009 Integrated Energy Policy report:

- Approximately 31.4% of the state's total energy savings were achieved through the appliance efficiency standards program in 2009.
- This represents the biggest savings in the state at 17,896 GWh, saving $2.5 billion in electrical bills annually.

The above estimates do not include the energy savings from 2008 and 2009 regulations. Regulations going into place in 2008 will generate approximately 11,000 GWh/year savings after the existing stock is replaced.

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At the present rate of 14 cents per KWh this will save an additional $1.54 billion a year.

Similarly, energy efficiency regulations for televisions adopted in 2009 will save California 6515 GWh/years after the current stock turnover. At the present rate of 14 cents per KWh, this will save California $914 million each year.

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RESOURCES

Database of Certified Appliances: http://www.appliances.energy.ca.gov/

Integrated Energy Policy Report: http://www.energy.ca.gov/2009_energypolicy/index.html

California Energy Commission 2009 Appliance Efficiency Regulations: http://www.energy.ca.gov/2009publications/CEC-400-2009-013/CEC-400-2009-013.PDF

State, local, utility and other incentive initiatives: www.DSIRE.org

CHAPTER III.
FINANCING SOURCES AND MECHANISMS

3A GOVERNMENT LOAN PROGRAMS

OVERVIEW

Government loan programs help customers overcome the financial barriers associated with renewable energy installations and energy efficiency improvements by spreading out costs over a period of time. They can be a better alternative to private lending agreements because they often provide lower interest rates, more favorable terms, and lower transaction costs; however, they can also be more complicated and time consuming to secure.

Loan programs can be administered by a government agency, a utility or a third party, either directly or by partnering with private lenders. Loan rates and terms vary by program and are sometimes determined on an individual project basis. Loan terms generally do not exceed twenty years. They can be managed as a revolving loan fund, a self-replenishing pool of capital created upon the program's inception. The fund revolves as payments from borrowers are returned to the capital pool and then lent to other borrowers.

HOW IT IS FUNDED

Funding for loan programs can originate from a variety of sources, including annual appropriations, public benefits funds, renewable portfolio standards (RPS) alternative compliance payments, environmental non-compliance penalties, or the sale of bonds.

KEY PROGRAM ELEMENTS

The Clean Energy States Alliance (CESA)[1] has identified ideal loan program guidelines, as summarized below and in CESA's March 2009 Briefing Paper, "Developing an Effective State Clean Energy Program: Clean Energy Loans" (Kubert et al. 2009).

- **Program modifications:** Programs need to be designed and adjusted to meet market objectives. For example, if the state program is trying to encourage certain clean energy technologies, the interest rates on those targeted technologies should be lower.
- **Low interest rates:** Interest rates should be below those of commercial lenders, with a long repayment term (at least 10 years), and minimal fees.
- **Simplified, high quality application process:** Programs should have an easy, concise application process, with quick loan approval. Loan program staff should be knowledgeable about renewable energy and energy efficiency in order to properly evaluate and underwrite loan requests.
- **Monitoring and evaluation:** Loan programs should include a mechanism for tracking the details of program use, costs, and energy savings or production for program evaluation and improvement. The loan fund should closely monitor projects throughout the lend-

1 CESA is a nonprofit organization that provides information and technical services to its members and works with them to build and expand clean energy markets in the United States.

ing cycle, throughout construction and operation, in order to anticipate and solve problems.

- Active program marketing: The state should coordinate with other state and local programs and relevant stakeholder groups to build program awareness among both potential borrowers and private lending partners.

RESOURCES

Clean Energy States Alliance, "Developing an Effective State Clean Energy Program – Clean Energy Loans." URL: http://www.cleanenergystates.org/Publications/CESA_Loan_Programs_March09.pdf

Example of Successful Implementation: Energy $mart℠ Residential Loan Fund; New York

HIGHLIGHTS

The Residential Loan Fund is a component of New York Energy $mart℠, a public benefit program designed to lower electricity costs by encouraging energy efficiency. One of the goals of the Residential Loan Fund is to demonstrate to financial institutions the economics of lending for energy efficiency and renewable energy projects.

The fund includes the elements of an effective loan program: (1) a term of up to ten years to reduce monthly payments to affordable levels; (2) an attractive program interest rate up to 4.0% below the normal market interest rate; and (3) the ability to obtain loans on a secured or unsecured basis, at the option of the borrower and the lender.

OVERVIEW

The New York State Energy Research and Development Authority (NYSERDA)[2] offers the New York Energy $mart℠ Residential Loan Fund Program, which provides eligible New York residents with an interest rate reduction of up to 4.0% or 400 basis points less than a participating lender's normal market interest rate, reduced as low as 3.0% (program interest rate floor) to finance certain eligible energy efficiency improvements and/or renewable technologies. NYSERDA makes a one-time lump sum payment to the participating lender to subsidize the borrower's interest rate by up to 4.0%. Customers of Systems benefit charge (SBC) participating investor-owned utilities are eligible to finance up to $20,000 for up to 10 years through the Residential Loan Fund, although Consolidated Edison customers may finance up to $30,000 (DSIRE 2009d).

Eligible borrowers must be approved for financing through a participating lender, and access to the Residential Loan Fund is contingent upon prior approval though another NYSERDA program, including home performance with ENERGY STAR. Participants in the Photovoltaic (PV) Incentive Program were formerly eligible to access the Residential Loan Fund, although a change in that program, effective January 11, 2010, now prohibits customers from accessing the Residential Loan Fund. Additionally, funding in support of the Wind Incentive Program has been exhausted, and applications are no longer being accepted for that program at this time (NYSERDA 2010).

KEY DATES

February 9, 2009 – The Commercial component of the Residential Loan Fund was suspended, and the program will remain closed.

FUNDING SOURCE AND COSTS

The Residential Loan Fund is currently funded by the state's system benefits charge applied to customers of SBC-participating investor-owned utilities.

Eligible participating lenders include: commercial banks, savings and loan associations, credit unions, farm credit associations, community development financial institutions, and other financial institutions

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2 NYSERDA is a public benefit corporation created in 1975. NYSERDA helps meet New York's energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment. It is currently funded by the state's systems benefits charge.

regulated by New York state and Federal regulatory agencies. Eligible participating lessors must be leasing subsidiaries of bank holding companies or bank-owned leasing companies. For purposes of the Residential Loan Fund, references to loans shall include leases.

LESSONS LEARNED

The greatest challenge to the Residential Loan Fund program is demonstrating the economics of lending for energy efficiency. A low default rate of roughly 2% is a strong indicator that energy efficiency retrofits decrease energy expenses and thus increase the customer's cash flow.

MONITORING AND EVALUATION

Eligible borrowers must use funds for certain eligible energy efficient improvements to facilities that are assessed the SBC or Renewable Portfolio Standard (RPS) by one of the following entities: Central Hudson Gas and Electric Corporation, Consolidated Edison New York State Electric and Gas Corporation, National Grid, Rochester Gas and Electric Corporation, or Orange and Rockland Utilities, Inc.

RESULTS

The program is highly publicized across the state, and experiences high demand. Banks are sought to participate in the program to offer their existing customers a new loan product to address their energy concerns, and use the Residential Loan Fund as a mechanism to attract new customers. At the time of publication of this document, there are currently 25 participating loan fund lenders which have joined since the program was issued on November 10, 2009), with new lenders being approved regularly.

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http://www.nyserda.org/resloanfund.asp

RESOURCES

New York Energy $mart Residential Loan Fund homepage:
http://www.nyserda.org/resloanfund.asp

3B PROPERTY ASSESSED CLEAN ENERGY

OVERVIEW

A Property Assessed Clean Energy (PACE) financing program provides private property owners with funding for energy efficiency and renewable energy measures, which is subsequently paid back over a certain number of years, via a charge on the owners' property tax bill. By design, the charge on the property tax bill is offset by reduced monthly energy bills.

The typical steps to setting up a PACE program include:

1. The state passes legislation to allow existing special municipal tax district law to include energy efficiency and renewable energy measures on private property;
2. A municipality (city or county) creates a special tax district, issues municipal bonds (e.g., property types or accesses other funding sources), and sets the terms of the program (duration, interest rates);
3. Real estate owners apply for PACE funds to install energy efficiency or renewable energy measures;
4. The municipality pays the property owner or installer once the project is complete;
5. The municipality adds a PACE line item to the property tax bill, and places the PACE funding as a senior "lien on the property"; and
6. The tax assessment is repaid by the real estate owner over 10–20 years via a line item on the property tax bills.

This method of financing energy efficiency and renewable energy measures allows property owners to benefit from

energy savings immediately while spreading out the cost of improvements over a number of years. By design, the resulting monthly energy bill savings will cover the cost of the payments. In addition, an existing mortgage (or future refinancing) may be more secure due to both an increase in the property owner's cash flow from reduced energy costs and the investment in the property.

The initial capital cost to buy new equipment or renovate buildings is often a major barrier to the greater implementation of energy efficiency or renewable energy. PACE eliminates this barrier for major energy efficiency retrofits and distributed renewable energy generation. The property owner and system installers can receive 100% financing.

Another significant barrier to major investments in energy efficiency and renewable energy is the payback period, which is often longer than the period that the current property owner actually owns the property. PACE financing removes this barrier as it ties the repayment to the property itself rather than the borrower, allowing the tax assessment to be transferred to the future property owner who will benefit from lower energy bills. Thus, the current owner is only responsible for the repayment on the loan during the period they own the residence or commercial property. Prospective buyers need to be informed that the cost of the higher tax bill is offset by lower energy bills.

HOW IT IS FUNDED

- State or local municipal entities, or the private entities they designate, provide the up-front financing for efficiency or renewable energy improvements.
- The program can be funded with internal public agency funds (for example, in the city of Palm Desert and the county of Sonoma, both in California), or via external sources of funding such as municipal bonds (as in Berkeley, California or Boulder County, Colorado).
- The lien placed on the home or commercial property can be used to secure bonds or other forms of debt financing.
- Bond proceeds typically cover administrative program costs in addition to the cost of the clean energy improvements.

KEY PROGRAM ELEMENTS

- If the home is sold after the energy efficiency or renewable energy upgrades are made, the assessment remains with the property, not the original borrower. The benefits of lower energy bills pass on to the new owner, and the new owner assumes the remaining payments.
- The lien on the home or commercial property should be the first position ahead of any private mortgage lien; in the event of failure to pay, foreclosure on the property begins (there is no personal or other asset recourse).
- It is imperative that major financers (such as Freddie Mac or Fannie Mae in the United States) provide clear guidelines that are not administratively burdensome and that they respect the senior tax structure of PACE liens.
- PACE programs should take into account the concerns of the lender/mortgage holder by incorporating underwriting standards into the program, such as specifying the ratio of the measure costs to the total property value.
- To scale up PACE programs, federal legislation providing a credit guarantee is being considered. This may reduce interest rates for the bonds by reducing lenders' risks, and make the program more cost-effective for property owners.
- In order to succeed, it is imperative to have real political commitment from the local government, and a truly dedicated staff championing the effort.[3]

3 For example, in Babylon, NY, the Municipal Chief Executive Officer (Steve Bellone, an elected official) actively promotes and supports the city's PACE program.

Example of Successful Implementation: Long Island Green Homes Program; Babylon, New York

HIGHLIGHTS

Property owners in Babylon, New York can get a loan to make extensive energy improvements to their property with no upfront cost.

OVERVIEW

In October 2008, the Long Island Green Homes Program began offering a program to allow residents to make energy efficiency and renewable energy upgrades in their homes with little or no upfront costs. Residents can apply for up to $12,000 to add insulation, install a new heating system or pursue other measures. The first step is to conduct an audit of the property to determine the most cost-effective energy upgrades. The audit is performed by a Town of Babylon Licensed Green Homes Contractor and costs $250. This expense is rolled into the loan if the resident chooses to go forward and make improvements.[4]

Next, the upgrades are made, and the town pays the contractor upon completion of the work. Over time, the property owner pays back the loan via a separate charge on their regular trash bills. The program is structured so that the monthly energy savings are more than the monthly loan payments.

If the home is sold thereafter, the loan remains with the property, not the original borrower. The benefits of lower energy bills pass on to the new owner, and the new owner assumes the remaining loan payments.

KEY DATES

The program launched in November 2008.

FUNDING SOURCE AND COSTS

Officials were able to secure $2 million from the town's solid-waste reserve fund for a pilot PACE program (please refer to the Lessons Learned section below).

In order to give the pilot program the best chance for success, the interest rate on the loans was kept to a minimum.

To pay off their loan, property owners are billed monthly. If they fail to pay on their loan, the loan becomes delinquent and the full remaining amount is then attached to their property taxes.

The town charges a 3% administrative fee which is built into the monthly payments made when paying their loan.

Going forward, officials are considering the possibility of PACE becoming a source of income for Babylon. They are considering developing a self-sustaining, market-based business model similar to the profitable energy-from-waste public/private partnership (PPP) model existing in Babylon today. The model would be developed based on these premises:

- Carbon savings resulting from the PACE installations would need to be legally and accurately quantified;
- The town would sell the "negawatts" resulting from PACE improvements into the wholesale energy market as a least-cost resource to be purchased by the local utility company[5] (see section 3G: Power Purchase Agreements of this report);
- If the energy measures of the PACE program were installed through a power purchase agreement[6] so that the PPP legally owns and maintains the installed equipment on a property, the town may be able to reap benefits that would otherwise not be harvested by the property owner—for example, tax depreciation benefits for equipment installed on residences, certain rebates, white tags or carbon credits.

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4 More than 80% of energy audits result in the property owner making significant energy improvements to their property, according to Dorian Dale, the Sustainability Officer for the Town.

5 The term "negawatt" was coined by Amory Lovins of Rocky Mountain Institute in Colorado and refers to electricity that was not generated (due to energy efficiency).

6 See Section 3G of this report for more on Power Purchase Agreements.

- The property owner would rent the equipment from the town and reap a share of the benefits via a reduced energy bill, and then have the option to buy the equipment at the completion of a specified period. This arrangement would be most viable on a larger scale—that is, for commercial or multifamily buildings.

LESSONS LEARNED

The town wanted to offer a way for community members to finance energy efficiency via a $25 million solid waste fund. In order to access these funds, the town had to amend the definition of solid waste to include energy as waste due to its carbon component. By doing so, town officials were able to secure $2 million to fund a pilot program, from the solid-waste reserve fund (Dale 2010).

Originally the town conceived of property owners paying for their loans directly on their regular monthly energy bills, but the local utility company did not want to act in the role of collector or have the obligation assigned to the meter. Therefore, the property owners are billed separately on a monthly basis on their trash collection bill.

MONITORING AND EVALUATION

A Building Performance Institute (BPI) certified project director accompanies all new program contractors on their first five jobs to ensure quality and uniformity. In addition, the project director performs measurement and verification (M&V) on 15% of the completed retrofits (Dale 2010).

RESULTS

- Improved residences reduce carbon emissions by about four tons per year (Dale 2010).
- Improved residences have an average of 24% lower energy bills, saving on average about $1,030 per year (Dale 2010).
- As of February 2010, more than 200 residents have participated in the program, and another 141 residents are in the queue awaiting retrofits (Dale 2010).

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RESOURCES

Alliance to Save Energy: http://ase.org/content/article/detail/6482

Berkeley, California pilot program and a guide for local governments: http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=26580

Database of State Incentives for Renewables and Efficiency (DSIRE): http://www.dsireusa.org

PACE NOW: http://www.pacenow.org/

Town of Babylon: http://ligreenhomes.com or www.thebabylonproject.org

3C MUNICIPAL BONDS

OVERVIEW

Bonding authority refers to local municipalities' ability to raise funds to pay for energy efficiency and renewable energy projects by utilizing a financial instrument known as bonds. Bonds have long been used as a fundamental means of financing public development projects. Bonds use public/private partnerships to bring capital to an energy efficiency or renewable energy project at an affordable cost.

Essentially, bonds are loans from a funding source (investors) to a city or other local municipality. The

investor providing the funds purchases the bond, and in turn receives interest payments over a predetermined period of time. At the end of the bond's term, its principal value is repaid.

Bonds can be issued by municipal authorities, private entities, or municipal authorities on behalf of private entities (known as private-activity bonds). Of these broad categories, the interest paid by municipal bonds and some private-activity bonds are typically tax-exempt. This allows the issuing authority to pay lower interest rates to the investors while remaining competitive within the bond market, thereby achieving a lower cost of funding for the public development project. Investors who buy taxable bonds will expect to earn a higher interest rate.

Municipalities can sell bonds to raise the funds necessary to overcome initial capital and other costs associated with new initiatives.

Bonds represent an important and frequently used funding route for launching new energy efficiency and renewable energy programs. Cities and other municipalities use such bond measures to facilitate investment in their communities by utilizing these funds for the public benefit, and repaying them through public funds typically recouped through routine tax revenues.

As one example of a bond measure which addressed solar photovoltaics, in 2001, San Francisco voters approved a $100M bond-financed solar project to install photovoltaic arrays on public buildings, including a 675 kW installation on the city convention hall.

A tax credit bond is a specific form of bond which yields payment from the federal government to the investor in the form of tax credits instead of having the tax-exempt status of other municipal bonds. Such tax credits allow municipalities to borrow for certain "qualified conservation purposes" at relatively low interest rates. Two tax credit bonds used to fund energy projects are:

- Qualified Energy Conservation Bonds (QECBs): Qualified uses include capital expenditures for renewable energy source development, research grants, energy efficiency programs, and other green programs.
- New Clean Renewable Energy Bonds (New CREBs): Qualified uses include the development of new renewable electricity generation facilities. The facilities must be publically owned, either by governmental entities, cooperative electricity generation companies or so-called public power providers. Again, the bond holder receives tax credits instead of the more conventional tax-exempt interest and these bonds often result in near-zero interest cost to the bond issuer. Note that New CREBs actually result in taxable credits (i.e., the amount of the credit is treated as interest and added to the bond holder's taxable income prior to the application of the tax credit). However, the usefulness of tax credit bonds is dependent on the ability of the buyer to "strip" and resell the tax credits on the secondary market.[7]

KEY PROGRAM ELEMENTS

- Bonds are an obligation that must be repaid to bondholders and are therefore appropriate for financing a loan program, but not appropriate for a rebate program (Brown 2008).
- A limited portion of bond proceeds can be used for administration costs associated with the loan fund.
- Bonds provide a low-cost financing source for traditional capital improvements as a partnership between public and private enterprise.
- Bonds traditionally maintain a strong value in the marketplace and do not generally fluctuate in value during economic downturns.
- The tax-exempt status of bonds makes them very attractive to institutional and individual investors.

7 According to Toby Rittner at CDFA, compared to traditional bonds (which are tax-exempt), tax credit bonds such as CREBS may be more difficult to sell to investors.

Example of Successful Implementation: Ann Arbor, Michigan

HIGHLIGHTS

- In 1988, the city of Ann Arbor, Michigan used its bonding authority to invest in $1.4 million worth of energy efficiency improvements in city facilities. The resulting energy savings allowed the city to create the Municipal Energy Fund in 1998 to build upon its success.
- The Municipal Energy Fund is a self-sustaining source of funds financed by avoided energy expenses since 1998. It pays for energy efficiency improvements in city facilities, reducing city energy bills over time and reinvesting that savings in efficiency measures in additional buildings.
- The Municipal Energy Fund has invested in streetlight improvements, parking garage lighting, a boiler, two electric vehicles and photovoltaic cells.

OVERVIEW

The city of Ann Arbor, Michigan operates 60 facilities which cost the city $4.5 million in annual energy bills. In 1988, Ann Arbor utilized its bonding authority to pay $1.4 million for energy efficiency upgrades in 30 city facilities.

The city paid off the original bond loan without hardship since the payment was offset by lower energy bills. When the bond was paid in full after its ten-year term, the city decided not to remove the line item from its annual budget, but rather to continue paying 50% of the former bond payment cost to create a Municipal Energy Fund to invest in more energy saving projects. In the following year, the city had saved $100,000. Thus, the Municipal Energy Fund was established in 1998 as a self-sustaining source of funds for energy efficiency investments in public facilities.

A three-person board must approve all projects for funding. The Municipal Energy Fund is administered by the city's Energy Office.

KEY DATES

1988 - The city of Ann Arbor utilized its bonding authority to fund a $1.4 million project.

1998 - The initial bond was paid in full and the Municipal Energy Fund was created. City Council approved the first $100,000 to be available in fiscal year 1998-1999.

1998-2004 - The $100,000 investment to the Energy Fund from the city was discontinued, as the city was able to rely on other upgraded facilities to finance new projects.

FUNDING SOURCE AND COSTS

Facility budgets are not impacted by the initial up-front cost of making energy improvements to their facilities, as new energy improvements are financed by the Energy Fund. To keep the Energy Fund working, annual payments to the Energy Fund are made from upgraded facilities at 80% of the resulting energy savings for five years. The remaining 20% savings is an immediate benefit to the facility's budgets. At the same time, after the initial bond was paid in full, the city continued to pay $100,000 annually into the fund from its initial energy saving projects.

In the first year (1998-1999), the City Council approved use of the Energy Fund to update energy audits for 21 facilities and to implement lighting improvements at 14 other facilities. As a result of these energy efficiency upgrades, the city of Ann Arbor saved $19,850 in 1999-2000, and of that, $15,880 was reinvested in the Municipal Energy Fund. The money was transferred from the budgets of the upgraded facilities to the Energy Fund at the end of the year for reinvestment in new projects the following year. The payments from energy-saving facilities to the Energy Fund continued for five years, with a total of $79,400 being put back into the fund from just the first-year projects.

LESSONS LEARNED

Using the Energy Fund to pay for energy-saving projects has generally been a smooth process. The first challenge encountered by the Energy Fund was how to measure actual savings from projects to calculate the amounts owed back to the fund. Ultimately, the Energy

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Fund Board decided to use pre-installation savings estimates to determine payback amounts, which alleviates the administrative burden of attempting to calculate actual energy savings. This approach has the added benefit of being able to provide facility directors with the payback requirements for projects before they are implemented; they know in advance what their payback requirements will be.

Another challenge encountered more recently is that many of the investments with the fastest payback period have already been made, leaving the Energy Fund with increasingly lengthy payback periods on new projects. The Energy Fund Board is currently considering an increase in the allowable payback period, now set at five years, so that additional projects can be implemented.

MONITORING AND EVALUATION

Primarily, monitoring is conducted by tracking projects for accomplishments, costs and the projected savings estimates. The Board is involved in decision-making on projects.

Quarterly reports are provided to the Board on projects and results, and updates to the City Council are provided periodically.

Every few years the Board will review the fund to ensure that it is sustaining itself and investing in good projects that save facilities money through reduced energy use.

RESULTS

To date, the Energy Fund has financed over $600,000 in energy-saving projects at city facilities and in the city fleet. These projects have saved the city over $1.2 million, while the Energy Fund still has a $600,000 balance to invest in new energy-saving opportunities.

The Municipal Energy Fund demonstrates that energy efficiency can pay for itself in the long term. By providing the difficult up-front costs and then capturing 80% of the resulting savings, the Fund not only motivates facility managers to move forward with energy efficiency projects, but it has the ability to become sustainable in 3-5 years, requiring no additional annual appropriations. The Energy Fund projects not only save facilities or departments operating dollars, but also improve the comfort and appearance of city facilities.

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RESOURCES

City of Ann Arbor Website: http://www.a2gov.org/government/publicservices/systems_planning/energy/Pages/EnergyFund.aspx

Ann Arbor Energy Fund By-Laws: http://www.a2gov.org/government/publicservices/systems_planning/energy/Documents/EnergyFundByLaws.doc

Alliance to Save Energy, information on funding mechanisms for energy efficiency: http://ase.org/content/article/detail/5057

Financing renewable energy projects with tax-exempt and taxable bonds, including state and local examples (presentation): http://www.cdfa.net/cdfa/cdfaweb.nsf/fbaad5956b2928b086256efa005c5f78/fec08a796476e6b28625769500705ab0/$FILE/CDFA-OK-John%20May.Stern%20Bros%20Presentation%202009.pdf

The Database of State Incentives for Renewables and Efficiency (DSIRE) offers a comprehensive database of energy efficiency and renewable energy policies and initiatives by state: http://www.dsireusa.org

California Solar Pilot Project using Bond Capacity:
For an article about a bond project in Berkeley, California: http://articles.sfgate.com/2007-10-26/news/17265184_1_solar-panels-solar-system-greenhouse-gas-emissions

3D DIRECT CASH SUBSIDIES: REBATES

OVERVIEW

Direct cash subsidies have played a significant role in the promotion of energy efficiency and smaller scale renewable energy in the United States. They are adopted by states and utilities for a variety of objectives, such as technology market penetration, increased installations, cost reductions and better tracking of use and sales (Lantz et al. 2009). They are typically paid after the installation is complete, as rebates.

Rebates, or buy-downs, provide an up-front payment to purchasers of renewable energy or energy efficiency equipment or systems, often covering between 20% and 50% of project costs. Rebate programs can establish specific criteria for eligibility, such as system size, performance standards, approved installers and project siting. Levels are ideally based on the market cost of a technology and the desired support of that technology, and can be adjusted downward as the cost of the technology declines.

Traditional rebate programs do not create an explicit incentive for energy production and system performance. Alternatively, performance-based incentives, such as production tax credits or feed-in tariffs, base payment on actual performance and are better suited for larger scale renewable energy projects (refer to section 3E, Feed-in Tariffs, of this report for more information).

HOW IT IS FUNDED

Unlike tax credits, subsidies, such as rebates, require explicit funding. This occurs most commonly through public benefit funds (refer to section C of this report), but incentives may also receive support through direct grants, revolving loan funds, or general funds.

KEY PROGRAM ELEMENTS

Without careful planning, rebates can deplete program funding with no recovery and cause customers to only install energy efficiency equipment or renewable energy systems when rebates are available. Rebate programs generally cannot control site selection or long-term system performance, and are not recommended for non-standard or early stage technologies. The following recommended design practices were identified by the National Renewable Energy Laboratory (Lantz et al. 2009) the Environmental Protection Agency (EPA 2006) and the Clean Energy States Alliance (CESA 2009).

- **Planning and support:** Public awareness and program accessibility are keys to a successful incentive program. Program administrators, state agencies, and other stakeholder groups should cooperate to effectively educate and market the incentive program to the public. In addition, designers must be fully aware of the existing state, local, and federal incentives and their impacts on current market activity and expected market activity with the program.
- **Technology specification:** Rebates are best suited for market-ready, standard technologies. Careful market analysis is required to determine which technologies have potential cost reductions and whether unexpected changes to the technology can be managed. Priority should be given to high efficiency technologies.
- **Incentive levels:** Incentive levels are ideally based on existing market trends, the cost of alternatives, and the size of the market desired. They should be given an adequate time period to allow the technology to penetrate and stabilize the market, around 5–10 years, and adjusted downward as the cost of the technology declines. Funding should be generous enough to exceed existing market demand and to sustain growth to prevent market volatility when rebates are reduced. Levels are often tiered with separate amounts for residential, commercial, and public sector projects.

  Incentive levels must also fit within the scope of the budget and be backed by a strong funding scheme in case the cost of the program exceeds expectations. An unstable funding scheme may seriously disrupt progress and weaken the industry.

- **Monitoring and evaluation:** Budgets should allocate funding for a clear and specific mechanism for the reevaluation and adjustment of incentive levels, and track program use, costs, and energy savings/production. There should be a quality-assurance mechanism to protect consumers by guaranteeing adequate system performance.
- **Complementary programs:** Rebate programs are only one component of a successful state energy program. They can be used to improve the market penetration of certain technologies, while other policy measures may be put in place to drive larger scale shifts in technology uptake (Lantz et al. 2009). Two measures are:
  - Tax credits: Tax credits are an alternative to direct incentives, but can only be collected when taxes are filed and require a tax liability for the consumer. However, they do not require explicit funding, unlike direct incentives, and do not have as great an impact on budgets.
  - Feed-in tariffs: Feed-in tariffs can function either as an alternative or a complement to direct incentive programs in helping to expand renewable energy markets.

RESOURCES

Database of State Incentives for Renewables and Efficiency (DSIRE), rebate programs for renewables and efficiency the United States. URL: http://dsireusa.org/incentives/index.cfm?SearchType=Rebate&EE=1&RE=1

National Renewable Energy Laboratory (NREL), "State Clean Energy Practices: Renewable Energy Rebates." URL: http://www.nrel.gov/docs/fy09osti/45039.pdf

Example of Successful Implementation: California Solar Initiative

HIGHLIGHTS

The California Solar Initiative (CSI) differentiates among projects in terms of whether a Performance Based Incentive (PBI) is required and how it is structured, unlike most other incentive programs which only offer one funding option (Barbose et al. 2006).

OVERVIEW

Launched in January 2007, the California Solar Initiative will invest $2.167 billion (CPUC 2010) over ten years in onsite, grid-connected solar energy used by customers in the territories of Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E). The CSI Program has a goal of reaching 1,940 MW (CPUC 2009a) of installed capacity by 2016. The aim of the CSI program is to transform the existing market for solar energy by reducing its cost. The CSI offers two types of cash incentives for existing homes, as well as new and existing commercial, industrial, government, non-profit, and agricultural properties. The incentives decline as the aggregate capacity of PV increases, allowing the solar industry to increase production and reduce costs (CAP 2008). The California Public Utilities Commission (CPUC) oversees the California Solar Initiative Program, while the California Energy Commission (CEC) oversees the New Solar Homes Partnership, targeting the residential new construction market (DSIRE 2010a). The program is administrated by California's utilities in their respective service areas.

Prior to the implementation of CSI, California offered solar incentives based on the stated capacity of a system, irrespective of how it was installed. CSI offers two types of solar incentives: (1) an E**xpected Performance-Based Buydown (EPBB)**, an up-front payment based on the system's expected performance, calculated by equipment ratings and installation factors, or (2) **Performance-Based Incentive (PBI)** payments, monthly payments based on the system's actual performance, offered over a period of five years on a dollar per kilowatt-hour basis. All systems over 50 kW are required to take the PBI,

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and, in 2010, this increases to all systems over 30 kW. Systems lower than 50 kW, or 30 kW in 2010, may opt for either the PBI or an EPBB.

Incentives are available to solar electric generating technologies, including photovotaics as well as, as of January 2008, electric generating solar thermal and solar technologies that displace electricity, such as solar cooling and solar forced air heating. The CPUC recently approved a statewide Solar Thermal Program (January 2010) and plans to offer over $200 million in incentives over the next ten years for solar thermal technologies such as solar water heating. It may also fund both electric-displacing solar water heating and other non-PV solar thermal technologies that displace electricity usage (CPUC 2010).

The California Solar Initiative is designed to create a mature market for solar energy, so that it will be cost-competitive without incentives by 2016. The program's stable, long-term, consistent support for solar energy also facilitates the development of a stable local supply infrastructure, less subject to boom and bust cycles. In addition, the program facilitates increased customer participation through simplified program requirements and an easy online registration process (CEG 2008).

KEY DATES

2006-2007 – The CSI builds upon over a decade of solar rebate programs in California. The CSI was established in early 2006 by the CPUC, and was officially launched on January 1, 2007. California's Governor signed the Million Solar Roofs Bill (SB1) in August 2006, which required the Commission to implement CSI with a number of specific provisions.

2008 – Originally limited to customers of the state's investor-owned utilities, the CSI was expanded as a result of Senate Bill 1, to encompass municipal utility territories as well. Municipal utilities were required to offer incentives beginning in 2008 (nearly $800 million).

2007-2008 – In 2007, PV systems that were greater than 100 kW were required to participate in the PBI program. As of January 1, 2008, PV projects that were 50 kW or greater were also included in the PBI program. This threshold will drop to 30 kW in 2010.

FUNDING SOURCE AND COSTS

- **Budget:** The total CSI Program budget is $2,167 million: $1,897 million for the General Market CSI Program, $108 million for the Multifamily Affordable Housing (MASH) Program, and $108 million for the Single-family Affordable Solar Homes (SASH) Program (CPUC 2009a).
- **Incentive Levels:** California Solar Initiative rebates vary according to system size, customer class, and performance and installation factors. The subsidies automatically decline in "steps" based on the volume of solar megawatts confirmed within each utility service territory (CPUC 2010). To find the currently applicable rebate level for each utility, check the CSI Statewide Trigger Tracker: http://www.csi-trigger.com
- **Funding Source:** The program is funded by California's ratepayers in the PG&E, SCE and SDG&E territories through a systems benefit charge, a small surcharge taken from customers' electricity bills each month.

LESSONS LEARNED

- One of the primary goals of the Program Administrators in the 3rd quarter, 2009 was to streamline and simplify the incentive application process for residential, commercial, governmental, and non-profit CSI participants. A number of forms can now be submitted via the internet; other forms were revised or eliminated (CPUC 2009b).
- There is often a surge in demand right before a decrease in incentive levels, and a slight drop off in demand right after incentive levels drop. However, the step change impact on demand patterns appears to be temporary in nature. The CSI Program continues to see strong demand despite a decrease in the available incentive levels (CPUC 2009b).

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MONITORING AND EVALUATION

The CSI Program Evaluation Plan, adopted in July 2008, established a plan to conduct program evaluations to support the CSI in achieving its goals and creating a transparent program. The CSI Program Evaluation Plan has a nine-year work-plan and is intended to ensure that the CPUC, and, by extension, the CSI Program Administrators, manage the CSI in a manner consistent with the intent of the Legislature, as well as the CPUC's objectives and directives. In addition to supporting the annual report to the Legislature as required by SB 1, the Evaluation Plan is designed to ensure that the CSI Program's impacts are independently evaluated, measured, and verified to provide reliable results for decision makers, resource planners, and program implementers. The SASH, MASH, RD&D and SWHPP program components each have separate evaluation budgets and plans (CPUC 2009b).

RESULTS

- As of the end of the third quarter 2009, the CSI Program has installed 257 MW of new solar photovoltaic projects at 21,159 sites since 2007 (CPUC 2009b).
- As of the end of the third quarter 2009, small solar systems prices declined 9% and large system prices declined by 13% since the same quarter in 2008 (CPUC 2009b).
- According to a report issued in June 2009, residential projects represented the large majority of the total number of projects, but just under half of the total rebated capacity. Commercial projects represented 50% of the total rebated capacity. There were more non-profit projects than government projects; however, the government projects were larger and represented slightly more capacity (CPUC 2009c).
- Overall, the CSI provided nearly 89,000 tons of avoided GHG emissions (as CO_2 equivalent) during 2008 (CPUC 2009d).

RESOURCES

The Go Solar California website is the statewide website for consumer information for solar customers. It has information about solar rebates, interconnection, net energy metering, and consumer online calculators. URL: www.GoSolarCalifornia.ca.gov

California Solar Statistics website provides information on the California Solar Initiative. URL: http://www.californiasolarstatistics.ca.gov

Example of Successful Implementation: Fort Collins Utilities - Commerical and Industrial Energy Efficiency Rebate Program; Fort Collins, Colorado

HIGHLIGHTS

- The city of Fort Collins' municipal utility offers rebates for commercial and industrial customers as one strategy to reduce the city's carbon footprint 20% below 2005 levels by 2020 and 80% by 2050—goals adopted by the city's 2009 Energy Policy and 2008 Climate Action Plan (City of Fort Collins 2008).
- Despite a 5% growth in population, the community's carbon emissions have not grown since 2005; municipal government emissions have dropped 0.7% from 2005 levels (Phelan 2009).
- Fort Collins Utility is striving to achieve annual energy efficiency and conservation program savings of at least 1.5% of annual energy use.[8]

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8 Relative to a three-year average history.

OVERVIEW

The city of Fort Collins, Colorado has an estimated population of 136,500 and is located 57 miles north of Denver, the Colorado state capital. Fort Collins Utilities (FCU) is the municipal utility responsible for providing services for water, electric, storm water and wastewater for the city. FCU is a distribution utility, and buys power from Platte River Power Authority, a wholesale electricity provider which is co-owned by the city of Fort Collins and three neighboring cities. Platte River Power Authority acquires, constructs, and operates generation capacity for the four municipalities.

With financial support from Platte River Power Authority, FCU offers the Business Efficiency Program (BEP) to all commercial and industrial customers. The BEP includes all efficiency related services, such as assessments, rebates, demand response and technical assistance. BEP assessments are provided at no cost to customers, and cover electricity, natural gas and water efficiency opportunities.[9] The objectives of the assessment are to provide detailed recommendations for efficiency upgrades, to guide customers towards available rebates, and to provide technical assistance related to operational changes to reduce energy use for the customer.

BEP rebate programs cover a wide range of technology options, including lighting, motors, windows, cool roofs, insulation, commercial restaurant equipment, refrigeration equipment, office equipment and more. Rebates can be applied to both existing buildings and new construction.

Rebate amounts are based on an underlying "value" calculation for peak power costs and lifecycle energy costs ($500 per summer peak kilowatt and $0.10 per annual kilowatt-hour). For customized projects, the rebates are calculated as the greater of $500 per kilowatt saved or $0.10 per kilowatt-hour of annual energy savings. Many of the technology rebates are offered on a prescriptive basis, such as a set dollar rebate per light fixture or motor horsepower. Rebates are limited to no more than 60% of a project's cost.

FCU works with their customers at each step of the process, as outlined below (Phelan 2009):

1. Projects are identified by the customer, a service provider or FCU (through the assessment process).
2. If the customer receives an FCU assessment, staff will review the results of the assessment with the customer. This review includes opportunities for savings, return on investment and a summary of all available rebates and incentives (including FCU, Platte River Power Authority, natural gas provider, state and federal tax incentives).
3. The customer or service provider submits an application to FCU to participate and reserve rebate funds. Rebates of $1000 or higher require pre-approval.
4. The equipment is installed.
5. The rebate is paid following a post-installation inspection. Depending on the type of measure completed, performance may be verified and seasonal testing completed.

In addition, FCU educates and encourages their customers to take energy-saving action by:

- Hosting special business education series and periodic meetings with major account customers to present program information and cutting-edge technological innovations related to energy efficiency and conservation. Customers are encouraged to share innovative energy-saving ideas and bring questions about their site-specific operations and equipment.
- Providing technical assistance to answer customers' questions about their energy bills.
- Supporting large customers' ability to manage their electric costs through demand response. FCU large

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9 Although FCU only provides electric service, and natural gas service is provided by a separate utility, FCU includes gas efficiency recommendations in its assessment because energy efficiency is maximized when a facility is viewed as a "whole systems" – that is, individual improvements in one area affect other areas.

customer rates include a "Coincident Peak Demand Charge" which can account for up to 50% of the total annual bill.[10] Voluntary demand response related to this rate component reduces bills for large customers and helps the utility avoid the need for expensive peak power generation.

KEY DATES

2002 - Introduction of the Electric Efficiency Program by Platte River Power Authority.

2003 - Adoption of the Electric Energy Supply Policy by Fort Collins City Council.

2004 - Increase in rebate amounts through co-funding between FCU and Platte River.

2008 - Fort Collins City Council adoption of greenhouse gas emissions goals of 20% below 2005 levels by 2020 and 80% below 2005 levels by 2050.

2009 - Fort Collins City Council adoption of its Energy Policy, which includes a target of reducing community electricity use by 1.5% per year through verifiable efficiency programs.

FUNDING SOURCE AND COSTS

Since the program began in 2002, over $3.3 million in rebate funds have been provided to customers. In 2009 alone, $838,000 was distributed.

Platte River Power Authority has contributed more than 80% of this funding. Due to Platte River Power Authority's major support in funding on this program, FCU is able to redirect its city efficiency funding for other sectors, primarily residential and small commercial.

Platte River Power Authority efficiency funding is built into its operational costs funded by general ratepayers.

FCU electric rates, starting in 2010, include a 2.8% allocation for energy efficiency programs and services (Phelan 2010).

LESSONS LEARNED

The early years of this program saw very little response from customers. Based on customer feedback, it was determined that there were several reasons for this, including:

- Initial rebate amounts were too low. With very low electric rates as a starting point, the return on investment for common efficiency opportunities (such as fluorescent lighting retrofits) with the rebates still did not meet most business criteria. Rebate amounts were increased, specifically to target the return on investment.
- There were no service providers who were focused on implementation of efficiency projects for commercial customers. FCU and Platte River supported the education of local service providers on the business opportunity related to efficiency projects. Over time, a robust set of providers has developed, which has helped to drive project implementation.
- Customers were not focused on reducing utility costs. Because FCU had a history of low and stable rates, many facility managers simply viewed their utility costs as a low priority. The combination of recent rate increases, awareness of the opportunity to save on utility bills, and corporate goals related to efficiency and climate protection have resulted in a higher demand for the program.

MONITORING AND EVALUATION

Monitoring and evaluation is primarily done at the project level. The level of effort for verification is determined by the level of uncertainty in the savings calculation. For many common types of efficiency opportunities, such as lighting upgrades, the savings are relatively well established and simple to verify. Other types of measures, such as those related to process improvements, may require on-site and seasonal monitoring to verify performance. In some cases, the rebates are split into an installation

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10 The term "Coincidence Peak Demand Charge" refers to the higher rates that are charged for electricity usage when all four cities are at peak demand.

portion of 50%, followed by 50% after performance verification (Phelan 2010).

RESULTS

- BEP savings from projects implemented since 2002 will reduce electric energy use in Fort Collins by more than 2.5%, or 40,000 MWh in 2010.
- Due to the increasing demand for the BEP since its inception, each year the program has grown. In fact, on average since 2002, the amount of energy saved annually is 50% more than the previous year.

Below are three examples of where the rebates have helped customers reduce energy use:

AVAGO TECHNOLOGIES QUICK FACTS:		CONTACT INFORMATION:
Facility size:	1,000,000 ft^2	Avago Technologies
		4380 Ziegler Rd.
Vacuum Pump Consolidation Project (2007)		Fort Collins, CO 80525
Date completed:	2007	www.avagotech.com
Total project cost:	$23,000	
Rebates/Incentives:	$8,000	Steve Wolley
Payback time:	10 months	Workplace Services Manager
Annual energy savings:	460,000 kWh	steve.wolley@avagotech.com
Annual cost savings:	$19,000	(970) 288-0317
Water cost savings:	$16,000	
Combined energy efficiency projects in 2008		
Number of projects:	17	
Annual energy savings:	894,000 kWh	
Annual cost savings:	2% of total electricity cost	
Project management:	Avago Technologies Workplace Services	

LSI CORPORATION QUICK FACTS:		CONTACT INFORMATION:
Facility size:	150,000 ft^2	LSI Corporation
Date completed:	December 2008	2001 Danfield Court
		Fort Collins, Colorado 80525
Total project cost:	$250,000	www.lsi.com
Rebates/incentives:	$90,000	
Net project cost:	$160,000	Bob Barley
Payback time:	less than one year	Central USA Property Manager
Annual energy savings:	2 million kWh electricity	Bob.barley@lsi.com
	110,000 therms natural gas	(970) 206-5430
Annual cost savings:	$200,000 per year	
(25% total energy cost; 5–7% of total operational costs)		
Project management:	LSI Corporation's Workplace Solutions	
Primary contractors:	Johnson Controls and Carrier Corporation	

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WOODWARD GOVERNOR COMPANY QUICK FACTS:		CONTACT INFORMATION:
▶ Fort Collins facility size:	234,000 ft^2	Woodward Governor Company Corporate Headquarters P.O. Box 1519 1000 East Drake Road Fort Collins, CO 80525 Jerry Becker, Facilities Manager Jerry.Becker@woodward.com (970) 498-3938
▶ Loveland facility size:	189,000 ft^2	
▶ Initial investment (as of October 2009):	$250,000	
▶ Utility rebates (as of October 2009):	$120,000	
▶ Annual electricity savings (as of October 2009:	2 million kWh	
▶ Projected total project cost :	$450,000	
▶ Projected total annual energy cost savings:	$400,000	

CONTACT FOR MORE INFORMATION

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RESOURCES

Rebate program overview: http://en.openei.org/wiki/Fort_Collins_Utilities_-_Commercial_and_Industrial_Energy_Efficiency_Rebate_Program_(Colorado)

Business Efficiency Program overview: http://www.fcgov.com/conservation/biz-index.php

Program application, including rebate amounts: http://www.fcgov.com/conservation/biz-eep.php

One-page flyer about the program: http://www.fcgov.com/conservation/biz-eep.php

Fort Collins Utility's Energy Policy: http://www.fcgov.com/electric/energy_policy.php

Fort Collins Climate Action Plan: http://www.fcgov.com/climateprotection/pdf/climate_action_plan.pdf

3E FEED-IN TARIFFS

OVERVIEW

Feed-in tariffs (FITs) are an effective policy tool for driving the large scale development of renewable energy. They are one of the most widely used renewable energy policies in the world, and are beginning to be adopted at the state and local level in the United States.

Under a feed-in tariff, utilities guarantee to pay renewable energy producers a fixed price payment for the electricity they produce over a fixed period of time. Contracts generally run 20 years and are designed to allow the producer to generate a reasonable return on investment.

In FIT designs, the generated electricity is "fed" into the grid, in contrast to net metering in which the electricity is used inside the building.

FIT design depends entirely on a state or municipality's policy objectives. Payments are generally determined in one of three ways: (1) based on the cost of levelized renewable energy generation, awarding payment levels to ensure profit on renewable energy investments (the most common and successful choice for FIT policies around the world); (2) based on the utility's avoided costs, either in real time or based on utility projections of long-run

fossil fuel prices; or (3) offered as a fixed-price incentive, sometimes established arbitrarily without regard to avoided costs or to project costs, and sometimes based on an analysis of these factors.

Feed-in tariffs have a number of advantages over several other commonly used renewable energy incentives (Courture et al. 2009):

- FITs are simple for administrators to implement and producers to utilize; the contract is simple and the payment plan is fixed (one price for every kilowatt hour produced). Producers are not confronted with the complications common in many other financing schemes and policies, such as negotiating with utilities.
- They provide stable funding for renewable energy projects over a 20 year period.
- They remove barriers to participation, allowing individuals with little tax liability or non-taxable entities—cities, counties, states, non-profits—to pursue renewable energy projects.
- They prioritize renewable energy by requiring utilities to purchase renewable electricity and feed it into the grid first.

HOW IT IS FUNDED

Feed-in tariff programs are generally funded through retail rate increases on all electricity consumers, thus spreading out the cost of new generation (example: Germany). In several European countries, the utility is reimbursed by the government to avoid rate increases (examples: Spain and France).

KEY PROGRAM ELEMENTS

The National Renewable Energy Laboratory (NREL) (Courture et al. 2009) and the New Rules Institute (Farrell 2009) have recommended the following practices for successful feed-in tariff programs.

- **Planning and administration:** FITs can be administratively time consuming to set up initially. A streamlined approvals process should be set up to reduce administrative barriers, minimize transaction costs, and allow a wider variety of producers to participate.
- **Contract terms:** Successful FITs set up contracts that guarantee a long-term, fixed price payment for 100% of electricity produced as well as interconnection to the grid. Contracts should preferably be for 15-20 years to provide stability and investment security. Longer contract terms also lower the levelized cost of the project.
- **Setting rates:** Payment levels are most successful if they are based on the levelized cost of renewable energy generation and generate a reasonable profit for developers and investors. Certainty of project cost recovery reduces the complexity and risks of project financing, and allows investors to obtain more debt financing, therefore lowering overall financing costs. Program administrators should make detailed analyses of technology costs and resource quality to determine payment levels. FITs can overheat the market if tariffs are set too high, or conversely, have little market impact if set too low. In general, successful FITs do not have project size or overall program caps.
- **Rate differentiation:** Rates should be differentiated for each technology based on their resource potential, cost to generate, geographical distribution, and technological maturity. Administrators should also consider offering separate payment levels by project size and resource quality, to prevent less than optimal project siting or, conversely, ensure that renewable sources are widely dispersed and all available renewable resources are tapped.
- **Adjusting rates:** Rates should be increased as needed for inflation, but generally should decrease for new projects each year. This process should be predetermined and transparent.
- **Sharing costs:** Added costs of the FIT should be incorporated into the electricity rate base, to allow costs be distributed through electricity rates equally and to ensure producers that they will receive payments, regardless of market disruptions.

RESOURCES

National Renewable Energy Laboratory, "State Clean Energy Policies Analysis (SCEPA) Project: An Analysis of Renewable Energy Feed-in Tariffs in the United States." URL: http://www.nrel.gov/docs/fy09osti/45551.pdf

World Future Council's Policy Action on Climate Toolkit, includes best practices and country and region specific information for feed-in tariffs. URL: http://onlinepact.org/renewableenergy.html

Ontario's Feed-in Tariff Program, North America's first comprehensive guaranteed pricing structure for renewable electricity production. URL: http://fit.powerauthority.on.ca/

Feed-in Tariffs in the United States

The feed-in tariff was first adopted by Germany. It has been a critical element in the development of the country's renewable energy industry. As of late 2009, feed-in tariffs had been adopted in roughly 50 countries worldwide (Mendonça et al. 2009).

Policy makers in the United States are becoming increasingly interested in feed-in tariffs. States and municipalities are adopting FIT policies with increasing momentum, and are experiencing various rates of success. Two new, fully fledged feed-in tariffs in the United States, which were both modeled off successful feed-in tariffs in Europe, are detailed in this report.

GAINESVILLE REGIONAL UTILITIES SOLAR FEED-IN TARIFF

The Gainesville Regional Utilities FIT program is the first feed-in tariff in the United States patterned after successful models in Europe. Introduced in February 2009, the program offers a fixed, 20 year rate to owners of solar photovoltaic systems, ensuring competitive returns on investment of around 5% for smaller developers (DSIRE 2009f). Residents are given the option to sell the electricity generated from their solar photovoltaic system and the associated renewable energy credits to their utility, for $0.32/kWh for systems smaller than 25 kW, and $0.26/kWh for free-standing systems larger than 25 kW. Rate differentiation by project size helps projects of all sizes to develop profitably (Courture et al 2009). The payments have decreased by approximately 5% in 2010. This process, known as tariff degression, is done to track and encourage cost reductions in the technology while fostering improved efficiencies and innovation (Courture et al 2009).

The program is funded through standard fuel cost recovery charges. In order to ensure that costs would not increase more than 1%, the utility capped the program to 4 MW of new solar per year. As a result, the program is fully subscribed through 2015, and is no longer accepting applications (DSIRE 2009f).

In the first year of the program, the utility has doubled the amount of solar capacity installed in the city. By 2016, the program will fund 24 MW of new solar energy.

VERMONT FEED-IN TARIFF

Vermont enacted the Vermont Energy Act in May 2009, becoming the first state to pass a feed-in tariff. The act requires all retail electricity providers to purchase electricity generated by eligible renewable energy facilities via long-term contracts with fixed standard offer rates.

The long-term contracts should be between 25 years for solar and 15-20 years for all other technologies. All renewable energy credits generated from the system are transferred to the retail electric provider as part of the agreement, with the exception of some methane production (DSIRE 2010b). The bill directs the Vermont Public Service Board to review and reset the tariffs every two years (Gipe 2009a). There is a project size cap of 2.2 MW. The overall program cap is 50 MW, for which no technology can occupy more than 25% of the queue.

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Vermont's feed-in tariff program contains the key elements of the successful policies found in Europe (Gipe 2009b):

- Tariffs are differentiated by technology.
- Tariffs are differentiated by size. In addition, the program includes a special tariff for small wind turbines of under 15 kW.
- Tariffs are set based on the cost of generation plus profit.
- Customers receive a reasonable rate of return.
- Contracts are long.
- Regular program review is conducted.

The program began accepting applications on October 19, 2009, and received applications for 208 MW, 172 MW of which were for solar photovoltaic projects. The lack of tariff differentiation for solar PV led to large projects qualifying for the majority of capacity (Gipe 2009c).

3F TAX INCENTIVES

OVERVIEW

State or local tax incentives encourage private investments in energy efficiency and renewable energy by reducing the amount of taxes owed by consumers and businesses. The term tax incentives refers to either:

- A tax *deduction* which allows a portion of the expense to be subtracted from a taxpayer's adjusted gross income; or
- A tax *credit* which allows a taxpayer to subtract a certain portion of the cost, dollar-for-dollar, from the amount of taxes owed.

Generally, the main types of tax incentives used in the United States are:

- **Corporate tax incentives** encourage energy efficiency and renewable investments by business. The two main corporate tax incentives used are:
  - **Industry recruitment incentives** are paid to product manufacturers by a specific state in exchange for siting a new facility in that state and meeting certain minimum requirements for creating new jobs.
  - **Production tax credits** provide an incentive based on the amount of energy produced by a renewable energy system.
- **Personal tax incentives** typically encourage individuals to install energy-efficient home improvements, purchase an energy-efficient home, or install renewable energy systems.
- **Property tax incentives** reduce or limit property taxes owed as a result of the installation of energy efficiency or renewable energy projects in homes or businesses.
- **Sales tax or value-added incentives** encourage the purchase of energy-efficient products.

The main benefits of successful tax incentive policies are:

- Due to the high upfront capital costs of efficiency and renewable energy projects, tax incentives may sufficiently reduce total costs to make a project viable.
- States can design their program to best match their goals and financial resources.
- Tax incentives can create new jobs each year that generate tax revenues, helping to offset lost revenue from the tax credits provided by state and local governments.
- Tax incentives help introduce new technologies into the marketplace by lowering the cost for consumers and attracting attention to the new technology.

- Tax incentives lower a manufacturer's production and investment risk.
- As a manufacturer's production volume increases with sales and the technologies become more available and affordable, the tax incentives can be phased out.

HOW IT IS FUNDED

Tax incentives are not funded per se, but rather reduce the amount that the state collects from taxpayers.

KEY PROGRAM ELEMENTS

- A strong political will on the state level is necessary to implement tax incentives because of the perceived decrease in overall tax revenues. Tax incentives may significantly reduce tax revenue for the state or city. However, in a successful program, tax revenues will go up with new businesses and jobs coming to the state.
- Tax incentives should be large enough to create a strong incentive to encourage private investment in the state, without being so large as to unduly impact state revenue.
- Tax incentives should be designed with a timeline long enough to provide consistency to the market, without becoming a crutch for the industry.
- Criteria for eligible products or improvements should be sufficiently strict so that 'business as usual' improvements or purchases are excluded.
- Assuming they are not refundable, tax credits will not be a significant incentive for businesses or individuals who pay little or no tax.
- States should adequately budget for consumer education and marketing, as well as program administration.
- Both the federal government and some state governments enacted tax incentives during the 1970s that had relatively little impact on consumer behavior for several reasons (Brown et al. 2002). Lessons learned from this experience were:
  - Low efficiency requirements for eligibility led to large "free rider" expenditures; the credits tended to be small; they lacked promotion; and they had excessive administrative requirements.
  - To maximize effectiveness, tax incentives should target cutting-edge, very high–efficiency technologies or practices that customers might not consider otherwise.
  - Tax incentives should be large enough to affect decision making, while reporting requirements should be just stringent enough to make fraud insignificant.

Example of Successful Implementation: Oregon Business Energy Tax Credit

HIGHLIGHTS

- The state of Oregon has the longest running tax incentive program in America. Tax credits have been used for nearly thirty years to save energy and attract renewable energy businesses to the state.
- Entities without tax liability, such as schools, are allowed to convert their earned tax credit into cash by selling a percentage of it to a taxable entity.
- In order to help fund the construction costs of a project, the tax incentive program is often used in conjunction with the Oregon State Energy Loan Program (SELP)[11] or the Energy Trust of Oregon.[12] The importance of the SELP program is underscored by its incorporation into the Oregon Constitution, in Article XI-J.[13]

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11 SELP loans range from $20,000 to $20 million. Terms range from five to 20 years and are funded by the periodic sale of state general obligation bonds. The program is self-supporting and borrowers pay administrative costs.

12 Energy Trust of Oregon is a non-profit organization funded primarily by utility customers in Oregon via a Public Benefit Charge (see section 2B of this report). In 2008, Energy Trust received about $64 million to support energy efficiency and renewable energy generation projects.

13 For more on Article XI-J, see http://bluebook.state.or.us/state/constitution/constitution11-4.htm

OVERVIEW

The Oregon Department of Energy (ODOE) provides tax credits to both commercial and residential consumers who invest in energy efficiency, conservation or renewable energy projects. For proposed renewable energy resource equipment manufacturing facilities, applicants must describe the number of jobs that will be created as a result of the project, illustrate their financial ability to build and operate the facility and certify that the tax credit is integral to the decision to expand or locate the facility in Oregon.

One example of Oregon's successful tax credit is the Business Energy Tax Credit (BETC), which encourages commercial investments in energy conservation, renewable energy resources and sustainable resource use. The tax credit is administered over five years (ODOE 2009).

The types of projects targeted for these tax credits are (ODOE 2010):

- Energy efficiency projects
- Renewable energy projects
- Homebuilders
- Rental dwelling weatherization projects
- Transportation projects
- Other projects, such as sustainable buildings

Energy Efficiency Program Specifics

Qualifying businesses, industries, rental property owners and builders who make energy efficiency and conservation improvements can deduct 35% of the eligible project costs from their Oregon income tax liability, up to a maximum of $10 million.

The tax credit for energy efficiency is based on the incremental difference in cost between the standard option and a more energy-efficient option. Eligible projects include the purchase of more efficient equipment (at least 10% more efficient than existing equipment; lighting retrofits must be 25% more efficient); projects that reduce vehicle miles traveled or use electric vehicles; or investments that result in high-performing homes and buildings (Repine 2009).

Renewable Energy Program Specifics

For renewable energy projects, eligible project costs include those associated with the use of renewable energy; facilities used to manufacture renewable energy equipment; co-generation projects; and projects that add renewable energy systems to high-performance homes.

Businesses that invest in renewable energy may qualify for a 50% tax credit up to $20 million in eligible project costs. For those businesses that manufacture renewable energy equipment, a 50% tax credit up to a maximum of $40 million in eligible costs is available for building, equipment, machinery and other costs. Businesses claim the tax credit over five years, and any unused portion can be carried forward for a maximum of eight years. Tax credits for small projects of $20,000 or less can be fully redeemed in one year.

For both energy efficiency and renewable energy projects, eligible costs can include engineering and design fees, materials, supplies and installation costs, loan fees and permitting costs. Costs that are not eligible include replacing equipment at the end of its useful life or equipment required to meet codes or other government regulations, and operation and maintenance costs.

Currently, there is no limit on the total amount of tax credits that can be issued in a year.

A unique aspect to Oregon's tax credit program is its "pass-through option," which allows a project owner to transfer the BETC eligibility to another entity in exchange for a lump-sum cash payment upon completion of the project. The lump-sum cash amount is lower than the tax credit value, by a rate set by ODOE. This setup allows a public entity without a tax liability, such as a school or nonprofit organization, to use the pass-through option to benefit financially from the tax incentive, even if they do not owe taxes to the state. It also allows a business owner to sell his/her credit to access the (lower) benefit without having to wait until filing taxes, although the actual payment will be less than if he/she had waited.

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Below are some examples of successful BETC uses (ODOE 2010):

- The Klamath County School District upgraded an existing geothermal heating system at Henley High School. The project cost more than $96,000 and will save about $23,000 annually in natural gas costs. Since schools do not have tax liabilities, using the BETC pass-through option, Henley High School chose to sell the earned credit and received $24,528 in return. The lump sum payment helped the school pay off the cost of installing the upgrades.
- Oregon farm and nursery owners rely on the sun for their livelihood. Many are now turning to solar energy to do more than just making their crops grow. Raintree Tropical Nursery in Silverton, Oregon, is making a name for itself growing palms and other tropical plants in the heart of the Willamette Valley. Owner Tim Peters has hardy palms that can survive in temperatures as low as 8° F and uses solar energy extensively for his tropical plant nursery business. Peters installed a 22.6 kW photovoltaic system on the 44 acres where his home and business are located. Financial incentives, including the BETC, made it worthwhile.
- The Gathering Together Farm in Philomath, Oregon, is the oldest organic farm in the Willamette Valley. Established in 1987, the farm has become a model for sustainable business and sustainability. The 35-acre farm employs more than 50 people during the peak season. The strictly organic farm is diverse, growing 50 different vegetables and more than 100 varieties of seed. The farm installed a solar water heater, received a BETC, and now saves on its water heating bills (Repine 2009).

KEY DATES

1979 - Original legislation was enacted.

1999 - The Oregon Legislature repealed the BETC program cap of $40 million per year and $2 million limit for any one project.

2001 - The Oregon Legislature made numerous changes, including adding sustainable buildings to the BETC program and expanding the pass-through option to include schools, tribes, non-profits and others without a tax liability.

2007 - The Oregon Legislature, under House Bill 3201, increased the tax credit to a maximum of 50% for renewable energy projects. House Bill 3619 in 2008 also redefined regulations for eligible projects and set the limit of eligible project costs for renewable energy manufacturing facilities at $40 million.

November 2009 - The Oregon Department of Energy adopted temporary administrative rules effective until May 2010 that define more specific criteria for projects and give the ODOE more power to revoke or accept applications for projects.

2010 – The Legislature is contemplating a new cap. The 2010 and 2011 legislative sessions may bring additional changes to the BETC program.

FUNDING SOURCE AND COSTS

Tax incentives are not funded per se, but rather reduce the amount that the state collects from taxpayers. The BETC is a statutory income tax credit approved by the Oregon Legislature, reducing the tax liability of an individual or business.

Program expenditures for BETC from January 1, 2008 through November 1, 2008 totaled $1.8 million (Repine 2009).

The program is funded by a fee based on the total estimated project costs multiplied by 0.6%. Today, about 12 full-time staff operate the BETC program.

LESSONS LEARNED

As incentive programs become more popular, it is important to communicate program results, such as the return on investment, with elected officials, community leaders and other stakeholders.

Incentives such as tax credits work best when used in combination with energy efficiency and renewable

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energy laws and policies, such as a public benefits fund and a renewable portfolio standard.

Departments responsible for tax incentive programs should work with elected officials to regularly review the efficiency and effectiveness of those programs, especially as state revenues decline. In difficult financial times, any tax credit will be highly scrutinized.

MONITORING AND EVALUATION

- The Oregon Legislature reviews and evaluates the tax credit program's revenue impact and administration every two years.
- In 2009, the Legislature directed the Oregon Department of Energy, Public Utility Commission and Oregon Business Development Department to commission an economic analysis of wind energy and conservation projects that qualify for the BETC. That study will be completed before the 2011 legislative session.
- The Oregon Department of Revenue controls the credits. Some businesses do not have a high enough tax liability to take their full credit, so not all the credits issued are used, but applicants can carry the credits forward for eight years (Repine 2009).

RESULTS

An independent economic study of the BETC program found that in 2008 the net impacts on Oregon's economy included (ECONorthwest 2009).

- $156 million worth of appproved tax credits.
- A $191.8 million annual decrease in energy costs (assumed cost based on calculating the annual savings for all investments made, along with renewable energy generation).
- Reduced reliance on fossil fuels.
- A 1.7 million ton reduction in carbon dioxide emissions.
- Creation of 703 new jobs.
- A $13.2 million increase in tax revenues for state and local governments.

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RESOURCES

Oregon Department of Energy Website: http://www.oregon.gov/energy

Report: Economic Impacts of Oregon Energy Tax Credit Programs in 2007 and 2008: http://www.oregon.gov/ENERGY/CONS/docs/BETC_RETC_Impacts-020209_FINAL.pdf

Information on the Business Tax Credit: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OR03F&re=1&ee=1

Information on the Personal Tax Credit: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OR17F&re=1&ee=1

News release about 2007 report: http://www.solaroregon.org/about/news_folder/study-reports-important-economic-benefits-from-energy-tax-credits/

Report: An Analysis of Green Building Tax Incentives (includes Washington and Oregon): http://www.leg.wa.gov/documents/legislature/ReportsToTheLegislature/An_Analysis_of_Green_Building_Tax_Incentives_FINAL_c23c09f1-6bb3-45f7-9945-0b559421386c.pdf

3G COMMERCIAL METHOD: POWER PURCHASE AGREEMENTS

OVERVIEW

A Power Purchase Agreement (PPA) is a legal contract between an electricity generator and a power purchaser. The power purchaser, which can be a utility, business, school, government or other end-user, purchases the energy produced, and sometimes the capacity and/or additional services, from the electricity generator, which is often an independent, taxable entity. The PPA can be

a key in the development and finance of independent renewable electricity generation, from distributed generation on commercial or public buildings to large power plants (Windustry 2010).

Under the PPA, the power provider secures funding for the project, maintains and monitors the energy production, and generally sells 100% of the electricity to the purchaser for the term of the contract (which generally lasts between 15 and 25 years). In addition, PPA contracts can include provisions for the commissioning process, curtailment agreements, transmission issues, milestones and defaults, credit, insurance and environmental attributes or credits. When the contract is complete, the power purchaser can be given the option to purchase the generating equipment, renew the contract with different terms or request that the equipment be removed.

PPA pricing structures vary in length and rates. The most common schemes are **fixed-price**, where the electricity produced is sold to the purchaser at a fixed rate over the life of the contract, and **fixed-escalator**, where the electricity produced by the system is sold at a price that increases with inflation according to a predetermined rate. Some system owners offer a rate structure that increases for a time period (i.e. 10 years) and then remains fixed for the remainder of the contract. Other structures lower the cost of electricity agreed to in the PPA by allowing purchasers to either (1) prepay for a portion of the power to be generated by the system or (2) make certain investments at the site to lower the installed cost of the system (NREL 2009).

PPAs allow businesses, schools, governments, and utilities to benefit from renewable energy without having to understand or take on the associated capital investment, maintenance costs and other risks. This is particularly convenient for tax-exempt entities, which do not qualify for the available tax benefits when installing a renewable energy system. The power provider is able to reduce the installed cost of the system significantly with available incentives (subsidies, rebates, tax credits, accelerated depreciation and others), thereby resulting in a lower per-kWh rate to the host.

HOW IT IS FUNDED

The project developer provides the pre-construction development costs. The project owner (often a special purpose partnership or corporation) provides all the installation and maintenance costs for the system. The owner of the property is only responsible for purchasing the energy produced.

KEY PROGRAM ELEMENTS

Entering into a PPA is a legally intensive process. Transaction costs are high for all involved, and it is not well suited for small projects. PPA based projects often require the availability of incentives, such as rebates or tax credits, to attract investors. With this in mind, the National Renewable Energy Laboratory has identified certain key elements which facilitate successful PPAs (NREL 2009).

- **Sensible locations:** When examining a potential site for a project, fully examine the parameters in terms of size of project, current cost of electricity, average daylight and watts(W)/ft^2. A general rule of thumb for solar PV installations is that a location must achieve 5-10 watts/ft^2 in order to be successful.
- **Create developer competition through a Request for Proposal (RFP):** Using an RFP can create competition among developers, leading to the best possible outcome for the property owner. If the proposed project generates less than 500kW, then the RFP may not be necessary because developers will not compete for the contract.
- **Contracting:** Upon deciding on the developer, PPA contracts must be completed quickly. The terms on the developer's access to the property, insurance, and municipal laws must be carefully considered.
- **Pricing structures:** Fixed price and fixed escalator schemes are the most common and successful pricing structures (refer to the overview). A less common PPA pricing model involves basing the PPA price on the utility rate with a predetermined discount. While this ensures that the PPA price is always lower than utility rates, it is complicated to structure and it undermines the price-predictability advantage of a PPA (NREL

2009). Pricing must take into consideration all factors of cost, incentives and other factors such as Renewable Energy Credits (RECs).

- **Permits and obtaining credits:** The property owner should be sure that the developer is informed about the timeline regarding filing permits and receiving state incentives before the deadlines.
- **Project execution:** At the point of implementation the developer must carefully render the project and design a system appropriate for the site. A firm timeline must be set between the property owner and the developer on construction dates in order to comply with state incentive guidelines.

RESOURCES

NV Energy's (Nevada Power Company) includes documents which have been previously tested in the marketplace. URL: http://www.nvenergy.com/company/doingbusiness/rfps/

Example PPA Requests for Proposals from several California municipalities. URL: http://www.lgc.org/spire/rfps.html

Department of Energy Office of Energy Efficiency and Renewable Energy provides an overview of third party financing for the public sector. URL: http://apps1.eere.energy.gov/state_energy_program/update/feature_detail.cfm/fid=82/start= 4

National Renewable Energy Laboratory, "Power Purchase Agreement Checklist for State and Local Governments." URL: http://www.nrel.gov/docs/fy10osti/46668.pdf

Example of Successful Implementation: Oregon Solar Highway

HIGHLIGHTS

- The nation's first Solar Highway project.
- Oregon's Department of Transportation had no capital budget for this project. Without the option for a public-private partnership enabling third-party ownership and sales of the energy generated through a power purchase agreement, the project would not exist.

OVERVIEW

The Oregon Solar Highway is a 504 panel, 104 kW ground-mounted solar array at the intersection of two interstate highways, supplying the Oregon Department of Transportation (ODOT) with around 128,000 kWh a year. All generated electricity feeds into the grid during the day, and at night, the equivalent amount of electricity from the grid flows back to light the interchange. ODOT buys the energy produced by the array at the same rate the agency pays for regular energy from the grid.

Oregon-based companies supplied the materials, and designed, installed, and now operate the project. The project is owned and operated by SunWay1, a limited liability company (LLC) managed by Portland General Electric (PGE) the utility serving the area. The project was financed through the LLC using the state's 50% Business Energy Tax Credit, the 30% federal Investment Tax Credit, accelerated depreciation and utility incentives. The private ownership was necessary to take advantage of these financing mechanisms since ODOT, as a public entity, has no tax liability. Further, ODOT's expertise is transportation, not energy generation. Partnering with the utility allows the entity with the greatest expertise to manage the resource.

ODOT plans to expand the use of roadside solar, using a third-party "sales-leaseback" model, to provide the electricity needed to run the state's transportation system, which uses more than 47 million kWh of electricity annually. It is projected that PV projects installed over less than 1% of the state's highways could cover ODOT's annual electricity usage and reduce greenhouse gas emissions by over 18,000 metric tons of carbon dioxide (ODOT 2008). The private partners—most likely utilities—would contract with solar developers to design, build and install the arrays. ODOT would purchase all electricity generated by the systems under a 25 year Solar Power Purchase Agreement, with options to renew for up to three five-year extensions.

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KEY DATES

February 2008 – The Oregon Transportation Commission approved development of solar installations on ODOT properties, including operating right of way. The Oregon Solar Highway demonstration project is the first of those installations, and the first solar highway project in the nation.

Late 2008 – The legal agreements were signed in September 2008 and the project started feeding into the grid December 19, 2008, just 135 days after the agreements were signed.

FUNDING SOURCE AND COSTS

The prototype project cost $1.28 million (ODOT 2009a). ODOT invested no capital and receives solar power at no greater cost than it would pay for power from the grid. Funding was provided through an innovative public-private partnership with Oregon's largest utility Portland General Electric. The utility makes use of state and federal tax credits, utility incentives and accelerated depreciation to minimize costs. PGE's SunWay1, LLC contracted with SolarWay, a solar energy engineer/procure/construct (EPC) consortium to build and commission the project and secure the tax credits.

LESSONS LEARNED

ODOT's core mission is to provide a safe and efficient transportation system. Addressing energy-related carbon emissions has added complexity to an already stressed and under-funded system. Through focusing on safety first in siting solar highway projects, and through innovative and responsible public-private partnering, both these goals—safety for the public, and reducing ODOT's carbon footprint—were achieved.

For details on the many challenges and how they were addressed, see http://www.oregon.gov/ODOT/HWY/OIPP/docs/Solar_LessonsLearned.pdf

MONITORING AND EVALUATION

Both ODOT and Portland General Electric are monitoring the production, operation and maintenance of the system. Results to date have been very positive, leading ODOT and PGE to actively investigate further solar highway partnerships (ODOT 2009b).

RESULTS

This project:

- Won the Federal Highway Administration's 2009 Judge's Award for Special Recognition (FHA 2009) in the biennial Environmental Excellence Awards.
- Won the national 2009 Solar Electric Power Association Award for Solar Business Achievement in the category of Partnering for Success.
- Will save or offset, over its lifetime, the energy equivalent to 2,900 tons of CO_2, 301,000 gallons of gasoline, or 8,700 trees.
- Demonstrates that solar arrays can complement and not compromise the transportation system, and they can be safely installed and operated on highway rights of way throughout the nation.

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RESOURCES

Solar Highway Monitor, shows how much energy is being generated on-site. URL: http://www.live.deckmonitoring.com/?id=solarhighway

Oregon Solar Highway website. URL: http://www.oregon.gov/ODOT/HWY/OIPP/inn_solarhighway.shtml

3H COMMERCIAL METHOD: ENERGY SERVICE COMPANIES

OVERVIEW

During times of economic downturn, there is heightened interest by state and local governments in cutting public expenses. At the same time, there is growing demand by state and local governments for cost-effective leadership solutions to address climate change. One obvious way for these governments to address both needs is to engage energy service companies (ESCOs) to implement performance-based energy efficiency projects that result in reduced costs and greenhouse gas (GHG) emissions through reduced energy consumption.[14]

ESCOs are private companies that allow state or local governments to lead by example (see Chapter 5 of this report) and to demonstrate fiscal responsibility with public dollars by reducing the state or local government's energy costs and CO_2 emissions.

In the United States, ESCOs provide comprehensive energy services to analyze the energy saving opportunities of a building. They recommend customized energy saving upgrades, install the measures, and maintain the system to ensure energy savings during a given payback period (Bharvirkar et al. 2008). Depending on the contract, an ESCO can implement a subset or the full range of energy efficiency, renewable energy and distributed generation technologies and can guarantee performance levels to ensure targeted results are achieved.

According to the Lawrence Berkeley National Laboratory, between 1990 and 2006, United States ESCOs reported market activity of about $28 billion, with about 75–80% of that activity concentrated in the institutional markets (schools, colleges and universities, hospitals, as well as state, local, and federal governments) (Bharvirkar et al. 2008).

While the ESCO market is currently evolving in China, India and other developing countries, there are some major differences and country-specific issues that affect how ESCOs operate.[15]

There are tremendous opportunities in public buildings to utilize ESCOs as performance-based financing mechanisms. ESCO projects pay for themselves over the long-term via a lifetime of reduced energy and operating costs and continue to save public dollars, even after the project is paid off. For developing countries with rapid economic and energy growth, improving the energy efficiency of buildings offers a very cost effective way to control increasing expenses.

HOW IT IS FUNDED

Unlike other public improvements such as roadways repairs, roof repairs or parking lots, ESCO projects reduce operational expenses that result in savings guaranteed by the ESCO; so they actually pay for themselves over time. That is, the ESCO guarantee is that the energy/operating savings will be sufficient to repay the project financing costs, and if these savings are not achieved, the ESCO must make up the difference.[16] This provides a strong incentive for the ESCO to make sure that savings are accurately estimated, and that the equipment is installed

14 The responsibility of managing ESCO projects is typically handled by the energy office of the state government. However, it can be handled by other departments such as the Department of Commerce.

15 For example, the financing structures are very different between the United States and developing countries and what works in the U.S. may not be directly replicable in developing countries. In addition, the main customers (and largest energy consumers) in many developing countries are industrial enterprises, whereas the United States' greatest ESCO successes have been in public buildings.

16 The details of an ESCO's guarantee are agreed upon in the contract. Since there are variables that will affect the final savings achieved—such as energy prices (which are likely to increase); weather; the operating hours of the facility; equipment used (perhaps the company will add energy intensive equipment that wasn't in place when the contract was signed)—rather than guaranteeing a specific dollar amount savings, the contract specifies the guaranteed units of energy that will be saved based on the existing situation and expected weather. If these assumptions change over the year (i.e., if operating hours are extended, energy prices increase or weather is severe) these changes are taken into account at the end of the year, so that the ESCO is not forced to pay due to the company's increased consumption of energy beyond the ESCO's control. In order to assess the actual energy savings and confirm the ESCOs contractual guarantee, the customer's energy use is evaluated annually (this may cost $5,000–$10,000 and is rolled into the cost of the ESCO project).

properly and is functioning at its optimum level. This guarantee also increases lenders' comfort in providing project financing.

Agencies or local governments in the United States typically pay for ESCO projects by securing a loan from a private lending institution or by issuing a bond (see section 3C Municipal Bonds). Another common way to finance public projects is through the use of lease financing. Rather than the agency or local government buying the equipment outright, the equipment or energy efficiency retrofits are "leased" from the lender for the duration of the loan. When the lease is paid off, the local government buys the equipment or retrofits for a token amount, e.g., one dollar. For local governments, the lease can be viewed as an ongoing operating expense which has a dedicated revenue stream (utility bill savings) rather than as a capital budget item.

KEY PROGRAM ELEMENTS

- It is important that a United States ESCO and its subcontractors be qualified to develop and implement a comprehensive energy efficiency and renewable energy project in a public facility.[17] The services that an ESCO provides include energy audits, design and engineering, construction management, arranging project financing, monitoring and verification of project savings and ongoing maintenance and operations. The technologies installed by ESCOs include lighting and lighting controls, HVAC, boilers, chillers, building control systems, building envelope improvements, distributed generation and renewable energy.
- In order to maximize the use of ESCOs, it is important that local governments and public agencies be provided with:
  - A list of pre-qualified ESCO companies (that are periodically re-qualified by the state) so that local government agencies know they are working with a trusted, high-quality company qualified to provide the retrofits and building improvements.[18]
  - Standardized documents, including a model Request for Proposals (RFP) for ESCOs and a model contract to be used between the agency and the ESCO.
  - Logistical, legal and financial support to the agency as they go through the process of hiring and working with an ESCO; and monitoring of the project savings for the term of the contract.
  - Technical support to help review the proposals by ESCOs and decide in which upgrades to invest.
  - Standard procedures for monitoring and verifying savings and reporting savings to the client. In the United States, the ESCO industry standard measurement and verification tool used is the International Performance Measurement and Verification Protocol (IMPVP).[19]

17 In order to qualify an ESCO, a state or local government will issue an RFP and evaluate the responses from ESCOs. The state or local government will typically require that the ESCO have a licensed engineer (as certified by the Association of Energy Engineers); have experience with energy efficiency and arenewable energy projects; and have excellent references. They will also review and consider the ESCO staff's resumes, and the company's experience with past projects, and will review samples of the ESCOs energy audits.

18 In Kansas, for example, the state re-certifies ESCOs every five years.

19 The International Performance Measurement and Verification Protocol (IPMVP) helps measure energy savings from projects in a standardized and reliable manner. Available through the Efficiency Valuation Organization www.evo-world.org.

Example of Successful Implementation: Kansas

HIGHLIGHTS

- The program has overseen more than $174 million in energy efficiency improvement projects in over 27 million square feet of public facilities (Armesto 2010).
- The state of Kansas is now saving more than $13 million annually on utility bills as a result of improvements.[20]
- More than 70% of all public buildings have achieved improvements in comfort levels, indoor air quality, lighting levels and overall occupant productivity by participating in performance contracting through the FCIP program.

OVERVIEW

The Kansas Energy Office has simplified and accelerated the process for public entities in Kansas to enter into contracts with private (ESCOs) through their Facility Conservation Improvement Program (FCIP). The FCIP offers oversight and consultation to public agencies, counties and municipalities throughout the entire process—from the initial contact between the public entity and the ESCOs, through the energy needs-analysis, design and implementation/construction of the project, maintenance and energy saving measurement and verification period, for up to 15 years.

While the state government (via the Governor) has issued directives to all public agencies to reduce energy use, public agencies are not required to use an ESCO to do so.

The FCIP program streamlines and speeds up the process of hiring an ESCO and helps overcome the major barriers, as outlined in the Lessons Learned secion below.

KEY DATES

The FCIP program began in 2001, after passage of state statute K.S.A. 75-37,125.

FUNDING SOURCE AND COSTS

The FCIP is a self-funding program. Three full-time program staff manage the program. Project fees are used to fund all the administrative costs of operating the FCIP program, including all project oversight activities.

Fees ranging from 0.5% to 4% are charged to each project based on the total cost of the project as shown below:

- For total project costs up to $99,999, the fee is 4% of total project costs;
- For project costs between $100,000 and $499,999, the fee is 3%;
- For project costs between $500,000 and $999,999, the fee is 2%;
- For project costs between $1,000,000 and $499,999,999 million, the fee is 1%; and
- For project costs over $5 million, the fee is 0.5%.

LESSONS LEARNED

Challenge: *The process of improving a facility is viewed as cumbersome and time consuming.*

Solution: A pre-negotiated, ready-made contract for hiring an ESCO is provided for use by public entities, including municipalities, counties, public schools, community colleges and universities and other public entities. Included are pre-negotiated pricing and fee schedules.[21]

Challenge: *The process of issuing a Request For Proposals (RFP), interviewing potential companies and negotiating pricing for services is cumbersome and time consuming.*

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20 This is the collective savings from all ESCO projects implemented in the state. A portion of that $13 million is being used to repay the loans that financed the projects. When the loans are completely paid off, the agency will continue to save money through lower energy bills.

21 In order to develop such contracts, the State of Kansas used its own attorneys on staff. The contracts are written to protect both parties, but especially protect the local governments. Qualifying ESCOs must agree to use these contracts in order to participate in the program.

Solution: The state of Kansas has negotiated contracts with ten pre-approved ESCOs who have offices in Kansas and extensive experience in performance contracting. Municipalities are not required to issue an RFP – they simply use one of the state pre-approved ESCO companies and a pre-negotiated contract. In order to qualify with the state government, ESCOs must be able to install and maintain a comprehensive menu of possible technologies and upgrades for facilities. Common improvements offered by all ESCO companies include:

- Interior and exterior lighting retrofits
- Occupancy sensors
- LED exit sign installations or retrofits
- HVAC system upgrades or retrofits
- Conversion to variable air volume systems
- Fan and pump improvements or replacements
- Ground or water source heat pumps
- Variable speed motor drives (VFDs)
- Chiller replacements
- Cooling tower retrofits
- Heat recovery systems
- Boiler controls improvements
- Energy management/building automation control systems
- CO_2 sensors
- Low water-using toilets, urinals, low-flow aerators and showerheads
- Window retrofits
- Building insulation
- On-site generation (wind and/or solar)
- Motor replacements
- Meter installation and/or consolidation

Challenge: *When a public facility pays lower energy bills, its budget is decreased by that amount in the following year, precluding it from using the energy savings to pay back the ESCO loan.*

Solution: The ESCO loan is structured in the form of a fixed-rate capital lease purchase agreement from a private financing institution. Payments of principal and interest are made semi-annually for typically 10–15 years (based on the simple payback of the improvements implemented). In other words, the value of the energy savings has to be equal to or greater than the loan payment. The lease is secured with a first lien on the related property. All documents are standardized, minimal and easy to read. Financing is tax-exempted.

Challenge: *A major challenge has been educating facility operators and public officials as to how performance contracting works.*

Solution: This challenge has been met by providing presentations and workshops to facility owners to inform them about the process and the benefits of performance contracting.

MONITORING AND EVALUATION

From conception of a project to completion, the FCIP staff monitors and provides oversight of all aspects of the project. FCIP staff reviews all audits and proposals, including all energy conservation measures, and for approval. FCIP staff meets with facility operators and makes sure that they understand every aspect of the project including total project cost, energy savings generated and the ESCO energy savings guarantee.

RESULTS

The Kansas Facility Conservation Improvement Program has overseen more than $174 million in energy efficiency improvement projects in over 27 million square feet of public facilities. The state of Kansas is now avoiding over $13 million annually on utility bills as a result of improvements through the FCIP.

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RESOURCES

FCIP: http://www.kcc.ks.gov/energy/fcip/index.htm

Case studies from Kansas: http://www.kcc.ks.gov/energy/fcip/profiles.htm

The Energy Service Coalition offers ESCO best practice information, and a collection of ready-made procurement and contracting document templates, such as requests for proposals (RFPs), project contracts to prequalify ESCO contractors and more: http://www.energyservicescoalition.org/resources/model/index.html#PreApproved_Contracts

Efficiency Valuation Organization: A non-profit organization that provides a free downloadable IMPVP library of documents to help determine energy savings from energy efficiency projects in a consistent and reliable manner: www.evo-world.org

CHAPTER IV.
UTILITIES AND TRANSMISSION

4A TRANSMISSION PLANNING: RENEWABLE ENERGY ZONES

OVERVIEW

Prior to the construction of new power plants and transmission lines, transmission planners can develop multi-stakeholder convening bodies to identify the transmission projects needed to accomplish state or region-wide renewable energy goals. Key components to this process include the use of Geographic Information System (GIS) technology, economic analysis, stakeholder involvement, transmission analysis, and other strategic planning to legally designate Renewable Energy Zones (REZs). REZs are special areas designated for renewable energy generation based on land suitability, resource potential, and existing renewable energy generation. Electric transmission infrastructure is constructed in those zones to move renewable energy to markets where people use energy.

Designating a zone has ramifications under law. It adds a statutory exception to the "used and useful" standard for transmission approval, giving REZs a different legal status from areas that are not designated as a zone in order to ensure that transmission is built. The legal issues associated with this process are more or less problematic depending on the state (Hurlbut 2008b).

Transmission planning and REZs may be time and resource-intensive to develop, but, if properly organized, can serve as a forum for balancing issues of renewable energy development, maintaining or enhancing electric reliability, costs of electric service, environmental challenges, and potential mitigation strategies. Ultimately, the REZ process effectively helps to avoid suboptimal development of renewable energy and transmission projects.

HOW IT IS FUNDED

There are two costs, each funded differently. Zone identification is either folded into the transmission planning process or funded by federal money. The transmission itself is a separate cost, funded according to prevailing law and precedent.

KEY PROGRAM ELEMENTS

- Steps for implementing REZs include: resource assessment and project identification, resource valuation, renewable energy zones identification and characterization, environmental assessment and ranking, conceptual transmission development, and the eventual build-out of new transmission lines and renewable energy projects.
- The cost of and potential for various renewable energy sources should be assessed using GIS analysis to assess the location specific nature of various renewable resource options.
- Possible renewable project potential should be identified by location, accommodating alternative land uses and environmental concerns both to restrict expected

development in some areas, and to assess the relative merits of development in others. If accessing a new and relatively undeveloped area, this may require considerable supporting transmission infrastructure, such as transmission collector systems.

- The relative cost and value of renewable resource options and locations should be based not just on generator costs, but also on transmission expenditures, as well as energy and capacity valuation.
- Transmission cost allocation and recovery provisions should be clear, well-defined and widely accepted, or transmission may not be built.
- REZ identification is intended to complement existing processes, such as interconnection reform and planning, transmission corridor designation and plant siting, and transmission planning processes by other state operations (Wiser et al. 2008).

Example of Successful Implementation: Texas Competitive Renewable Energy Zones

HIGHLIGHTS

Texas was the first state to introduce the concept of Competitive Renewable Energy Zones (CREZs) for transmission planning. The process is currently being adopted by states and regions nationwide.

OVERVIEW

The Texas CREZs (1) establish legal exceptions to laws governing transmission approval and cost recovery, and (2) give the Public Utility Commission of Texas (PUC) unambiguous authority to approve transmission on the informed expectation of future renewable energy development (Hurlbut 2008b).

In 2005, Texas adopted a transmission bill for renewable energy in response to the high demand for wind transmission capacity to meet the Texas Renewable Portfolio Standard. The bill ordered the PUC to (1) designate Competitive Renewable Energy Zones in the areas of the state with the highest resource capacity and suitable land areas; (2) consider the level of financial commitment by developers; and (3) develop a plan for electric transmission infrastructure to move the energy from CREZs to areas where it will be consumed. The CREZ effort is expected to approximately double Texas' wind generation capacity from the level in the 2008 timeframe to 18.5 GW (LRCA 2010).

The PUC's first action was to authorize the Electric Reliability Council of Texas (ERCOT) to provide a study of potential wind energy production in the state and the associated transmission constraints limiting its deliverability (ERCOT 2006). After the completion of the study, the PUC designated five zones statewide for renewable energy generation through a multi-stakeholder process, considering the following factors for each zone: the area's land suitability and potential for renewable energy resources; the level of financial commitment by generators; the estimated cost of constructing the transmission capacity; and the estimated benefits of renewable energy in the zone. The five CREZs will have transmission capacity to accommodate 11.5 GW of wind energy (Wind Coalition 2010). In 2008–2009, the PUC approved the selection of a $4.93 billion transmission scenario and transmission plan, and assigned transmission projects in the identified zones to specific companies (CVA 2009).

KEY DATES

2005 - Texas Senate Bill 20 passed directing PUC to establish Competitive Renewable Energy Zones.

2006 - PUC began development of a massive plan to move energy produced in the Panhandle and West Texas to the Metroplex and IH-35 corridor.

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2007 - The PUC's interim final order outlined four scenarios for building transmission lines.

2008 - The PUC approved the selection of a $4.93 billion transmission scenario and transmission plan.

2009 – The PUC assigned transmission projects in the identified zones to specific companies (CVA 2009).

FUNDING SOURCE AND COSTS

The project will fund $4.9 billion worth of transmission lines, which will be paid for by all consumers across the Texas grid through a small surcharge added to their electricity bills (SECO 2009). All transmission in ERCOT is paid for in this way. Planning efforts to date have been borne by ERCOT and the entities selected to construct the CREZ transmission.

LESSONS LEARNED

- One challenge was whether to supersize transmission planning, or to take the option that offered the least risk in the short-term. The PUC ended up taking a middle option, and identifying five zones for transmission build out.
- The PUC has faced a challenge in setting the level of financial commitment that generators would have to demonstrate, in order for the transmission companies to proceed with the construction of the transmission facilities. The PUC met this challenge through a two-stage process, involving public participation at both stages, setting generic rules first and then applying the rules to the particular circumstances.
- During CREZ selection, ERCOT conducted a study to determine the zones that were suitable for renewable energy development and could most readily be connected to the existing transmission system. ERCOT also commissioned a study of the challenges of integrating large amounts of wind capacity into the region. ERCOT met this challenge through its own capable planning staff, the use of outside consultants, and significant involvement in the planning effort by interested persons.

MONITORING AND EVALUATION

When determining which areas to identify as CREZs, the PUC consulted with wind developers, utilities, and other stakeholders to determine which areas would offer the greatest return on investment. The PUC worked with consultants during this process to ensure all voices were heard. Going forward, the PUC has hired a consultant to be a clearing house for information on the large number of CREZ transmission projects, including establishing a web site for information that is available to the public and providing more detailed reports to the PUC.

PROJECTED RESULTS

- The overall CREZ effort will approximately double Texas' current level of wind generation capacity to 18,456 MW.
- The transmission lines that will connect the CREZs to the load centers will increase reliability of the ERCOT grid and increase the transfer of wind and other power into various parts of the state (LRCA 2010).
- The development of wind energy resources will bring significant economic development to areas that have experienced limited development opportunities in the recent past.

RESOURCES

The final map of identified CREZ transmission projects- http://www.lcra.org/library/media/public/docs/energy/crez/MAP_lcraTSC_awarded0209.pdf

The State Energy Conservation Office's website on renewable energy and transmission in Texas: http://www.seco.cpa.state.tx.us/re.htm

4B NET METERING AND INTERCONNECTION STANDARDS

OVERVIEW

Interconnection standards and net metering requirements facilitate the development of small-scale renewable energy systems by effectively removing several of the obstacles associated with connecting a renewable energy system to the grid.

Net metering is a billing arrangement between a utility and a customer that owns renewable electricity generating equipment. Under net metering, the customer's electric meter runs in reverse when the system is producing excess electricity, so the customer can still receive the full value of the electricity the system produces. In months when electricity usage is low, net excess electricity is rolled over to the next bill. State net metering policies vary widely according to: the types of technologies that are eligible; the types of customer classes that may enroll; the size of a system that can be net metered; the total aggregate generation capacity of systems that may enroll; the treatment of monthly and annual net excess generation; the types of utilities covered by a state policy; and the ownership of renewable energy credits (IREC 2009a).

Interconnection standards refer to the comprehensive technical, legal and procedural requirements that states set on utilities and system owners to facilitate the connection of consumer-sited renewable systems to the grid. These standards are intended to ease the conflicts of interest created when utilities set their own procedures, which may impose complicated requirements irrelevant to small systems and unnecessary fees. Uniform connection standards maintain the stability and safety of the grid, and allow for a wide variety of products and technologies to be developed at a low cost.

HOW IT IS FUNDED

The only costs associated with net metering and interconnection are indirect. The customer buys less electricity from the utility, and the utility earns less revenue from the customer. Although this represents lost revenue for a utility, this indirect "cost" is at least partially offset by administrative and accounting savings.

KEY PROGRAM ELEMENTS

Net Metering - The Interstate Renewable Energy Council (IREC) has identified several "best practice" net metering rules that have been highly influential in some of the country's most successful programs. They are paraphrased below and can be downloaded in full at the IREC website:[1]

- Net metering system size limits should be at least 2 MW to accommodate large commercial and industrial customers' loads. The limit on total capacity from distributed generation should be at least 5% of the utility's annual load.
- Standards should be applied to all utilities in the state, including investor-owned utilities, municipal utilities, and electric cooperatives.
- All renewable technologies and customer classes should be eligible for net metering.
- Utilities should not be allowed to charge extra fees or impose unneeded rules and procedures, such as application fees.
- If the credit from the renewable energy system is not used in the month in which it is generated, excess electricity should be allowed to carry over at the utility's full retail rate until the customer leaves the utility. Without net metering, customers would be required to use two electric meters: one to measure electricity consumed from the electric grid, and one to measure any extra electricity sent back to the grid when the system provides more energy than needed.
- Customers should retain ownership of the environmental benefits their renewable energy system produces. The utility should be restricted from selling

1 IREC's best practice net metering rules can be downloaded from: http://irecusa.org/fileadmin/user_upload/ConnectDocs/IREC_NM_Model_October_2009-1.pdf

renewable energy credits (RECs) from the system to other customers.

Interconnection - IREC's model interconnection procedures incorporate the best practices of small-generator interconnection procedures developed by multiple stakeholders. They are paraphrased below and can be downloaded in full at the IREC website:[2]

- Utilities should set fair fees proportional to a project's size.
- Maximum capacity for an individual system should be at least 10 MW.
- Timelines should be reasonable and punctual, and applications should be processed within the first few days. There should be three or four separate levels of review to accommodate systems of different capacities, complexities, and levels of certification. Different timeframes should be adopted depending on the system's degree of complexity.
- Application costs should be kept to a minimum.
- Form agreements should be standard and simple to use. The more legal documents they must go through, the less likely customers are to move ahead in installing a system.
- Policies should be transparent, uniform, detailed, and public.
- Utilities should not charge fees for interconnection or inspections, require interconnection studies for standard projects, require customers to install unnecessary devices, or require that customers obtain additional liability insurance.
- Existing relevant technical standards should apply. In the United States, state interconnection standards work within the specifications of the national technical standards IEEE 1547 and UL 1741.

Complementary Practices

- Community Renewable Energy: Customers unable to install renewable energy systems on their own residences can sometimes purchase shares from systems that provide power or financial benefit to multiple community members, also known as community renewable energy systems. These systems often offer "Virtual Net Metering" programs, in which customers can receive credit on their energy bill for their portion of the renewable energy produced. The Sacramento Municipal Utility District's Solar Shares Program is an example of this growing trend. More information can be found on the program's website.[3]
- Feed-in Tariffs: Although each policy refunds energy producers for the amount of electricity they produce, it is important for legislators to distinguish between the separate market segments served by feed-in tariffs and net metering programs. Feed-in tariffs provide direct payments for wholesale energy generation for sale to utility customers, whereas net metering programs provide indirect compensation to customers by allowing them to offset retail purchases from the utility (NEC 2009). More information on feed-in tariffs can be found in Section 3E.

RESOURCES

IREC's nationally recognized, annual guide to net metering and interconnection: "Connecting to the Grid: A Guide to Distributed Generation Interconnection Issues." URL: http://irecusa.org/wp-content/uploads/2009/11/Connecting-to-the-Grid-Guide-6th-edition.pdf

Nationally recognized standards for utility interconnection, which many states use as a template for their interconnection standards:

- Institute of Electrical and Electronic Engineers, Standard 929-2000: Recommended Practice for Utility Interface of Photovoltaic Systems. Institute of Electrical and Electronic Engineers, Inc., New York, NY
- Underwriters Laboratories, UL Subject 1741: Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems (First Edition). Underwriters Laboratories, Inc., Northbrook, IL (December 1997).

2 Interconnection rules can be downloaded from: http://irecusa.org/fileadmin/user_upload/ConnectDocs/IREC_IC_Model_October_2009.pdf
3 SMUD Solar Shares Program Website: http://www.smud.org/en/community-environment/solar/Pages/solarshares.aspx

Example of Successful Implementation: Oregon Net Metering Policy and Interconnection Standards

HIGHLIGHTS

Oregon has used best practices from other states to implement net metering and interconnection standards that are among the highest quality in the country. Unlike many other programs, Oregon's net metering program is inclusive, allowing customers with more than one electric meter on their property to use net metering credits at multiple sites. Oregon's interconnection standards benefit owners of both large and small systems, by setting high limits and reducing unnecessary and redundant safety requirements for smaller systems (NEC 2009).

OVERVIEW

The Oregon Public Utilities Commission (PUC) adopted new rules for net metering for customers of its largest investor-owned utilities in July 2007, raising the individual system limit from 25 kW to 2 MW for nonresidential applications. The limit on residential systems is 25 kW. Covered technologies include solar power, wind power, hydropower, fuel cells, landfill gas, anaerobic digestion and biomass. Net excess generation is carried over to the customer's next bill as a kilowatt-hour credit for a 12 month period. Any net excess generation remaining after 12 months will be credited at the utility's avoided-cost rate to customers enrolled in Oregon's low-income assistance programs. Customers retain ownership of all renewable energy credits associated with the generation of electricity. The cumulative capacity of net metered systems will not be limited until a system limit of 0.5% of a utility's historic single-hour peak load has been reached (DSIRE 2009a).

Oregon has two separate interconnection standards: one for net metered systems and one for small generator facilities that are not net-metered. The PUC rules include three levels of interconnection for investor-owned utility customers who own net metered systems. The PUC also requires the use of a standard application, a standard agreement, and reasonable procedural timelines for utilities and applicants. Application forms and information are made easily accessible through a designated office or employee by each utility. Net metering customers are not required to purchase additional liability insurance or to name the utility as an "additional insured" on the customer's liability policy (DSIRE 2009a).

In September 2009, the PUC finalized additional administrative rules for the interconnection of small generator facilities up to 10 MW. There are four tiers of review for these small generating facilities, based on system capacity and the complexity of the interconnection: 25 kW, 2 MW lab tested systems, non-exporting systems up to 10 MW, and other systems of any size up to 10 MW. Application fees are differentiated, based on the tier (DSIRE 2009a).

Along with interconnection standards and net metering requirements, Oregon passed a Renewable Portfolio Standard, requiring 25% renewable energy by 2025, and a ruling to clarify that third party investors may participate in net metering. By passing these and other complementary energy actions, Oregon enables interconnection standards and net metering to have their fully desired impact.

KEY DATES

Implemented in 1999. Amended in 2005, 2007 and 2009.

FUNDING SOURCE AND COSTS

Oregon state costs associated with net metering and interconnection are minimal. The costs for utilities, in the case of net metering, are primarily indirect, as the customer buys less electricity from the utility, and the utility earns less revenue from the customer. Though this represents lost revenue for a utility, this indirect "cost" is at least partially offset by administrative and accounting savings, which can exceed $25 per month, were the customer to enter in to an avoided cost

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based power purchase agreement where the utility would be required to purchase the entire generation output at avoided costs.

LESSONS LEARNED

- Net metering was originally only open to very small generators of 25 kW or less. After advocacy by private and public entities, it was eventually determined that expanding net metering to larger systems would not have a significant negative financial impact for the state, and the state expanded net metering to 2 MW for non-residential applications. Prior to implementation, multiple workshops were held to allow interested parties to provide input regarding rules needed to facilitate the interconnection of net metering facilities up to 2 MW.
- Wind turbines sized for farms and community projects, fuel cells designed for loads larger than 25 kW, and biomass were originally not eligible for net metering. Increasing the size of eligible systems encouraged the use of wind turbines in rural areas and spurred their adoption by businesses and institutions as their costs went down (Schwartz 2005).
- Aggregation—the ability to combine several net metered facilities—can allow the surplus from one facility to offset a deficit at another net metered facility. However, increasing the number of aggregated meters can create administrative, safety, and reliability problems for the utilities. The final rule from the Commission allows aggregation of one customer-generator's net metering facilities, if the aggregated facilities do not receive more than one rate schedule, i.e. residential or commercial, and if they exist on one property site (Stoel Rives 2007).

MONITORING AND EVALUATION

PGE and PacifiCorp base their monitoring systems on the standards set by the National Electric Code (NEC), National Electrical Safety Code (NESC), Institute of Electrical and Electronic Engineers (IEEE), and Underwriters Laboratories (UL).

RESULTS

The program's success has earned it recognition as the best in the United States in the 2009 Edition of Freeing the Grid, a policy guide that grades states on their current net metering and interconnection practices (NEC 2009).

RESOURCES

A copy of Pacific Power's Interconnection and Net Metering agreement: http://www.pacificpower.net/content/dam/pacific_power/doc/Contractors_Suppliers/Electric_Service_Requirements/Contractors_OR_4.pdf

A copy of the OAR Chapter 860 Division 039: http://arcweb.sos.state.or.us/rules/OARS_800/OAR_860/860_039.html

Oregon's interconnection rules, Div 860 Division 82: http://arcweb.sos.state.or.us/rules/OARS_800/OAR_860/860_082.html

4C REVENUE STABILITY MECHANISM

OVERVIEW

In the United States, under traditional, price-based regulation in the electric and gas utility sectors, revenues are primarily a function of the number of units of energy sold (whether kilowatt hours or therms). Therefore, successful energy efficiency and conservation programs lower utility revenues—a clear disincentive for utilities to encourage investments in these programs.

Revenue stability mechanism (RSMs), sometimes also called revenue decoupling, removes this financial disincentive. An RSM separates a utility's revenue recovery from the actual units of energy sold, thereby shifting the utility's culture from one in which revenues vary with sales to one in which the utility is a service provider and will earn a prescribed level of revenue, irrespective of sales.

In the United States, electricity and natural gas services are regulated by state public utility commissions through a process that sets retail prices per unit of energy sold. With traditional regulation, the price is set at the conclusion of each rate case based upon a cost-based revenue requirement, while actual revenue collected by the utility goes up or down with actual sales in the period after the rate case. In this system, a utility can increase profits in two ways:

1. Reduce expenses
2. Increase sales

Since it is often easier to increase sales than to reduce expenses, utility companies have a powerful incentive to increase their sales of energy. This is generally referred to as the "throughput incentive."

The RSM breaks the link between energy sales and utility revenues. While traditional regulation holds prices constant between rate cases and allows revenues to change with consumption, an RSM holds revenues constant (or sets them according to a formula) and allows prices to change with consumption. Under the RSM, regulators set a "revenue target" or "revenue requirement," and the utility is entitled to collect that target regardless of the units of energy sold. In order to accomplish this, the price per unit of energy sold is adjusted periodically (either quarterly or monthly) to ensure that the revenue target is met, regardless of the actual units of energy sold. If sales increase, the price per unit of energy goes down. If sales go down, the price rises. The magnitude of the price adjustments should be small, if the mechanism is well designed.

RSM only removes the throughput incentive. It does not provide an incentive to pursue energy efficiency, so RSM works best with complementary practices such as funding for energy efficiency programs (directly in rates or via public benefits funds); energy efficiency resource standards; integrated resource planning; and shareholder incentives for superior performance in the acquisition of energy efficiency.

KEY PROGRAM ELEMENTS

- A common way for a regulatory board to calculate the targeted revenue is to use the "revenue per customer" calculation. That is, they divide the last approved revenue target by the number of customer accounts assumed in that ratemaking process, and then multiply the per-customer amount by the number of customers in the current period to obtain the target revenue. This approach recognizes that in the short term, utility costs do vary with changes in the number of customers (not with changes in sales volumes) (Weston 2009).
- As noted above, since RSM only removes the disincentive for utilities to support energy efficiency programs, it is important to pair RSM with financial incentives for the utility in order to encourage superior performance from the utility in the design and delivery of energy efficiency programs. RSM goes hand-in-hand with energy efficiency and conservation programs in that, without decoupling, the utility has a financial incentive to avoid conservation programs. However, the utility also must be financially rewarded (i.e., allowed to charge higher rates) for successes in such programs in order to implement effective conservation programs.
- An RSM has both short-run and long-run implications. In the short run, to the extent unit sales are lower due to energy efficiency or other causes, prices will be adjusted upward to maintain the target revenue. In the long-run, to the extent the RSM enables the utility to aggressively embrace energy efficiency, the long-run cost of the delivery system should be lower, because the more energy efficient the customers are, the less infrastructure and maintenance are needed to serve them (Shirley 2010).

Example of Successful Implementation: Baltimore Gas and Electric; Maryland

HIGHLIGHTS

Maryland has both electric and gas decoupling policies in place. Gas decoupling began in 1998, and electric decoupling began in 2008.

OVERVIEW

Baltimore Gas and Electric (BGE) is a regulated distributor of electricity and natural gas in the city of Baltimore, Maryland and in all or part of 10 counties in central Maryland. It has more than 1.2 million electric customers and 640,000 gas customers (Constellation Energy 2009). Its total annual distribution volumes are approximately 32 million MWh and approximately 100 million DTH (Manuel 2010).

BGE uses a *revenue per customer* mechanism with a monthly true-up to adjust for new and departing customers. Changes in rates cannot be more than 10% in any one month with any adjustment amount in excess of that carried over to future periods (Manuel 2010).

In order to determine the appropriate revenue requirement for BGE under decoupling, the prior rate case test year is used to determine the base revenue per customer as follows:

*Test Year No. of Customers * Customer Charge + Test Year Average Use per Customer * Delivery Price * No. of Customers = Test Year Revenue Requirement*

BGE's program is designed to recover multiple sources of revenue lost due to energy efficiency and conservation, weather, and price elasticity. It includes three parts: (1) Test year revenue requirements are set based on weather-normalized patterns of consumption; (2) monthly revenue adjustments are accrued based on actual revenues; and (3) monthly adjustments to rates are made based on the accrued adjustments.

Any difference between the actual sales and estimated sales is reconciled in a future month by filing monthly with the Public Service Commission. Calculations are done separately for each class of customer.

BGE then applies the revenue-per-customer (RPC) mechanism, based on the revenue requirement as pre-determined by the rate case test-year. The RPC is expressed as a function of average usage per customer per month. Monthly adjustments keep BGE on track to earn its revenue requirement.

For example, assume that BGE expects to get $30 a month on average from each customer for gas distribution based on normal weather for each month of the year. Also assume that it is delivering an average of 100 therms per customer in December. But if December is warmer than usual and the average is only 80 therms, BGE does not collect the full $30 per bill for that month. To make up for that loss and ensure that it collects the full amount of its target revenue by the end of the year, BGE would raise the delivery rate in its February bills. For example, the utility would charge $36 instead of $30 for 100 therms in February.

The system also works the opposite way. If December was an exceptionally cold month and customers use more than an average of 100 therms of gas, the utility would charge less for delivery in February.

In 2008, to complement its revenue decoupling mechanism, the state of Maryland passed the EmPOWER Maryland Energy Efficiency Act, which requires electric utilities to design and implement energy efficiency programs as part of a statewide goal to achieve 15% reduction per capita by the end of 2015 (State of Maryland 2009). Following this, BGE launched several energy efficiency programs as summarized below (Manuel 2010):

Residential programs

- Electric Lighting and Appliance Program – designed to increase use of ENERGY STAR lighting and appliances through incentives for CFL light bulbs and appliance incentives.
- Gas and Electric Home Performance with ENERGY STAR Program – offers customers several levels

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of participation, at different price points, in home energy audits.

- Electric Residential New Construction Program – offers incentives to home builders in order to accelerate the penetration of ENERGY STAR qualified homes in BGE's service territory.
- Gas and Electric Low-Income Program – provides free energy assessment, education and retrofit services to qualified program participants. (The existing gas CHIP program will be incorporated into the full program).
- Gas and Electric HVAC Program – designed to increase the energy efficiency of central air conditioning and heat pump equipment by providing incentives for high efficiency units and for quality installation, repair and duct sealing.
- Electric Multifamily Program – a tenant-focused program that targets renters (in addition to landlords) to address the issue of how to motivate renters to make improvements to homes they do not own.

Small Commercial Programs

- Electric Direct Install/Prescriptive Program – the direct install, or retrofit element is designed to identify opportunities for early replacement of existing equipment that continues to function but is outdated and energy inefficient. The prescriptive program offers customers opportunities for incentives for end-of-life replacements of (usually) single pieces of equipment.
- Electric Multifamily Program – targets property owners and managers of multi-family residential dwellings by offering free energy efficiency audits of common areas, and if possible, at least one unit within the building, to identify potential opportunities for prescriptive measures, particularly common area lighting measures.

Large Commercial, Industrial and Institutional Programs

- Electric Prescriptive Program – provides onsite audits to identify energy efficiency opportunities and incentive payments for the purchase of specified equipment.
- Electric Custom Incentive Program – BGE anticipates co-funding (up to 50%) a limited number of custom studies to identify energy savings. Customers implementing measures that achieve over 50% of the identified savings may receive a full or partial refund of its share of their study costs.
- Electric Re-commissioning Program – offers technical and financial assistance to identify and implement low cost tune-ups and adjustments that improve the efficiency of building operating systems (focusing on building controls and HVAC systems).

KEY DATES

1998 - Gas decoupling began.

2008 - Electric decoupling began.

2008 - The Maryland EmPOWER Energy Efficiency Act passed.

2009 - BGE launched their conservation and energy efficiency programs.

FUNDING SOURCE AND COSTS

Decoupling is not a funded program, but rather a different way of structuring the way rates are structured.

If energy efficiency programs are also required, they need to not only be funded via increased rates, but the utility must be allowed to increase its revenue based on the successful delivery of such programs.

LESSONS LEARNED

Challenge: *BGE had no financial incentive to initiate energy efficiency programs and the Public Utility Commission would not allow increased revenue based on successes with such programs.*

Result: Following the passage of the EmPOWER Maryland Energy Efficiency Act of 2008, BGE is now engaged in energy efficiency and conservation

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programs. Because decoupling is in place, BGE can run such programs without the fear of lower revenues due to decreased energy consumption by customers. Without being mandated by law, or without a financial incentive to the utility, it will be difficult to get utility companies to take the lead in successful energy efficiency and conservation initiatives.

Challenge: *In a downturned economy, success will be dependent on what customers can afford.*

Result: If customers cannot afford to spend discretionary funds on energy efficient business and household improvements, appliances, or fixtures, a rebate program for such items will not work well. If the economy is doing well, customers can afford more and the utility can give rebates. BGE did not spend as much on rebates in 2009 as expected due to the downturned economy, since customers had less discretionary funding available to spend on energy efficiency goods and services. BGE is currently investigating other energy efficiency and conservation program options in addition to ramping up its efforts to educate customers about the many long-term benefits associated with increased energy efficiency efforts.

MONITORING AND EVALUATION

The success of RSM depends on the success of conservation and energy efficiency efforts combined with whether or not the utility recovers the "lost" revenue due to its own conservation and energy efficiency efforts. Under RSM, in some years the utility will earn more revenue, and other years it will earn less relative to its revenue without decoupling.

RESULTS

For the gas business, BGE has experienced a steady decline in usage per customer since the implementation of RSM and BGE's efforts to encourage gas conservation. Over the twelve-year period from 1998 to 2009, BGE recovered more revenue under the RSM program during six of the years and less revenue during the other six. It should be noted that BGE had two gas base rate cases in those years, so the target revenue test years were reset twice during that period (Manuel 2010).

For the electric business, and similar to the gas business's first two years after RSM was implemented, BGE experienced a notable decline in usage per customer due to the initial ramp-up of customer conservation efforts. As a result, the RSM program allowed BGE to recover more revenues in these initial years (Manuel 2010).

BGE knows that it is important to keep customers engaged in efficiency and conservation efforts over the long term. If customers lose interest in saving energy in their home or business, BGE cannot help the state of Maryland achieve its energy efficiency and conservation goals (Manuel 2010).

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RESOURCES

Legal agreements and documents between BG&E and the Maryland PUC: http://webapp.psc.state.md.us/Intranet/Casenum/CaseAction_new.cfm?RequestTimeout=500? On the left side in the gray bar, type case number 9154; then see sections 54, 85, and 96 for relevant reports and information.

Legal information on energy efficiency programs in Maryland: http://webapp.psc.state.md.us/Intranet/home.cfm

CHAPTER V.
LEADING BY EXAMPLE IN PUBLIC FACILITIES, OPERATIONS, AND FLEETS

5A LEADING BY EXAMPLE IN PUBLIC BUILDINGS AND FACILITIES

OVERVIEW

State and local governments across the United States are using their regulatory authority to mitigate greenhouse gases (GHGs) through leading by example (LBE) initiatives. Local governments lead by example by adopting formal policy commitments for energy efficiency and renewable energy in publicly funded buildings and facilities and by providing assistance to local businesses and residents to do the same. LBE demonstrates a government's commitment to fiscal responsibility and environmental stewardship, and increases demand for efficient and clean energy products and services.

LBE is used by local governments in the United States to demonstrate the feasibility and benefits of energy efficiency and renewable energy standards directly to the building community, industry leaders, policymakers, and others who may otherwise be hesitant to support new energy regulations. The benefits of local government LBE include:

- Incorporating more advanced energy efficiency practices into new or renovated buildings familiarizes and trains the construction industry and code enforcement officials, and increases demand for such products from product suppliers, manufacturers and service providers.
- The reduced energy bills resulting from LBE efforts demonstrate responsible government stewardship of tax dollars.
- Setting energy targets provides leadership and a common goal to work towards within a local government.
- Well-publicized government programs raise awareness of energy efficiency and renewable energy opportunities and help change behaviors on individual and societal levels.
- Increased reliance on energy efficiency and renewable energy, rather than traditional fossil fuels, helps governments hedge against uncertain future energy costs and availability, and reduces governments' susceptibility to fuel price volatility.
- LBE actions create jobs and stimulate the local economy.

Successfully implementing local-level energy efficiency and renewable energy policies adds credibility to state and federal efforts. For example, states that have had difficulty passing energy codes often adopt energy standards for public buildings as a manageable first step, giving stakeholders a "trial run" to become more comfortable understanding and implementing the standards. Further, states that have had success adopting energy codes and other building measures often adopt higher standards for public buildings. In both cases, public building standards ratchet up building energy performance, paving the way for more advanced statewide policies.

LBE actions by local governments include:

- Advanced energy efficiency or renewable energy requirements for new or existing public funded buildings (e.g., libraries, government buildings, hospitals); facilities (e.g., garbage, water supply and wastewater treatment plants, street and public area lighting); and fleets (government-owned vehicles).
- Requirements for energy-efficient product procurement (e.g., requiring all appliance and equipment purchases to meet the ENERGY STAR[1] or comparable standards).
- Using renewable energy, often through one of the following ways:
  - Purchasing renewable energy directly from the electricity provider, often as a fixed percentage of monthly use (refer to section "5B—Green Power Purchasing" of this report;
  - Buying Renewable Energy Credits (RECs);[2] and/or
  - Generating renewable energy at public facilities or on public lands. By generating renewable energy on-site, governments obtain improved power quality and supply reliability, incentives for renewable energy generation, and the option to sell surplus electricity generated to the grid. The renewable energy technologies typically used on-site include: small wind turbines; solar photovoltaics installed on a building or as stand-alone systems on parking meters, bus stop canopies, or street or parking lot lights; solar hot water; solar process heating and cooling; geothermal heat pumps; biomass for use in waste-to-energy applications; and landfill gas, which involves equipping landfills and other facilities to capture biogas and convert it into electricity.

HOW IT IS FUNDED

Often, governments fund public sector energy efficiency and renewable energy programs through their own budget allocations or through federal or state grants.

Other sources of LBE program funding may include:

- Energy Service Company (ESCo) or other third-party performance contracts;
- Utility rebates to public sector customers, or in some cases utility loans to public sector customers which are repaid over time on their energy bill;
- Capital raised by state or locally-issued revenue or general-obligation bonds;
- Revolving loan funds for energy-saving projects, with initial capital coming from grants, bond issues, or other sources (such as environmental fines or legal settlements);
- Dedicating money from energy bill savings from previous energy efficiency improvements to be reinvested in new energy-saving programs or projects; or
- Revenues from a city-owned electric or gas utility.

KEY PROGRAM ELEMENTS

- State and local governments can use the cost savings from energy efficiency to fund additional efficiency improvements and/or on-site renewable energy generation.
- Setting state-level goals for improving public building efficiency (e.g., by 50% or more) and collaborating with the energy codes community to reach those goals will help states meet energy policy objectives.
- Governments should negotiate terms for energy purchases that reflect government or community-specific preferences, such as a preference for green power generated locally. Governments can also aggregate demand for energy efficient products or services or for green power with other jurisdictions to negotiate lower rates and reduce transaction costs.

Consumer outreach is important to ensure that the public is aware of local and state government measures to reduce its own energy consumption.

1 Energy Star is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy to help consumers identify energy-efficient consumer products. It is now an international standard that generally means that a product uses less energy than a conventional product.

2 RECs operate like certificates that represent proof that each megawatt-hour (MWh) was generated from an eligible renewable energy resource. These are used when renewable energy is not readily available in the specific area where needed, nor from the local utility company, so the renewable energy is generated elsewhere, and the electricity is fed into the grid, offsetting the specific amount that the government has committed to using.

Example of Successful Implementation: New York City Municipal Building Code

HIGHLIGHTS

- New York City (NYC) is a leader in enacting legislation to reduce building energy consumption for both public and private buildings. The city is leading by example by reducing energy use in city buildings via Local Law 86 (LL86).
- NYC is implementing strategies to improve the energy performance of its own buildings and fleets by 30% over the next decade (City of New York 2009a).
- The cost of professional services and energy efficiency measures required to upgrade public (non-school) buildings averages 1.5% of construction cost, and the energy upgrades pay for themselves on average in seven years.

OVERVIEW

The energy consumed for electricity, heating and hot water in all NYC buildings—public and private—accounts for 75% of the city's GHG emissions, and $15 billion in annual energy costs (City of New York 2009b). Energy use in NYC municipal buildings totals more than $800 million each year and accounts for about 6.5% of NYC's total GHG emissions.

Local Law 86 of 2005 (LL86) demonstrates the city's commitment to leading by example by reducing GHGs and energy use. It is one of the nation's first laws requiring that most of a city's capital building projects be designed and constructed to meet the standards of the Leadership in Energy and Environmental Design (LEED)[3] green building rating system developed by the United States Green Building Council (USGBC). LL86 also requires that most of these projects, as well as some plumbing, HVAC, and lighting system upgrades, exceed the minimum energy and potable water requirements in the New York State Energy Conservation Code. The Mayor's Office of Environmental Coordination administers LL86.

Following the passage of LL 86, NYC launched PlaNYC in 2007—a comprehensive sustainability plan to reduce GHG emissions. The targets are:

- Citywide emission target:
  - 30% reduction (from 2005 levels) by 2030.
- Government operations emission targets:
  - 30% reduction (from fiscal year 2006 levels) by 2017 ("30 by 17").

In addition to its focus on the five key dimensions of the city's environment—land, air, water, energy and transportation, PlaNYC puts forth a strategy to accommodate a population growth of nearly one million and improve the city's infrastructure and environment.

The legislated construction specifications outlined in Local Law 86 (LL86) support the goals of PlaNYC to reduce GHG emissions for municipal operations, reduce energy costs, decrease the use of potable water and reduce the amount of stormwater that enters the city's water treatment systems and surface water bodies (City of New York 2005).

Capital building projects of city agencies and those of non-city agencies that receive capital funding from the city treasury—except for those with residential and industrial occupancies and open-air structures—are subject to the requirements of LL86. An overview of the requirements for projects subject to LL86 is below (City of New York 2009a):

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3 According to www.usgbc.org, LEED is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. Developed by the U.S. Green Building Council (USGBC), LEED provides building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions. Version 3 is the most updated version of LEED. There are four levels of certification based on a 100-point scale: "Certified" (40-49 points); "Silver" (50-59 points); "Gold" (60-70 points); "Platinum" (80 points and above).

- All new municipal construction or major reconstruction projects with an estimated capital cost of more than $2 million, except schools and hospitals, must meet LEED Silver certification standards.
- Non-municipal projects meeting the above criteria and receiving at least 50% of project costs or $10 million from the city treasury must also meet LEED Silver certification standards.
- School and hospital projects meeting the above criteria need only meet LEED certification standards.
- Projects with an estimated construction cost of $12 million–$30 million, schools excluded, must achieve an energy cost reduction of 20% above LEED Credit EA1 or the New York State Energy Conservation Construction Code (ECCCNYS), whichever is more stringent; and achieve an additional 5% energy cost reduction if the payback period is less than seven years.
- Projects with an estimated construction cost of more than $30 million, schools excluded, must achieve an energy cost reduction of 25% above LEED Credit EA1 or ECCCNYS, whichever is more stringent; and achieve a further energy cost reduction of 5–10% if the payback period is less than seven years.
- School projects with a construction cost of more than $12 million must achieve energy cost reductions of 20% above LEED Credit EA1 or the ECCCNYS, whichever is more stringent; and achieve a further energy cost reduction of 5–10% if the payback period is less than seven years.

KEY DATES

October 3, 2005 - Mayor Michael Bloomberg signed LL86 into law. On January 1, 2006, the law took effect for the Department of Design and Construction. For all other city agencies, it went into effect on January 1, 2007.

November 20, 2006 - The mayor issued Executive Order 97 (EO 97), which authorized the Director of the Mayor's Office of Environmental Coordination (MOEC) to exercise the powers and duties of the mayor with respect to the implementation of LL86. Rules to implement LL86 were published in draft form for public comment on December 1, 2006 and, following a public comment period and hearing, became effective on April 2, 2007.

April 2007 - The city released its comprehensive GHG inventory, which detailed the sources and levels of GHG emissions from both citywide activities and NYC government operations, providing a baseline[4] from which the city's GHG emission reduction targets are measured. The baselines were later adjusted upward (City of New York 2008).

October 2007 - The mayor issued Executive Order 109 (EO 109). EO 109 created and charged an Energy Conservation Steering Committee with developing a plan to achieve the "30 by 17" goal and allocated the equivalent of ten percent ($80 million) of the city's energy budget towards its implementation (City of New York 2007).

July 2008 - the Energy Conservation Steering Committee fulfilled its mandate with the release of the "Long Term Plan to Reduce Energy Consumption and Greenhouse Gas Emissions of Municipal Buildings and Operations" (Long-Term Plan). The Long-Term Plan estimates that in order to achieve the GHG emissions target by 2017, municipal GHG emissions must be reduced to an annual rate that is 1.68 million metric tons less than the comparable rate in 2006 and that a reduction of energy use in the city's existing buildings can contribute nearly 60% of what is needed to achieve that target rate. To achieve this reduction, the plan outlines potential energy efficiency improvements across the range of building types and sizes represented in the city's portfolio. These mainly include retrofits of HVAC and lighting systems as well as the adoption of best practices for maintenance and operation.

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4 For the citywide base year, 2005 data were used. For city government operations, fiscal year 2006 (July 1, 2005–June 30, 2006) was used for the base year.

2009 - The Mayor's Office of Environmental Coordination updated LL86 to require that all projects beginning on or after June 26, 2009, meet the standards of LEED version 3.

December 2009 - NYC became the first U.S. city to legislatively mandate comprehensive and mandatory efforts to reduce emissions from large existing, privately owned buildings in the city. Each of four bills addresses a different aspect of improving energy efficiency, as follows: (1) energy conservation standards for building renovations; (2) annual energy benchmarking and disclosure; (3) mandatory lighting system upgrades and tenant submetering; and (4) mandatory energy auditing, retro-commissioning and retrofits (DSIRE 2010c).

FUNDING SOURCE AND COSTS

As of March 2010, a total of 114 projects subject to LL86 provisions have commenced since LL86 was enacted. The city covers the additional planning and construction costs for energy efficiency features stipulated by LL86. No additional funding source is dedicated to covering the relatively minor incremental cost of enforcing compliance with LL86.

According to the City of New York's Local Law 86 of 2005, Fiscal Year 2009 Annual Report, incremental cost data show that the average investment to meet both the LEED rating and energy cost reduction requirement for non-school projects averages 1.5% of construction cost. Roughly half that amount is dedicated to the professional services needed to meet the LEED requirements and the other half is dedicated to the incremental cost of the investment in energy efficiency measures, an investment with an average simple payback of seven years.

According to the NYC Energy Conservation Steering Committee's Long Term Plan, in order to achieve a targeted reduction of 1.68 million metric tons annually the city will require an investment of over $2.3 billion over the next nine years, approximately $900 million of which has already been committed by the city.[5]

While the city will pay for an additional portion of the overall investment through the agency appropriations process (i.e., for routine maintenance and renovation projects which also often include GHG reduction savings), it will face a significant funding gap of close to $1.4 billion. To close this gap, the Steering Committee will explore additional funding from a variety of external sources, including state and federal grant programs, private foundations, utility programs and energy performance contracts.

LESSONS LEARNED

- Monitoring and reporting on projects has become increasingly complex. To address this problem, a Web-based tracking system for city-funded building projects is currently being developed. Another Web-based system, developed and managed by the USGBC, allows users to view detailed progress on the certification of any given project and may also be utilized to track compliance with LEED provisions.
- It is important that the mayor's office take a proactive role in ensuring periodic training sessions for key people charged with LL86 implementation in affected agencies.
- Since some potential candidates to be LEED 2009 projects are not covered by LL86, several enhancements are currently under consideration, such as expanding the law to cover all occupancies.
- The current version of LL86 stipulates when improvements are required for boilers, lighting and HVAC systems based on the age or condition of the existing equipment. Some of these thresholds are set too high and allow potentially significant energy-saving opportunities to slip by without improvement.

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5 Note that this $900 million is intended to fund the audits and retrofits of existing municipal buildings rather than the relatively minor incremental cost of LL86, though the Long Term Plan does call for LL86 to be enhanced and expanded, which is currently under consideration by the Mayor's Office of Environmental Coordination, which administers LL86.

- Requirements and reference standards in the law, as well as alternative rating systems such as the NYC Green Schools rating system, need to be periodically reviewed to stay current with new technologies and updated reference standards.[6] To keep requirements and standards up to date and aligned with current best practices in the industry while still remaining cost effective, a standard three-year review of applicable reference standards is being considered. For example, linking energy cost reduction requirements to appropriate credit requirements in LEED 2009 is under consideration as a means to simplify administration while remaining more stringent than applicable building codes.

MONITORING AND EVALUATION

The Mayor's Office of Environmental Coordination continues to actively monitor and report on the laws' outcomes, field questions, present updates as required and periodically amend the regulations as necessary to keep up with current best practices.

An annual report summarizes all projects subject to LL86 provisions that completed construction in the prior calendar year.

RESULTS

According to the City of New York's Local Law 86 of 2005, Fiscal Year 2009 Annual Report:

- As the result of LL86, many city-funded projects will meet LEED green building standards and will exceed the minimum requirements of the New York State Energy Conservation Code. And, perhaps more importantly, these projects will continue to influence other public and private initiatives by providing built precedents that contribute to advancing green building in New York City.
- Although the preamble to the 2005 law estimated that an average of $1.2 billion worth of capital projects would be subject to LL86 each year for each of the first ten years after it took effect, the actual annual rate appears to be closer to $2 billion.
- LL86 is a cost-effective measure by which the city's capital program is contributing to the advancement of PlaNYC emission target reduction goals. The city estimates that the incremental investment in energy efficiency mandated by LL86 will contribute an additional 3,000 metric tons of GHG emissions reductions annually towards this goal for the estimated average $2 billion dollars of capital building construction currently covered by the law.
- Since most city-funded building projects must comply with LL86 for the foreseeable future, its provisions will continue to inform and support initiatives intended to lessen the increasing pressure on the city's energy and water infrastructure and to improve the overall health of its citizens in the years to come.

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6 All standards, codes and rating systems are updated to ensure the best use of technology. For instance, Energy Star has been recently updated to reflect market changes to ensure energy efficiency.

Example of Successful Implementation: New Mexico

HIGHLIGHTS

All government facilities from all levels of government in New Mexico have been ordered to set an example for the private sector and the general public by reducing GHG emissions, improving energy efficiency of public buildings, increasing usage of renewable energy sources, and more (State of New Mexico. 2010).

OVERVIEW

The Governor of New Mexico has issued several executive orders that direct state agencies to work toward greater adoption of energy efficiency and renewable energy, and the reduction of greenhouse gases. All of the executive orders supplement previous executive orders to strengthen their mandates. Three notable orders for public buildings that demonstrate leading by example are:

- Executive Order 2006-001 requires the pursuit of LEED Silver certification in new public buildings.
- Executive Order 2006-069 creates a state government implementation team tasked with ensuring that state agencies implement climate change actions plans.
- Executive Order 2007-053 sets a target of 20% reduction in energy usage (below 2005 levels) in state buildings for all executive branch state agency operations by 2015, as well as for New Mexico as a whole by 2020.

Executive Order 2006-001, the State of New Mexico Energy Efficient Green Building Standards for State Buildings, requires all executive branch state agencies, including the Higher Education Department, to adopt and meet the standards set by the United States Green Building Council's LEED rating system. More specifically:

- For buildings in excess of 15,000 square feet or using over 50 kW peak electrical demand, and for renovations involving the replacement of more than three major systems (e.g., HVAC, lighting), the building must achieve a minimum rating of LEED Silver (DSIRE 2010c).
- Projects between 5,000 and 15,000 square feet must achieve a minimum delivered energy performance standard of one half of the energy consumption for that building type as defined by the United States Department of Energy (DSIRE 2010c).

Executive Order 2006-069 establishes a Climate Change Action Implementation Team to ensure all state agencies are implementing the climate change actions in all of the Governor's previous Executive Orders and also providing periodic updates and reports to the Clean Energy Development Council[7] and the Governor. While the lead agency is the Department of Environment, each agency has a representative on the team who serves as the primary point of contact in their respective agency regarding the implementation of these orders.

Executive Order 2007-053 specifies a goal for all executive branch state agencies to achieve a 20% reduction below 2005 levels in energy usage in state building operations by 2015. The 20% energy use reduction is based on the average energy usage per square foot of building space (EO 2007-053). Compared to 2005 levels, it includes provisions such as:

- A 20% reduction in per capita energy use statewide by 2020, with an interim goal of 10% reduction by 2012;
- A 20% usage reduction by 2015 in state fleet and transportation-related activities based on the average transportation-related energy usage for work purposes per state employee;

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7 The Clean Energy Development Council (created by a separate Executive Order, number 2004-019) was established to oversee the climate change goals associated with all climate change Executive Orders issued by the Governor, including Leading By Example goals for buildings. The council is made up of Secretaries of the Energy, Minerals, and Natural Resources Department; the Environment Department; Economic Development Department; the Department of Transportation; the Department of Agriculture; and the General Services Department, as well as the State Engineer with staff support from the office of the Governor.

- The pursuit of aggressive use of renewable energy and renewable fuels as directed in previous Executive Orders for both the buildings and transportation sectors;
- Preference for public facilities to be located within close proximity of Rail Runner transit stations; and
- Establishment of a "Lead by Example Coordinator" to serve as the central point of contact for implementation of the order, who is authorized to monitor implementation progress for each agency.

KEY DATES

2006 – In January, the Governor of New Mexico issued Executive Order 2006-001; and in December of that year, the Governor issued Executive Order 2006-069.

2006-2007 – A How-To Guide to LEED Certification for New Mexico Buildings was developed from a Clean Energy Projects grant, funded through state appropriations.

2007 – The Governor of New Mexico issued Executive Order 2007-053.

2010 – Energy, Minerals and Natural Resources Department (EMNRD) conducts LEED toolkit training for state property management staff.

FUNDING SOURCE AND COSTS

The state General Services Department (GSD) examines the lifecycle cost of any new construction or renovation project. As a consequence, the ongoing energy efficiency and operational costs are important factors in making capital improvement funding decisions. Funding comes from direct appropriations from the state legislature, issuance of severance tax bonds and utilization of a capital building repair fund.

In 2007, $4 million was appropriated by the New Mexico legislature to the Public School Facilities Authority to increase energy efficiency in projects throughout New Mexico. By March 2010, an additional $3 million had been allocated to public schools to increase building energy efficiency by 50%. The High Performance (HiP) Schools Task Force continues to monitor projects to ensure the goals are pursued and the results are used to shape future school projects.

The Efficient Use of Energy Act[8] commits potentially more than $20 million per year in utility-provided energy efficiency incentives to the residential and commercial sectors in New Mexico.

As of March 2010 the state is utilizing $12 million from American Reinvestment and Recovery Act (ARRA) state energy program funding to make energy efficiency upgrades on state buildings.

LESSONS LEARNED

Tracking energy consumption was a key challenge, since:

- Data were not collected by some government agencies;
- Data were not centrally collected by one agency;
- Available data were not always accurate;
- There were thousands of accounts; and
- Agencies lacked an understanding of the value of the data.

To solve this problem, the state began using the EPA Portfolio Manager Tool,[9] which provided a method of compiling all of the information in one central location, resulting in an organized data monitoring scheme.

Additionally, by establishing a Climate Action Implementation Team (Executive Order 2006-069) and a Lead by Example Coordinator (Executive Order 2007-053), the governor provided a framework for oversight, implementation and coordination among agencies.

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8 According to the American Council for an Energy-Efficient Economy (ACEEE), the Efficient Use of Energy Act directs utilities to develop and implement cost-effective Demand Side Management (DSM) programs, establish cost recovery mechanisms for both electric and natural gas utilities, and direct the Public Service Commission to remove financial disincentives for utilities to reduce customer energy use through DSM programs – i.e., enact some type of decoupling (see Revenue Stability Mechanism).

9 Portfolio Manager is an interactive energy management tool that allows agencies to track and assess energy and water consumption across an entire portfolio of buildings in a secure online environment. Portfolio Manager helps building owners, managers or property investors identify under-performing buildings, verify efficiency improvements and receive EPA recognition for superior energy performance.

Currently, the slow economy has caused a reduction of capital projects. However, the state has been able to utilize American Reinvestment Recovery Act funding through the U.S. Department of Energy's State Energy Program to continue to support this program.

MONITORING AND EVALUATION

While all executive branch agencies are responsible for meeting the energy efficiency and green building design requirements of EO 2006-001, state facility projects must be formally approved by the State of New Mexico, upon project completion, as to their compliance with performance standards. The state agency-owner of a new state building or major renovation reports to the Government Services Division (GSD) on compliance with the LEED Silver and 50% energy reduction requirements, as applicable.

Additionally GSD, through the Building Services Division (BSD),[10] tracks all new construction and major renovations for compliance with EO 2006-001 for all executive branch agencies. The Energy, Minerals and Natural Resources Department (EMNRD) provides technical support to GSD in this effort.

Performance is measured by tracking the following measures:

- Percent annual reduction of greenhouse gas emissions for state-owned buildings served by the BSD relative to baseline;
- Percent of operating costs for Santa Fe state-owned buildings relative to the industry standard for that building type;
- Percent of major facility equipment replaced in Santa Fe buildings that reached its life expectancy; and
- Percent of electricity purchased by the Building Services Division from renewable energy sources.

State agencies in New Mexico are responsible for their own utilities bills. Energy managers within each agency report monthly energy usage to the General Services Department in an effort to benchmark building performance for both therms and costs from monthly natural gas bills; and kWh and costs from monthly electricity bills.

Financial staff from the General Services Department then enters the information into EPA's Portfolio Manager tool.

RESULTS

Despite a reduction in capital construction projects due to the economic downturn, the state's accomplishments include:

- One state government-owned building has been built since the issuance of EO 2006-001. This state laboratory building is scheduled for completion in early 2010 and is in the process of achieving LEED Silver certification.
- As of March 2010, the Public Schools Finance Authority has implemented energy savings measures in 12 new schools to meet the HiP Schools 50% energy use goal. The measures in these schools are in the process of completion and energy saving results will be available after construction (Aaboe 2010).

The cumulative effect is not only the resultant energy savings, but the shifting of the building industry toward a more energy-conscious and knowledgeable cadre of professionals.

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10 BSD manages utilities (electricity, natural gas, water, sewer, garbage collection)

RESOURCES

The text of LL86, Executive Order 97, the final Rules, the subsequent amendment and the NYC Green Schools Rating System and Guide: www.nyc.gov/oec

NYC Mayor's Office of Environmental Coordination: http://www.nyc.gov/html/oec/html/sustain/green_build.shtml

NYC Department of Design and Construction: http://www.nyc.gov/html/ddc/html/home/home.shtml

NYC Fiscal Year 2009 LL86 Annual Report: http://www.nyc.gov/html/oec/downloads/pdf/Green_Building/LL86For2010_1_2010RelWeb.pdf

NYC Energy Conservation Steering Committee, Long Term Plan: http://www.nyc.gov/html/om/pdf/2008/pr264-08_plan.pdf

NYC Greenhouse Gas Emissions Report, September 2009: http://www.nyc.gov/html/planyc2030/downloads/pdf/greenhousegas_2009.pdf

The Energy, Minerals and Natural Resources Department (EMNRD) website, http://www.emnrd.state.nm.us/ECMD/GovernmentLeadByExample/governmentleadbyexample.htm

NM Sustainable Building Tax Credit: http://www.emnrd.state.nm.us/ECMD/CleanEnergyTaxIncentives/sustainablebuildingtaxcredit.htm

EMNRD Government Lead By Example State Government web page. http://www.emnrd.state.nm.us/ecmd/GovernmentLeadByExample/State-Government.htm

A message for the Energy Conservation and Management Division Director:http://www.emnrd.state.nm.us/ECMD/Multimedia/documents/ECMD2008.pdf

5B GREEN POWER PURCHASING

Governments at all levels, businesses, schools, homeowners, non-profit organizations, and other entities unable to meet their renewable energy needs through on-site generation can still make a significant contribution to the advancement of renewable energy by choosing to purchase electricity generated from renewable energy sources, or "green power."

Many state and local governments in the United States, as well as the federal government, have committed to buying green power to account for a certain percentage of their electricity consumption (DSIRE 2009c). They are finding that green power purchasing is an effective part of a strategic energy management plan, one that considers options such as energy efficiency, load management, power purchases, on-site generation, and non-electric energy needs to achieve environmental, financial, and other goals (EPA 2004).

The United States Environmental Protection Agency (EPA) defines green power as electricity produced from renewable sources which produces no man-made greenhouse gas emissions, has a superior environmental profile compared to conventional power generation, and was built after January 1, 1997. Green power can be purchased through several sources.

- In deregulated electricity markets, customers can chose to purchase directly from a green power product supplier.
- In states that do not allow retail competition in the electricity markets, many utilities offer customers the opportunity to purchase green power through "green-pricing" programs.
- In areas where consumers cannot buy green power directly, renewable energy credits (RECs) are available in every state to allow consumers to support green power. RECs are tradable, non-tangible energy commodities that represent the environmental, social, and other positive attributes of power generated by renewable resources. They can be sold separately from the underlying commodity electricity.

By choosing to purchase green power, governments set a good example for their community and "lead by example" by reducing their greenhouse gas emissions and supporting the renewable energy industry. Because renewable resources are typically local, purchasing renewable energy can also stimulate the local economy: jobs are created to install and operate renewable generation facilities and the local tax base is increased,

which can provide income for farmers and rural communities (EPA 2004).

STEPS TO PURCHASING GREEN POWER

The government should determine its energy objectives in purchasing green power. This can be partially accomplished by convening decision makers to identify relevant interests and concerns associated with green power. Secondly, the government should take an inventory of its energy usage to determine where energy can be saved, how much green power to buy, and the environmental impacts of the government's energy use. Thirdly, the government should determine its most appropriate power option by becoming familiar with the electricity markets and available green power technologies in the area in order to determine whether to generate power on-site and/or purchase power or RECs from outside vendors (EPA 2004).

The EPA has identified a number of recommended approaches for state and local governments to strategize their green power purchasing commitments (EPA 2009b) (EPA 2004):

- **Aggregated purchasing**: combining the electricity needs of a number of agencies to negotiate lower prices, making purchases more affordable.
- **Green power product certification**: requiring certification for green power products as meeting customer protection and environmental standards as well as verifying that the green power product claims are valid and that the products have not been repackaged.
- **Fixed price, long-term contracts**: requesting long term contracts that can reduce the supplier's risk, which translates into reduced prices. However, a short-term contract can offer greater flexibility. The most appropriate contract length will depend, based on the particular situation and products available.
- **Offsetting the cost with savings from energy efficiency**: reducing the total amount of electricity purchased helps make green power more affordable. Some green power providers offer energy efficiency services, with the goal of "no net increase" in their customers' power bills.
- **Local preferences**: negotiating terms of purchases to reflect government or community specific preferences, such as a preference for green power generated locally.

RESOURCES

The Environmental Protection Agency's Comprehensive Guide to Purchasing Green Power. URL: http://www.epa.gov/grnpower/documents/purchasing_guide_for_web.pdf

The Database of State Incentives for Renewables and Efficiency's (DSIRE) database of state and municipal green power purchasing in the United States. URL: http://dsireusa.org/incentives/index.cfm?SearchType=Purchase&Back=regtab&&EE=0&RE=1

Example of Successful Implementation: Bellingham, Washington

HIGHLIGHTS

Located in northwest Washington State, Bellingham is a community of just over 76,000. As one of the most successful green power communities in the United States, Bellingham in 2007 and 2008 was chosen as the EPA's Green Power Partner of the Year, the most prestigious of the green power purchaser awards.

OVERVIEW

City of Bellingham (COB) - COB's municipal green power purchase program began in 2006 with passage of a city council resolution. In 2007, COB began a contract with its local utility provider, Puget Sound Energy (PSE), to purchase enough third-party certified renewable energy credits (RECs) to offset 100% of the electricity used for the city's municipal operations (24 million kWh). The City is contracted through 2011 with PSE and another REC provider to continue purchasing green power equal to 100% of COB's annual municipal electricity use.

Bellingham Community - As a community (city government, businesses, state agency offices, the local university, and residential customers), Bellingham

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purchases over 91 million kilowatt hours (kWh) of green power annually to cover 13.3% of its electricity demand.

Facets of the COB and the Community's green power purchase program are explained below:

- From September 2006 through Earth Day 2007, the COB partnered with PSE and a non-profit organization to kick-off the Bellingham Green Power Community Challenge. The challenge's goal was to increase green power purchasing among the city's citizens and businesses to meet at least 2% of the city-wide electric load.
- The Bellingham City Council passed a 2007 resolution committing to reducing GHG emissions from government operations by 64% below 2000 levels by 2012 and 70% by 2020. By purchasing RECs for 100% of the electricity used by city government, the COB achieves an approximate 60% overall reduction in GHG emissions for municipal operations.
- In May 2007, the City adopted a Greenhouse Gas Inventory and Climate Protection Action Plan based on a GHG emissions inventory conducted from August 2005 to August 2006. The inventory noted that government operations account for just over 2% of the community's total GHG emissions, with electricity use being the largest share (60%) of the city government's contributions.

FUNDING SOURCE AND COSTS

From a municipal perspective, green power purchase costs come from the same funds that pay for electricity generated from traditional sources. The COB's participation in PSE's green power program (by purchasing third-party certified RECs) adds an additional fee to COB's electricity bill. The Washington Utilities and Transportation Commission (WUTC) regulates the rates PSE charges its in-state customers; PSE must obtain WUTC approval for in-state customer rates and must offer the same rates to all qualifying customers. This is in contrast to private renewable energy generating companies or third-party brokers, who can sell RECs as a commodity directly to a consumer at a competitive, market-based price. The COB in 2009 opted to seek from the national retail REC market a better price for the purchase of some of its third party certified RECs, while still maintaining its valued relationship with PSE's green power program. Costs to COB for its 100% green power purchase (24 million kWh) averaged approximately $131,000 annually from 2007 to 2009. With new contracts through 2011, the City's cost for green power will be less than $55,000 annually (24 million kWh).

LESSONS LEARNED

Budget constraints in 2009, reflective of an economic downturn, forced the COB to examine continuation of its green power purchase program. For a portion of its annual REC purchase, COB opted to seek a better price in the national retail market. By purchasing the bulk of the City's RECs from the national retail market, while still ensuring third party certification and associated environmental benefits, COB was able to save money and maintain its commitment to 100% green power.

MONITORING AND EVALUATION

Bellingham utilizes ICLEI's Clean Air and Climate Protection software to monitor progress towards GHG reduction targets established within the City's Climate Action Plan. Through PSE's Utility Manager program, the City tracks progress towards resource conservation goals by monitoring energy and water consumption, as well as monitoring waste disposal and recycling from municipal facilities.

RESULTS

- Bellingham's efforts have earned the city national recognition as an EPA Green Power Community, 2007 EPA Partner of the Year, and a Green Power Leader. The Bellingham community is ranked second nationwide on the EPA's list of Green Power Communities, and the City of Bellingham is ranked 17th nationwide on the EPA's list of "Top 20 Local Governments."
- The goal of the Bellingham Green Power Community Challenge was to increase community green

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power purchasing to at least 2% of the city-wide electric load. Results have far exceeded projections. The green power annually purchased by city government, businesses, state agency offices, the local university, and residential customers, totals over 91 million kilowatt hours (kWh) and covers 13.3% of the community's electricity demand.

- The COB is in the process of performing a GHG emissions inventory to monitor and evaluate the success of the Climate Action Plan (CAP) Phase I and II measures. The GHG inventory will be used to develop annual CAP implementation measures to guide COB municipal operations towards achieving the GHG emissions reduction targets established for 2012.

RESOURCES

The City of Bellingham's environmental initiatives website. URL: http://www.cob.org/services/environment/green-resolutions.aspx

5C GREENING FLEETS

OVERVIEW

State, city, and other municipalities operate and maintain fleets of vehicles associated with their routine tasks and responsibilities in providing services to the citizens. As a collection of hundreds or thousands of vehicles, each fleet represents a substantial source of fuel consumption, costs, and exhaust emissions; each fleet also represents an opportunity to save fuel and money while reducing air pollution and simultaneously setting a good example for private fleets and citizens. While the term "greening fleets" refers to multiple aspects of improving the environmental impact of vehicle fleets, this report focuses on the energy-use aspect of greening fleets.

HOW IT IS FUNDED

Greening fleets is typically paid for using public dollars from a local governments' capital improvement budget. Federal and state agencies also offer financial and technical assistance in some areas.

KEY PROGRAM ELEMENTS

"Greening" a fleet involves devising and implementing strategies for reducing the total fleet fuel consumption and the release of harmful emissions from the use of the fleet vehicles. Strategies for greening a fleet include reducing the total miles traveled, improving overall fuel economy, and reducing the polluting emissions (primarily CO_2 emissions). Reducing vehicle miles traveled can be achieved through rendering some trips unnecessary (e.g., replacing face to face meetings with telephone and/or email communications, or co-locating workplaces and/or businesses to enable walking between buildings) and by carpooling or encouraging the use of alternate modes of transport such as public transportation or bicycles. Other strategies for greening fleets include better vehicle maintenance to improve fuel efficiency, and retiring inefficient vehicles and choosing fuel-efficient replacements. Alternative fuel vehicles may in principle reduce emissions per mile traveled, though careful accounting of energy sources is necessary.

In addition to energy savings and emissions reductions, financial savings and improved quality of life are two co-benefits of greening fleets. Cost savings arise from reduced fuel use, lowered vehicle and road maintenance costs, and potentially from the sale of carbon credits for CO_2 emission reductions. Quality of life improvements include improved air quality resulting from lowered emissions—both from the government fleet itself as well as from any private sector uptake of fleet greening practices—and time savings stemming from fewer trips and overall reductions in vehicle miles traveled.

Example of Successful Implementation: Denver, Colorado

HIGHLIGHTS

- Alternatively fueled or powered vehicles make up 43% of the city's entire fleet (City of Denver 2010).
- For more than a decade, the city of Denver, Colorado has prioritized efficiency in city fleets, made official by the Mayor's Executive Order in 1993.
- The Denver Public Works Fleet Maintenance Division has received multiple awards for their leadership in greening fleets.

OVERVIEW

Faced with rising fuel costs, increased air pollution and Federal mandates to clean the city's air, Denver enacted the "Green Fleets" executive order on Earth Day in 1993, which was later strengthened by Mayor John Hickenlooper's Executive Order in 2007 (ICLEI 2000). The latter Executive Order created the Greenprint Denver Office, set an action agenda for sustainability, and directed the city to procure and operate a fleet of vehicles that minimizes environmental impact, enhances domestic energy security, and maximizes fuel efficiency and diversification.

The Executive Order specifically calls for:

- Use of hybrid automobiles and B20 biodiesel fuel;
- Replacement of light-duty vehicles with hybrids, alternative fuel vehicles, or the most fuel-efficient and least-polluting vehicles available as older vehicles are phased out; and
- Reductions in petroleum use by the city's fleet through an increase in the fleet's average fuel economy; increased purchase of hybrid, alternative fuel, and fuel-efficient vehicles; and a decrease in vehicle miles traveled.

The Denver Public Works Fleet Maintenance Division ("Denver Fleet Maintenance") takes a leading role in the research, testing, procurement, and implementation of new green technologies for Denver.

The agency has been actively pursuing the use of alternative fuels such as biodiesel, E85, and propane.

- Biodiesel: Denver piloted the use of biodiesel in 2004 and now fuels its entire fleet of diesel-powered vehicles and equipment (approximately 800 units) with the alternative fuel. Biodiesel is made from natural renewable resources such as new and/or recycled vegetable oils and animal fats. Soybean oil is currently the leading source of virgin vegetable oil used for biodiesel feedstock in the United States. Denver regularly uses a B20 biodiesel blend, which is a mixture of 20% biodiesel and 80% regular petroleum diesel.
- E85: Used in Denver's light-duty "flex-fuel vehicles," E85 is a motor fuel blend of 85% ethanol and 15% gasoline. Denver installed an E85 dispenser in 2008 to further reduce its petroleum usage. Denver has 300 flex fuel vehicles in its fleet, which can use both regular gasoline and E85.
- Propane: Thirty propane-fueled vehicles are in use in Denver as of March 2010.

The benefits of using these alternative fuels are 1) reduced dependency on petroleum; 2) environmental benefits via use of a cleaner burning fuel; and 3) support of a domestically produced product.

The Denver Fleet Maintenance Division is also implementing a variety of strategies to increase the fleet's overall fuel economy and reduce harmful emissions.

- In addition to its fleet of 140 light-duty hybrid-electric vehicles, Denver is adding medium duty hybrids to its fleet with the purchase of hybrid-electric aerial bucket trucks.
- The city purchased a heavy duty hybrid-hydraulic trash truck in 2008 that achieves 25% better fuel economy than its non-hybrid counterparts. Four more hybrid trash trucks have been ordered.
- Denver has been applying for and implementing federal grants that fund the purchase of emissions control and idle reduction technologies. The tech-

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nologies are retrofitted onto existing diesel-engine vehicles and equipment and stay with the units for the rest of their useful lives. Technologies utilized to date include diesel oxidation catalysts, crank case ventilation systems, cab heaters, and hydraulic tank heaters. By the end of 2010, Denver will have retrofitted approximately 197, or 24%, of its diesel vehicles and equipment with emissions control technology.

- Denver is expanding its use of global positioning systems (GPS) to find routing efficiencies and safe fuel.
- The Fleet Maintenance department is making facility improvements, installing low-energy light bulbs, water-saving toilets, and more efficient fuel pump dispensers, and increasing the performance of its truck wash while using less water.

Other initiatives aimed at "greening Denver's fleet" include using low-volatile organic compound (VOC) paint, reducing hazardous waste production, mandating light-emitting diode (LED) lights on new equipment purchases to save energy, and providing ongoing analysis of utilization of the fleet to control the overall size of the fleet and set standards for any requirements to increase fleet size.

Additionally, Denver is one of the first cities in the U.S. to implement an Environmental Management System (EMS), which is a proactive management tool that helps the city incorporate environmental considerations into its day to day operations. The EMS was introduced in several departments in 2008 and, by 2011, most of Denver's city agencies will have an EMS in place. The EMS implemented in 2008 received ISO 14001 certification, confirming the city's commitment to outstanding environmental performance.[11]

In the process of certifying Denver's EMS (EMS) in 2008, all fleet employees were required to:

- Receive training so as to have a general awareness of the EMS and ISO 14001
- Use EMS documents applicable to their work duties
- Resolve EMS corrective actions assigned to them in a timely manner

ISO certification involves ongoing inspections, ensuring that agencies are utilizing environmental best practices.

KEY DATES

1993 - Denver's Green Fleet program is established. Mayor Wellington Webb's executive order calls for emissions reductions and consideration of alternative fuels. Denver converts some vehicles to propane.

2001 - The city and county of Denver begins purchasing Toyota Prius hybrids. Denver's fleet of 39 Priuses was believed to be the largest municipal hybrid fleet in the world at that time. Fleet Division begins purchasing "combo units"—snow plow trucks able to apply both solid and liquid deicers to control particulate matter.

2004 - The city and county of Denver pilots B20 biodiesel vehicle use.

2005 - Mayor John Hickenlooper launches the Greenprint Denver Office and sets an action agenda for sustainability calling for the use of hybrids and biodiesel. Denver secures one of the first Ford Escape hybrids. The Escape hybrid becomes the standard City utility vehicle.

2006 - Denver expands its use of biodiesel to all fueling locations and all diesel engine vehicles. Denver begins retrofitting diesel engine units with emissions-control technology.

2008 - The city begins dispensing E85 fuel. Denver adds a Peterbilt-Eaton HLA hybrid-hydraulic trash

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11 The International Organization for Standardization (ISO) is the world's largest develop and publisher of International Standards. ISO 14001 provides the requirements for an EMS. More at www.iso.org.

truck to its fleet and purchases a Toyota Camry hybrid. Fuel Conservation Committee established. Denver expands its use of LED emergency lights.

2009 - The city passes new anti-idling ordinance. Denver purchases a Ford Fusion hybrid and three hybrid electric bucket trucks.

FUNDING SOURCE AND COSTS

Denver Fleet Maintenance is a division of the city government, and funded as such. The agency chooses green fleet initiatives based on cost and ease of implementation and return on investment. For example, biodiesel was chosen as a focus since it can be used in any diesel-engine vehicle with no modifications to the vehicle required.

The additional expenses incurred as a result of the city's Executive Order include: 1) Slightly higher fuel costs; 2) The incremental cost difference between buying a hybrid vehicle and a standard vehicle of the same size and class; and 3) Any special training required to educate the staff. These costs are rolled into the city's annual budget, and the city feels that the benefits far outweigh the expenses. For example:

- In the case of biodiesel, the difference between standard fuel and biodiesel was approximately 5 cents more per gallon in 2009. The cost difference is budgeted annually.
- While the purchase price of a hybrid vehicle may initially be higher, the cost differential is offset by fuel savings, high resale values, and financially beneficial incentive programs such as the Colorado Alternative Fuel Vehicle Rebate. Plus, the city experiences cleaner air.

For some initiatives, particularly those that involve retrofitting units with emissions-control technology, Denver seeks out grant dollars, typically from the U.S. Environmental Protection Agency or the Department of Transportation. In 2010, Denver will receive approximately $550,000 in federal grant money to purchase and install retrofits and help offset the cost of utilizing biodiesel.

LESSONS LEARNED

There have been few challenges from a management perspective, but staff education and involvement is critical. New initiatives require implementation plans, proper training, and clear and open lines of communication so feedback can be gathered and program adjustments made, if necessary. This challenge is overcome by:

- Putting in place key staff who are committed to the cause and able to train, track and report on results; and
- Staff education and training. It is important to spend some time educating staff when new initiatives are implemented.

MONITORING AND EVALUATION

Denver's Executive Order 123 requires that a Green Fleet Committee be established and ensure that green fleet objectives are met. The committee maintains an approved list of hybrid, alternative fuel, and fuel-efficient vehicles for purchase and develops policies and procedures that implement the executive order. The committee generates an annual report detailing the current year fleet and a comparison to previous years. The report contains data on:

- Fuel efficiency of new vehicles purchased during the previous year.
- Total number of vehicles in the fleet.
- Total miles driven by all vehicles.
- Total gallons of gasoline (or equivalent alternative fuel) consumed, by fuel type.
- Any additional information required for the annual report.

Progress toward the following goals determines the success of the Green Fleet program:

- Increase the average fuel economy of the fleet.
- Increase the number of hybrid, alternative fuel, and fuel-efficient vehicles in the fleet.
- Minimize the total vehicle miles traveled by city employees using fleet vehicles.

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RESULTS

- Gallons of biodiesel used annually: 1,400,000.
- Percentage of fuel that is alternative: 49%.
- Percentage of fleet that is alternatively fueled: 46%.
- Percentage of flex-fuel vehicles in fleet: 11%.
- Percentage of hybrid vehicles in fleet: 5%.
- Percentage of diesel fleet retrofitted with fuel-saving/emissions control technology: 24% by end of 2010 (Kuhn 2010).

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RESOURCES

Greenprint Denver web site: www.greenprintdenver.org

Denver Fleet Maintenance web site: www.denvergov.org/fleet_maintenance_division

Information on biodiesel fuels: http://www.biodiesel.org/

The United States EPA Transportation and Air Quality website: http://www.epa.gov/otaq/

The United States EPA Green Vehicle Guide website: http://www.epa.gov/greenvehicles/Index.do;jsessionid=3ba9ff82a53d14c8c971b3d3b2b560effbd6a371ceb4eeeaa5618c40c79e7f7e

5D OPTIMIZING TRAFFIC SIGNALS

OVERVIEW

Traffic signals use energy 24 hours a day to orchestrate the safe and efficient flow of transportation. Traffic signals influence energy consumption through (1) the electrical energy consumed to power traffic lights, and (2) the energy efficiency associated with the idling and acceleration of motor vehicle engines.

Electrical power consumption: Conventional incandescent bulbs are being replaced by lamps deploying light-emitting diodes (LEDs) based on solid-state semiconductor technology. Throughout the United States, greater than 30% of traffic lights have been converted to LEDs (DOE 2010). LED traffic lights are brighter, consume just 10% the power of their predecessors and last much longer, reducing energy costs as well as equipment and labor costs associated with maintenance and/or replacement.

As of 2007, one estimate indicated that converting all traffic signals within the United States from conventional incandescent bulbs to LEDs would reduce power consumption by 340 MW (CEE 2007). Consider the following example:

> A typical 100-watt incandescent bulb uses about 2.4 kilowatt-hours per day. If electricity costs 14 cents per kilowatt-hour, the traffic light costs about 34 cents a day to operate, or about $118 per year. There are perhaps eight signals per intersection, which equates to about $941 per year in energy costs per intersection.
>
> Chicago, Illinois expects to save about $2.5 million annually in lower energy bills once all 2,800 intersections have been upgraded to LEDs (350 have been upgraded to LEDs already). The

associated CO_2 emissions are expected to decrease by 8,000 tons annually (City of Chicago 2010).

Traffic flow efficiency: Traffic signals affect the flow of motor vehicle traffic, thereby influencing the total time of a trip as well as the total time vehicles spend waiting to proceed through signaled intersections. Vehicles waiting at traffic signals require additional fuel consumption to supply their idling gasoline engines, and consume energy to accelerate following a stop light. Thus timing street lights to improve the flow of traffic saves both time and energy.

HOW IT IS FUNDED

Optimizing traffic signals is typically paid for using public dollars from a local governments' capital improvement budget. Federal and state agencies also offer financial and technical assistance in some areas.

Other sources of funding may include:

- Utility rebates to public sector customers, or in some cases utility loans to public sector customers which are repaid over time on their energy bill;
- Capital raised by state or locally-issued revenue or general-obligation bonds;
- Revolving loan funds for energy-saving projects, with initial capital coming from grants, bond issues, or other sources (such as environmental fines or legal settlements);
- Dedicating money from energy bill savings from previous energy efficiency improvements to be reinvested in new energy-saving programs or projects; or
- Revenues from a city-owned electric or gas utility.

KEY PROGRAM ELEMENTS

Some ways in which traffic signal timing is being optimized successfully in the United States include:

1. **Coordinating signals:** A system wherein traffic lights switch to green in sequence such that platoons of vehicles encounter and proceed through a continuous series of lights. Commonly referred to as a "green band," this system can also be used to influence driving speeds. For example, timing a series of lights so that vehicles traveling slightly below the speed limit will encounter green lights along the way discourages speeding in urban areas.
2. **Modified timing parameters:** As traffic patterns change throughout the day and week, traffic signal timing can be aligned to correspond with traffic patterns. Each set of traffic lights operates with its own unique signal controller located in a field cabinet at the intersection, which can be used to adjust the traffic light settings. In some areas where traffic is very light at night, traffic lights can be turned off to minimize interruptions to traffic flow. That is, the primary street light becomes a flashing amber light to warn of an intersection, while a flashing red light is provided at the secondary street.

In regards to LED signals, it is important for local governments to take into consideration two barriers or challenges:

- LEDs have a high upfront cost.
- Since LEDs do not heat up, they do not melt snow, which can be a problem in cold climates during inclement weather.

The scope of the LED retrofits can vary from single lights being upgraded one at a time to a large coordinated project of multiple lighting retrofits. According to the Center for a New American Dream and the Responsible Purchasing Network,[12] it is important to assemble a lighting working group comprised of staff from departments affected by lighting, such as: environment, purchasing and facilities, energy, public safety, parks and recreation, ports and airports, and other interested stakeholders. The group should:

- Review existing policies such as those that address energy efficiency, waste prevention, and safety, and add language pertaining to lighting, or adopt a new lighting policy;

12 The Responsible Purchasing Guide can be accessed at http://www.seattle.gov/purchasing/pdf/RPNLEDguide.pdf

- Establish a baseline of expenses and equipment, then determine costs associated with energy-efficient retrofits;
- Establish goals for the project and implement the lighting retrofit plan;
- Inform and train stakeholders on the new technology, improve practices, report progress, and reward successes (Responsible Purchasing Network 2009).

It is important to work with reliable product suppliers who can provide quality LED products that have been tested and are known to work as marketed. LED product suppliers should be able to provide buyers with information about the delivered lumens; the operating temperature range specifications; the expected lifetime (and how it was calculated); test reports from an independent third party laboratory; the color of the light output; how much power it consumes in the "off' state; whether it is ENERGY STAR rated; whether it is lead-free and mercury-free and RoHS compliant; and whether the warranty covers a reasonable length of time (about one third to one half of the expected lifetime) (McClear 2009).

Example of Successful Implementation: Portland, Oregon

HIGHLIGHTS

The city of Portland, Oregon is a leader in efficient transportation—it leads the nation in the number of hybrid vehicle purchases per household; has a successful and growing light-rail system; and has a higher percentage of bicycle commuters than any other major city in the United States (U.S. Census Bureau 2008).

OVERVIEW

In 2009, Portland developed a Climate Action Plan to reduce local carbon emissions 80% below 1990 levels by 2050 (City of Portland 2009a). But its commitment to environmental stewardship is not new.

In 2001, Portland began upgrading traffic signals to LEDs and in 2004 began optimizing signal timing in order to reduce city energy bills and reduce traffic congestion for its 540,000 residents.

In under a year, the city of Portland upgraded nearly all its 13,000 red and green incandescent traffic signals, 140 flashing amber beacon lights and several light rail transit signals to LED lighting. Since the completion of the project, Portland has been saving $400,000 annually in energy and maintenance costs, and the project had a net payback of three years (City of Portland 2009b).

To optimize traffic flows around Portland, engineers gathered data on existing traffic volumes. These data were entered into a computer software program that modeled the existing traffic signal patterns and recommended improved timing.[13] The software takes into account the peak traffic periods throughout the day, and the off-peak periods (typically midday, nights and weekends). It also computes the resulting fuel and CO_2 savings.

City of Portland staff then used the recommendations from the software program to reprogram each traffic signal at the signal controller.

KEY DATES

2001 – The city completed LED traffic signal upgrades within the year.

2004 – The city began optimizing traffic signal timing.

2009 – Additional LED signal replacement began. Traffic signal optimization program was completed.

FUNDING SOURCE AND COSTS

LED Traffic Signals

- Portland did not have a capital budget for LEDs; they were able to secure funding from two local electric utilities, PGE and Pacific Power, who of-

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13 Several optimization software programs are available, but the city chose Trafficware Synchro Studio program. More information on this software program can be found at www.trafficware.com/products.html.

fered incentives for projects completed before the end of 2002 totaling $715,000.

- Total project cost: $2.3 million.
- To pay for the remaining costs, a lease was set up to spread out the capital costs, which allowed the city to pay for the project over time.
- The leasing company was able to take advantage of the Oregon Business Energy Tax Credit (BETC) for its project, receiving a tax credit of 35% of the project's total cost. In turn, it reduced the cost to Portland by about 22%, saving the city nearly $500,000.[14]
- The total cost to the city was $900,000.

Optimizing Traffic Timing

- Total program cost: $2.2 million
- The cost per intersection was $1,000–$3,000, and the cost to develop the traffic flow optimization was $533,000.

The Climate Trust of Oregon provided funding for the traffic flow optimization portion of the project.[15]

The costs were paid through a pay-for-performance contract with The Climate Trust. After the signal timing was completed, The Climate Trust paid the city based upon the amount of carbon dioxide emissions that were avoided at a rate of $2.54 per metric ton of carbon offsets (Rotich 2010).

The city of Portland paid any additional expenses if total expenses exceeded funding provided by The Climate Trust.

LESSONS LEARNED

Monitoring and verification was a major challenge when the project was initiated. A methodology was developed for determining carbon offsets and standard reporting procedures to prepare Monitoring and Verification Reports for each project milestone (Rotich 2009).

MONITORING AND EVALUATION

The Climate Trust contracted an engineering consulting firm to independently review timing analyses, carbon offset calculations and the Monitoring and Verification Reports.

RESULTS

LED Traffic Signals

- Annual fiscal savings: $335,000.
- Annual energy savings: 4.9 million kWh per year.
- Annual maintenance savings: $45,000 (City of Portland 2009b).

Optimizing Traffic Timing

- So far, Portland has optimized 135 intersections on 16 streets, saving motorists more than 1.7 million gallons of gas per year.
- Annual CO_2 reductions: 15,460 tons.
- Annual fiscal savings: $4.13 million (CCI 2009).

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RESOURCES

12 Questions Your LED Luminaire Supplier Must Answer: http://www.architecturalssl.com/content.php?section=magazine/archive&id=02_09_story3

Responsible Purchasing Guide: LED Exit Signs, Street Lights, and Traffic Signals: http://www.seattle.gov/purchasing/pdf/RPNLEDguide.pdf

City of Portland and Multnomah County Climate Action Plan: http://www.portlandonline.com/bps/index.cfm?c=49989&a=268612

Climate Trust of Oregon: www.climatetrust.org

Portland Bureau of Planning and Sustainability: www.portlandonline.com/bps/index.cfm?

A case study of LED replacements in California: http://www.aceee.org/utility/14bledtrafficca.pdf

14 After the completion of this project, the BETC tax credit structure was revised to allow for a "pass-through" tax credit. See Chapter four "Tax Incentives" for more information.

15 The Climate Trust is a non-profit organization founded to manage funds derived from the Oregon CO_2 Standard.

5E WASTEWATER TREATMENT PLANTS

OVERVIEW

Wastewater treatment is an essential public service that provides clean water for fishing, swimming and drinking water. In the United States, the lack of wastewater treatment during the first half of the 20th century resulted in polluted waterways and lakes that led to occurrences of low-dissolved oxygen, fish kills, algal blooms and bacterial contamination. In 1972, Amendments to the Federal Water Pollution Control Act—the Clean Water Act (CWA)—established the current minimum standards that govern the release of treated water into U.S.'s waterways from the country's approximately 16,000 wastewater treatment plants.

Because of the stringency of the CWA regulations, wastewater plants have high energy requirements. Overall, wastewater treatment consumes approximately 1.5% of all electricity in the United States; energy use represents between 25% and 40% of total operating costs in wastewater treatment plants(PG&E 2003). There is enormous variability from plant to plant in wastewater flow rates, concentration of contaminants, type of process used, discharge regulations the effluent must meet, disinfection method used, and wet-weather flows the plants must treat.

There are many methods and processes to treat wastewater. The most common approach in the United States uses three main processes: 1) Primary treatment; 2) aerobic, suspended growth, activated sludge secondary treatment; and 3) disinfection. Of these processes, secondary treatment uses the greatest amount of energy, followed by pumping and sludge processing. A tertiary treatment process that occurs before disinfection is becoming more common, as discharge permits increasingly call for the removal of specific contaminants not normally removed during conventional secondary treatment.

Primary treatment involves screening, grinding and sedimentation/clarification to remove the floating solids found in raw wastewater. When raw wastewater enters the treatment plant it is typically coarse-screened to remove large objects and ground to reduce the size of the remaining solids; then it flows to primary sedimentation tanks. As this process is not very energy intensive, it does not offer many opportunities for energy efficiency.

Secondary treatment uses a biological process—aerobic, suspended-growth, activated-sludge treatment—in which the aerobic bacterial culture (the activated sludge) is maintained, suspended in the liquid contents using a combination of pumps, motors (mechanical agitation) and large blowers (fans) in large reactors or basins. Activated sludge secondary treatment typically accounts for between 30% and 60% of total plant energy consumption.

Tertiary treatment (also known as "advanced wastewater treatment") involves removal of nutrients (particularly nitrogen) that enable algal growth in the receiving waters (which reduce dissolved oxygen and cause fish kills and odor). This stage of treatment requires significantly more energy to further oxygenate the effluent, and it increases total plant energy consumption by 40–50% (PG&E 2003).

Disinfection of effluent is performed using chlorine or ultraviolet (UV) irradiation. Chlorine gas is fed into the water to kill pathogenic bacteria and to reduce odor. If done properly, chlorination will kill more than 99% of the harmful bacteria in the effluent (PG&E 2003). UV disinfection transfers electromagnetic energy from a mercury arc lamp to an organism's genetic material, destroying the cells' ability to reproduce. The source of UV radiation is either low-pressure or medium-pressure mercury arc lamps with low or high intensities. While medium-pressure systems disinfect faster, they are more energy-intensive due to the higher operating temperatures. While low-pressure UV systems take longer, they are generally 40 to 50% more energy efficient than medium-pressure systems (PG&E 2003). One advantage of UV irradiation is that it provides a high degree of disinfection without adding any chemical residues to the water.

In addition, sludge processing operations contribute significantly to wastewater plant energy use. The main sludge processing operations—thickening, stabilization and dewatering—require pumping, motor and fan systems.

Energy efficiency in wastewater treatment plants can be achieved through management/engineering methods as well as by properly implementing technologies that can reduce energy use. Generally, management/engineering methods have rapid paybacks (less than 2 years) and do not require large capital expenditures (Lung 2003). Energy savings can vary significantly depending on the type of method that is implemented, size of the plant, climate/season and energy costs.

HOW IT IS FUNDED

Local governments typically pay for capital improvements to their own wastewater treatment facilities. Federal and regional agencies also offer financial and technical assistance.[16]

KEY PROGRAM ELEMENTS

Common examples of management/engineering methods for reducing energy use in wastewater treatment plants include establishing benchmarks of energy use, assessing actual versus perceived energy needs, sequencing of treatment capacity and basin use depending on seasonal demand, recovering excess heat from wastewater, covering basins for heat retention and reducing the amount of head against which pumps and blowers operate.[17]

Technology-based energy efficiency opportunities in wastewater treatment usually involve capital equipment purchases and often involve plant down time. Energy savings can range from 10%–50% of energy used by the specific processes being optimized, and paybacks can range from less than 2 years to 12 or more years (EPA 2004b).

Some common energy efficient technologies include:

Fine-Bubble Diffusion – Fine-bubble technologies are installed in aeration tanks during activated secondary treatment. They usually improve operations and increase the organic treatment capability of a wastewater treatment facility. For optimum performance, this should be combined with dissolved oxygen monitoring and control and a variable capacity blower. Energy savings range from 20%–75% of the aeration or aerobic digestion unit's energy consumption (Focus on Energy 2006).

Dissolved Oxygen (DO) Control – Continuous DO control technology is used to vary the air flow rate in an aeration basin to maintain a stable DO level. Generally, energy savings for the aeration system are in the 20–50% range (PG&E 2003).

Variable Speed/Variable Frequency Drives (VSDs/VFDs) – VSDs/VFDs provide continuous control, allowing motor speed to be matched to the specific demands of the work being performed and can be applied to most processes in a wastewater treatment plant. Replacing a throttling valve on a pump with a VSD/VFD can save 10%–40% (EPA 2004b). Applied to a secondary treatment process, a VSD/VFD can save more than 50% of that process's energy use (PG&E 2003).

Premium-Efficiency Motors – Premium-efficiency motors can be used in all electric motors but replacements are particularly important for motors with high annual operating hours and those that operate during peak demand, e.g., aeration blowers, disinfection systems (seasonal), pumps and clarifiers. Savings can vary, but usually are 5%–10% of the energy used by the lower-efficiency motor that gets replaced (EPA 2004b).

Efficient Aeration Blowers – Single-stage blowers with variable inlet vanes and variable discharge diffusers on aeration systems and activated sludge systems can allow for flow adjustments while maintaining constant impeller speed. Energy savings depend on site conditions, usually

16 For more information, see EPA's Federal Funding Sources for Small Community Wastewater Systems website: http://www.epa.gov/owm/mab/smcomm/grants.htm

17 The term "head" refers to the resistance that a pumping system faces. The greater the head, the harder the pump has to work, causing it to use more energy.

ranging from 15% to 50% of the energy consumed by these processes (EPA 2004b).

Final-Effluent Recycling – This technology reuses final effluent to replace potable water use for wash-down of tanks and process-related applications such as gravity belt thickeners, belt-press washing and compressor-cooling water. The installation should include a pressure tank so the recycle pump will not operate continuously. Energy savings may reach 50% of total system energy use (EPA 2004b).

UV Disinfection – Low-pressure UV disinfection systems are generally 40%–50% more efficient than medium-pressure systems (PG&E 2003). UV disinfection system design should include flexibility to allow a reduction in the number of lamps used during off-peak demand (when flow is reduced). Reducing UV lamp usage when not needed saves energy. Energy is saved when the total UV output meets but does not exceed the treatment required based on water flow and transmissivity (the amount of UV light needed to treat the water). Including an automatic wiping system which ensures that the quartz sleeves stay clean and that the maximum amount of UV can be transmitted into the water can result in an additional 10% savings of energy costs (Focus on Energy 2006).

Screw Press – Sludge dewatering can be accomplished more efficiently by using a screw press instead of a conventional belt press or centrifuge products.

Another and more efficient alternative to the activated sludge process is the use of aerated lagoons, trickling filters and rotating biological contactors. This approach is not widely used, because aerated lagoons require a large land area, and trickling filters and rotating biological contactors are better suited for smaller-capacity applications.

In the United States there are numerous examples of successful energy efficiency projects in the wastewater treatment sector, including programs created in several municipalities, states and utilities that encourage greater energy efficiency in wastewater treatment plants within their jurisdictions and service territories.

Example of Successful Implementation: Santa Rosa, California

HIGHLIGHTS

- Aeration fans in wastewater treatment plants can often account for a significant amount of the energy used in the treatment process.
- Proper optimization and sizing of a fan system can improve performance and save energy.

OVERVIEW

In 2000, the city of Santa Rosa, California, decided to take steps to increase the energy efficiency at its municipal wastewater treatment plant in Laguna, California.

With an average flow of 17.5 million gallons per day, the Laguna facility uses an activated sludge process for secondary treatment to treat sewage. The plant is equipped with six multistage, 900-hp centrifugal fans (blowers) that serve the aeration system of the secondary treatment phase. A review of the plant's aeration system found that two of the blowers were oversized and operated inefficiently, and that the aeration control system could be improved.

The facility implemented a project that replaced two existing blowers with two smaller, more efficient units that were fitted with variable diffusers and inlet guide vanes. This retrofit project made the aeration blower system more efficient.

KEY DATES

The blower replacement project was performed in 2002 and completed by early 2003. Automatic monitoring and air flow control upgrades were completed in late 2003.

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FUNDING SOURCE AND COSTS

The project cost for blower replacement was $1.5 million and was paid for by a loan from the California Energy Commission.[18] Aeration flow control valves and metering were installed as part of another aeration basin upgrade project.

LESSONS LEARNED

The aeration system was not efficient for three reasons. The aeration blowers' output was set manually to maintain dissolved oxygen levels manually measured at four-hour intervals. While operating the blowers in this manner ensured that the treatment process was reliable—because it prevented the dissolved oxygen level from falling below the set points—it caused the blowers to consume greater quantities of energy than necessary.

Also, the inlet airflow on the existing fans was controlled by butterfly valves that throttled the inlet air. The use of butterfly valves to control inlet airflow decreased blower efficiency. In addition, the blowers were needed to overcome high system backpressure. The combination of inlet airflow throttling and high backpressure caused the blowers to work harder to generate the required volume of air.

Additionally, the infrequent dissolved oxygen measurements and lack of flexibility in delivering air just where needed within the aeration system resulted in slow responses to changes in air demand, as well as in over-aeration in parts of the tank in order to provide adequate air in other parts.

The plant examined four main improvement strategies:

1. Rebuild the existing blowers with differently curved impellers;
2. Install smaller, but similarly designed, blowers;
3. Install new centrifugal blowers controlled by variable frequency drives (VFDs); and
4. Install new centrifugal blowers controlled with variable diffusers and inlet guide vanes.

After calculating the energy costs associated with each proposed system, the most cost-effective and energy efficient approach was found to be the installation of new, 600-hp blowers controlled by variable diffusers and inlet guide vanes. The new blowers included sophisticated controls that could greatly minimize the inefficiency associated with the operator-selected set points. While rebuilding the existing blowers would have been less costly and would have saved 75% as much energy as the smaller, high-efficiency fans did, a financial analysis showed that the high-efficiency blowers will save the city of Santa Rosa more money and energy over their estimated 20-year lifespans.

On-line dissolved oxygen monitoring with multiple analyzers per tank, air flow meters and automatic flow control valves at each drop leg, and a most open valve control strategy were employed to control dissolved oxygen in the system to close tolerances and operate the blowers efficiently.

MONITORING AND EVALUATION

The city provided its annual energy consumption status and performance updates to the CEC (Schwall 2010). See the aeration electrical load results in the table below.

RESULTS

- Annual estimated energy savings: 2.1 million kWh.
- Annual estimated fiscal savings: $200,000.
- These savings represent a 32% decrease in the energy used by the secondary process. About 15% of

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ENERGY USE BASE YEAR (2000)	ENERGY USE REPORTING YEAR 1 (6/03–5/04)	ENERGY USE REPORTING YEAR 2 (6/04–5/05)	ENERGY USE REPORTING YEAR 3 (6/05–5/06)	ENERGY USE REPORTING YEAR 4 (6/06–5/07)	ENERGY USE REPORTING YEAR 5 (6/07–5/08)
7,603,680 kWh	6,398,844 kWh	5,356,693 kWh	5,265,964 kWh	5,356,860 kWh	4,997,697 kWh

18 The California Energy Commission is the state's primary energy policy and planning agency, created by the legislature in 1974.

the cost savings is attributable to blower replacement and 15% to new aeration controls.

- The simple payback was just under 4 years (Schwall 2010).

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Example of Successful Implementation: Onondaga County, New York

HIGHLIGHTS

- Metropolitan Syracuse Wastewater Treatment Plant (Metro WWTP) provides wastewater treatment for 270,000 people, as well as many industrial and commercial customers in the city of Syracuse, New York, and other areas in Onondaga County.
- Wastewater treatment process systems can consume a significant amount of the energy used by wastewater plants. Optimizing these systems can save energy and improve system efficiency.
- The plant treats an average of 84 million gallons of wastewater daily.

OVERVIEW

In 2004, the Metro WWTP in Onondaga County, New York, upgraded several processes to improve the efficiency of the plant's wastewater treatment process.

The wastewater treatment process includes a waste-activated sludge process served by six 25-horsepower (hp) pumps, eight aeration tanks served by 32 100-hp blowers and a low-lift pumping station that includes five 600-hp pumps.

An independent assessment led to a system-level project to improve the plant's energy efficiency. The project involved removing the throttling valves and replacing motors on the waste-activated sludge pumps with premium-efficiency motors fitted with VFDs.

Next, the operating strategy of the activated sludge process was changed to stop wastewater nitrification in the aeration tanks, eliminating the need to operate the blowers. Then, the impellers on some of the low-lift pumps were repaired and others were replaced. Finally, plant engineers recalibrated the waste gas burner controls to increase the amount of methane they could reuse.

KEY DATES

This assessment was commissioned in 2004 and the project was completed by 2005.

FUNDING SOURCE AND COSTS

The entire motor evaluation study and 7.7% of the project implementation was paid for via a subsidy from New York State Energy Research and Development Authority (NYSERDA).[19] The remaining costs were paid for out of the wastewater treatment department's annual operating budget.

LESSONS LEARNED

New, stricter requirements for ammonia and phosphorous levels from the state of New York and the flaring of waste gas led the plant's management to commission an outside evaluation all of the plant's operations. The most significant energy savings opportunity found was to modify the process control of the secondary treatment activated sludge process

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19 New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created in 1975. NYSERDA helps New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources and protecting the environment. Currently, NYSERDA is primarily funded by state ratepayers through the System Benefits Charge (SBC).

to prevent nitrification from occurring in the existing aeration tanks. The plant's assessment showed that 16 of the 32 100hp motors serving the aeration tanks could be deactivated for six months out of the year. This was possible because a biological aeration filtration system, which provides wastewater nitrification year-round, had recently been installed.

The low-lift pumps serving the plant were more than 40 years old. Complete replacement of the pumps, as well as replacing the impellers on several of them, was evaluated. The study determined that the low-lift pumps could operate most efficiently with new replacement impellers, as opposed to restoring existing impellers or purchasing all new pumps.

The existing 25-hp waste-activated sludge pumps were also evaluated. These pumps were sized the way they were because they had to be powerful enough to overcome throttled discharge valves at the outlet of the tanks. The assessment showed that if the throttling valves were taken out, these 25-hp pumps could be replaced with smaller (3-hp) pumps fitted with variable frequency drives.

Metro WWTP engineers began implementing the recommendations that came out of the analysis by removing the throttling valves and replacing motors on the waste-activated sludge pumps with premium-efficiency motors fitted with VFDs. Next, the operating strategy of the activated sludge process was changed to stop wastewater nitrification in the aeration tanks, eliminating the need to operate the blowers. Then, the impellers on some of the low-lift pumps were repaired and others were replaced.

MONITORING AND EVALUATION

Plant processes are continually monitored by plant operations staff to ensure the plant meets permit limits. In the case of the low lift pumps and waste activated sludge pumps, the pump efficiencies were measured before and after the modifications were made. The results were a lower cost per million gallons pumped after the modifications were completed (Gunnip 2010).

RESULTS

- These measures significantly improved process efficiency and yielded annual electricity savings of approximately 2.8 million kWh, and a natural gas savings of 270 MMBtu (DOE 2005).
- Resulting annual cost savings are $207,500.
- At a total cost of $233,000, this project achieved a 13-month simple payback.

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Other Examples

STATE ASSISTANCE PROGRAM: FOCUS ON ENERGY; WISCONSIN

In the state of Wisconsin, a public-private partnership entitled Focus on Energy offers energy information and services to utility customers throughout the state. One of the areas Focus on Energy targets as part of its energy efficiency program is wastewater treatment plants. Focus on Energy's wastewater treatment program provides resources to wastewater facilities that enable them to reduce energy use and operating costs.

Focus on Energy helps these plants identify energy-saving opportunities—from installing energy-efficient pumps, motors and variable-speed drives to adopting energy-saving best practices, modifying process operations and utilizing renewable energy. Focus on

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Energy also educates staff on energy management practices and provides cash incentives to help cover the costs of energy-efficient modifications. Focus on Energy offers financial incentives of up to 30% for the purchase and installation of energy-efficient technologies, as well as for biogas anaerobic digesters and solar, wind and biomass combustion energy systems.

Many wastewater treatment facilities have worked with Focus on Energy since this sector was targeted in 2004. Some have achieved energy savings of nearly 75% (Focus on Energy 2006), while improving the quality of their treated water.

UTILITY ASSISTANCE PROGRAM: PACIFIC GAS AND ELECTRIC; CALIFORNIA

In California, the state's largest utility, Pacific Gas and Electric (PG&E), has long offered a wide range of services to help conserve energy at wastewater treatment plants. Services include energy analyses of existing facilities, design assistance for planned projects, equipment rebates, project incentives, education and training.

In 2003, PG&E implemented an incentive program for new wastewater treatment facilities under the statewide Savings By Design program. As part of this utility-funded project, the program provides design assistance and financial incentives for new construction, expansion or total renovation projects (where there is an increase in load) to improve energy efficiency. Participating customers are eligible to receive free design assistance and a one-time financial incentive, based on the energy saved in one year when compared to what would have been installed in a typical or "baseline" design.

To facilitate the analysis of energy-efficient design, standard energy consumption and opportunities for energy savings in wastewater treatment plants, PG&E commissioned a baseline study of energy use by wastewater treatment facilities. This study serves as the reference of standard versus premium efficiency for all wastewater treatment plants in PG&E's service territory. Additionally, cash incentives are available for low-pressure ultraviolet disinfection systems and fine bubble aeration. Water treatment facilities can also receive incentives for generating their own power in parallel with the electric system grid.

RESOURCES

Case study for Onondaga county: http://www1.eere.energy.gov/industry/bestpractices/pdfs/onondaga_county.pdf

Case study – Sanra Rosa Utilities: www.ccwi.org/issues/Fuller-EnergyEff.pdf

A Primer for Municipal Wastewater Treatment Systems from the U.S. Environmental Protection Agency: http://www.epa.gov/owm/primer.pdf

Municipal Wastewater Treatment Plant Energy Baseline Study from PG&E, San Francisco CA: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/bls_energybaselinestudymunciplewastewatertreatment.pdf

Water and Wastewater Industry Energy Best Practice Guidebook from Focus on Energy, Madison WI: http://www.focusonenergy.com/business/industrial-business/guidebooks/default.aspx

CHAPTER VI.
HIGH PERFORMING CITIES

High performing cities take a whole-system approach to energy efficiency and renewable energy by adopting policies and initiatives that complement each other to produce exponentially better results. Coordinated packages of energy practices, such as those outlined in this report, are often adopted as part of strategic climate and energy plans to help cities achieve specific greenhouse gas reduction (GHG) and other goals.

Complementary policies and programs work together to maximize impact and attain a multitude of benefits. Cities can implement climate and energy plans to achieve: load growth management; energy supply diversity and security; decreased, stable energy prices; reduced air pollutant and GHG emissions; and new sources of revenue from modern, clean energy technologies. Ultimately, these benefits equate to improved public health and quality of life for local residents. Other factors driving cities to adopt and implement climate and energy plans can include:

- Strong leadership from the highest levels of the city government to champion the plan and guide it to completion.
- Historical precedence for environmental awareness and support from the community.
- The existence of a favorable policy environment from higher levels of government. This can include state support, such as renewable portfolio standards and interconnection standards, as well as federal support.
- Economic stimulation, using energy efficiency and renewable energy as drivers to create jobs and support the local economy.
- The desire for domestic and international leadership—for the city to be looked to as an example by other cities in their region and from around the world.

The cities profiled in this chapter have taken their energy actions a step further by developing their own "climate protection plans." There are generally five steps to developing a strategy for comprehensive climate protection plans (ICLEI 2006): [1]

1. Conduct an inventory of greenhouse gas emissions produced by the city within a particular year. The inventory provides a benchmark against which the city can measure its progress in reducing greenhouse gas emissions. The inventory should collect data about energy management, recycling and waste reduction, transportation, and land use.
2. Set an achievable target to lower greenhouse gas emissions by a specific year.
3. Develop a climate action plan. This involves planning a suite of programs and actions that will reduce greenhouse gas emissions by the identified target amount. The plan may include measures for energy efficiency, renewable energy, green building, transportation, waste reduction, land use, and other goals.

1 These five steps are adapted from ICLEI's Climate Action Handbook. ICLEI is an international association of local governments as well as national and regional local government organizations that have made a commitment to sustainable development.

4. Implement the climate action plan. Successful implementation is highly dependent on a realistic timeline, management and staff, financing mechanisms, community support, and other variables.
5. Monitor and evaluate performance and report results. It is important to track and evaluate the plan's progress to make sure it is achieving its goals. Reporting the plan's results builds political and community support, maximizing its effectiveness.

By committing to energy efficiency and renewable energy, high performing cities are playing a key role in solving the climate crisis by becoming less resource-intensive and more self-reliant. The remainder of this section highlights examples of localities that are combating climate change at the local level through whole-systems approaches.

Example Climate Protection Plan: Austin, Texas

Austin, Texas is a city of 757,700 residents located in central Texas on the eastern edge of the American Southwest. The Austin City Council passed a Climate Protection Plan in February 2007, which calls for the city "to develop and promote innovative programs and bold initiatives to reduce greenhouse gases and improve air quality in our community, thereby establishing Austin as a national leader in climate protection" (City of Austin 2009). The five main components of the plan focus on reducing carbon emissions in city buildings, city operations, city vehicle fleets, and the community.

The Municipal Plan: The Austin City Government is committed to making its facilities, vehicles and operations carbon neutral by 2020. To date, all general fund departments, which represent 75% of city buildings, have been put on the utility's renewable power program, GreenChoice® (City of Austin 2009). A Climate Action Team of City Department representatives was formed in January 2008 to identify actions that the city could take internally to reduce carbon emissions. As a result of this team's actions, Austin developed the City Cycle program, in which bicycles are provided for city employees to use for travel between city offices; an all-in-one recycling program for city offices; and a program to put office computers in hibernation during the nighttime and week-end hours. The Climate Action Team was then expanded in 2009 to include all city departments for the purpose of developing department specific climate action plans. These plans, which include the departments' goals for reducing carbon emission and ground level ozone, are signed by Department Directors and the appropriate Assistant City Manager. The plans will be included in the departments' 2011 performance measures as part of the city's budget process.

Austin Climate Protection Program staff also completed yearly greenhouse gas inventories for all city departments as a baseline to measure its carbon footprint and to allow assessment of the relative impact of various reduction measures. City goals emerging from this process include:

- Power all city facilities with renewable energy by 2012.
- Convert the city vehicle fleet to electricity and non-petroleum fuels to negate any remaining vehicle emissions. 55% of the city's fleet is now alternative fuel capable, using biofuels and electric drive hybrids.
- Develop an employee climate protection education program, including training and incentives. To date, staff has trained 2,100 employees in climate protection strategies. Additionally, a "Train the Trainer" program has been implemented to improve outreach.

The Utility Plan: The city's municipal utility, Austin Energy, will continue to develop its impressive

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catalogue of renewable energy and energy efficiency programs as well as efficiency improvements for power generation and transmission in order to achieve 700 MW of energy demand savings by 2020. Any new energy generation is required to achieve carbon neutrality through lowest-emission technologies, carbon capture and sequestration, and/or mitigation. Specific goals include:

- Establish a CO_2 cap and reduction plan for existing power plant emissions;
- Obtain 30% of energy needs from renewable resources by 2020;
- Install 100 MW of solar energy capacity by 2020.

Austin Energy developed a Public Participation Process to determine future energy generation and to establish the utility's CO_2 cap through consultation with a stakeholder group representing diverse community interests. The Resource and Climate Protection Plan resulting from the public participation was submitted to the Austin City Council for approval in March 2010.

Homes and Buildings: The City Council passed the Energy Conservation Audit and Disclosure Ordinance, also known as a "point of sale" ordinance, to encourage efficiency upgrades for existing buildings. A series of building energy code changes is being phased in through 2015 to help make new buildings and remodels in Austin the most energy-efficient in the nation. The plan also calls for enhancing existing green building programs.

Community Plan: Austin is also using public outreach to engage Austin's citizens, community groups, and businesses to reduce greenhouse gas emissions throughout the community. The Community Climate Protection planning process, which began in March 2010, is a 12-month process designed to engage the community in an effort to set goals and to develop processes to reduce carbon emissions.

"Go Neutral" Plan: Austin is also working on providing tools and resources for citizens, businesses, organizations, and visitors to measure and reduce their carbon footprints. The Climate Protection carbon calculator, which was launched in January 2010 on the CoolAustin.org website, uses Austin-specific emissions factors for energy and water service. The website also houses the recognition program, the "Austin Environmental Awareness Awards."

The Austin Climate Protection Plan has very aggressive goals that require steady effort and continuous monitoring and reporting. An annual report is published each spring to document the progress from the previous years, and to outline the planned program for the upcoming year.

Through March 2009, the Austin Climate Protection Plan has avoided approximately 188,453 tonnes of carbon dioxide-equivalents (CO_2-eq.), approximately equal to the emissions from the electricity used by 26,100 United States homes each year. From October 2006 through 2008, Austin Energy's residential and commercial energy conservation programs and Green Building program reduced peak demand by 140 MW, which accounts for 20% of the city's 700 MW goal. Altogether, the programs saved approximately 214,400,000 kWh and approximately 123,400 tonnes of CO_2 emissions in 2007 and 2008. Austin Energy has also increased its renewable energy to 14% of the generation mix, nearly half of 30% goal. Total city renewable energy use was raised to 19% (City of Austin 2009).

Austin's strong multi-sector engagement has led to a coordinated, fast-tracked climate program. Austin has long benefited from owning its own electric utility, and environmental stewardship has set the stage for future carbon reduction opportunities. The city's request for federal stimulus funding has resulted in $7.4 million for energy efficiency upgrades in existing City facilities, $6.4 million for low income weatherization, and $10.5 million for a smart grid pilot program at the 709 acre redevelopment site of a closed municipal airport. To prepare for these funding opportunities, the city and Austin Energy have been working with the local community college to train and certify contractors.

RESOURCES

Austin Climate Protection Plan's website. URL: http://www.ci.austin.tx.us/acpp/

Example Climate Protection Plan: San Francisco, California

San Francisco, California has a population of 809,000 and is located on the northern end of the San Francisco Peninsula in Northern California. The city has been a leader in the promotion of renewable energy and energy efficiency since the 1970s with its innovative, practical, wide-ranging programs, ambitious carbon cutting goals, and groundbreaking legislation. The city takes coordinated, strategic and effective steps to reduce its carbon impact across the commercial, residential, and municipal sectors by means of its strong leadership and public engagement.

San Francisco's Climate Action Plan was adopted in 2002 and aims to reduce the city's greenhouse gas emissions to 20% below 1990 levels by 2012 across all sectors (City of San Francisco 2004). To meet this goal, each person who lives or works in San Francisco will need to cut almost 2 tons of carbon dioxide annually. The city has also developed an innovative mechanism designed to help finance the reduction of greenhouse gas emissions, known as the Green Finance SF, a property assessed clean energy (PACE) financing program that uses a property tax lien to ensure payment and provide residential and commercial property owners with the capital they need to perform energy efficiency, renewable energy, water conservation, and storm/waste water management.

Some of the city's goals were updated with the release of a new Environmental Plan in 2008. The Plan highlights the status of its goals for city's programs in climate action, renewable and efficient energy, clean transportation, green building, urban forest, zero waste and environmental justice (City of San Francisco 2008a).

San Francisco's renewable energy and energy efficiency policies and programs have already led to 12 MW of installed renewable energy capacity and 35 MW of energy savings as of January 2010. The city plans to continue on this path to reach 31 MW of installed renewable energy capacity and 105 MW in energy savings by 2012 (EERE 2009). Strategies used to achieve these goals include:

- A pilot project in wave energy, partnering with numerous agencies.
- Installation of the largest municipal solar power system in the United States, a 5-MW photovoltaic system at the city's Sunset Reservoir, financed through a Power Purchase Agreement.
- GoSolarSF, a ten-year solar rebate program that offers incentives to residences and businesses to install solar power on their properties. By December 2009, GoSolarSF has funded projects totaling 4 MW, primarily in the residential sector, and has created 28 new green-collar jobs (Green Cities California 2009a).
- The Power Savers Program, which reduced electricity demand by 6 MW during the program's run by installing energy-efficient lighting in 4,000 small businesses, saving $3.5 million in annual electric bills (City of San Francisco 2008b).
- The San Francisco Energy Watch program, which offers businesses and multifamily residential properties free on-site assessments to identify energy savings, new energy-efficient equipment and technical services at reduced cost, and installation of energy saving equipment. The program has created 150 green collar jobs (City of San Francisco 2009).
- A green building program, which assists municipal construction projects to meet the requirements of the Resource Efficient Building Ordinance. San Francisco adopted a mandatory green building code in September 2008, which requires commercial buildings to acheive LEED Gold certification and single family residential buildings to acheive LEED Gold or a GreenPoint Rating of 75.[2]

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2 LEED certification is an internationally recognized standard for measuring building sustainability, developed by the United States Green Building Council. The LEED rating system offers four certification levels for new construction for all building types – Certified, Silver, Gold and Platinum. GreenPoint Rated is another green building rating program, developed by Build it Green, which measures the building sustainability of new and existing residential houses.

- Installation of Light Emitting Diodes (LED), traffic signals across the city to reduce electricity use by an estimated 7.7 million kilowatt/hours, saving the city $1.2 million per year (City of San Francisco 2008c).
- A $5-8 million annual expenditure on energy efficiency through a department-by-department retrofit program of 900 municipal facilities. Retrofits on hospitals, clinics, the convention center, and the wastewater treatment plant reduced electricity demand by 2 MW to produce a savings of $20 million over the next 15 years at an initial cost of $5 million (City of San Francisco 2008c).
- A mass transit fleet run entirely on electricity or B20 biodiesel, with a goal of a completely zero-emission fleet by 2020 (City of San Francisco 2008d).

San Francisco has the most comprehensive mandatory recycling and composting legislation in the nation (Green Cities California 2009b), with the goal of achieving 75% landfill diversion by year-end 2010 and zero waste by 2020 (City of San Francisco 2008e). The Ordinance applies to all residential and non-residential properties. To date, the city has managed to divert 72% (1,367,000 tons annually) from landfills, reducing landfill disposal to its lowest level in 29 years—the highest recycling rate of any metropolitan city in the nation] (City of San Francisco 2008f). A few strategies used to achieve these ambitious goals include:

- The establishment of the first and largest urban food scraps composting collection in the United States. The program is available to all households and over 2,000 businesses citywide and collects almost 300 tons per day.
- SFGreasecycle, a citywide program that recycles restaurant grease into a fuel source for the city's 1,500 city-owned buses and trucks which use diesel fuel. The program helps curb improper disposal of grease by restaurants, lower petrol consumption, and meet the B20 mandate set on the city fleet (SFPUC 2010).
- Policies such as the Resource Conservation Ordinance, which directs all city departments to maximize waste reduction and purchase recycled products, and an Extended Producer Responsibility Resolution, which urges the passage of state legislation that would hold producers more responsible for the waste they create (City of San Francisco 2008f).

San Francisco also requires every department to have a Climate Action Plan that includes energy, water, recycling, vehicle fuels, employee transit, and how the department can affect change through its public contact. For example, the Public Libraries which receive 15 million visits per year have instituted a climate education program in every neighborhood library.

As a result of these programs, San Francisco was on course for its emissions reduction goal in 2009, with a 6% emissions reduction compared to 1990 levels, among the highest reductions in urban America (Crowfoot 2009). San Francisco's success is due to broad-based efforts to inform and mobilize the public, provide practical action that can be taken by individuals that bring immediate and tangible benefits, and create partnerships with organizations of all types including non-profits, business organizations, and private companies. San Francisco's broad-based, integrated climate protection strategies will have a lasting impact for the city.

RESOURCES:

San Francisco's Department of the Environment website. URL: http://www.sfenvironment.org/

San Francisco residents can track their personal carbon footprint and compare their neighborhood to others in the city. URL: http://sf.urbanecomap.org/

San Francisco Solar Map: maps every solar installation in the city; building owners can get an automated solar potential estimate and connect to a contractor. URL: http://sf.solarmap.org/

Example Climate Protection Plan: Seattle, Washington

Seattle, Washington has a population of 602,000 and is located in the Pacific Northwest region of the United States, about 100 miles south of the United States–Canada border. In 2006, the city released its Climate Action Plan, which outlines how the city government, residents and businesses will work together to achieve the city's climate protection goals. The city's Office of Sustainability and Environment is responsible for leading, monitoring and evaluating all initiatives associated with the plan. Since 1990, Seattle's population has grown roughly 16%, yet total emissions have dropped 7% (City of Seattle 2009).

The city continues to make progress in implementing its comprehensive approach to dealing with climate change. The Seattle Climate Action Plan outlines how the city will achieve its emission reduction targets for both its government operations and its community. The targets are (Simmons 2010):

- Government operations emission targets:
  - 7% reduction (from 1990 levels) by 2012.
  - 80% reduction (from 1990 levels) by 2050.
- Community emission targets:
  - 7% reduction (from 1990 levels) by 2012.
  - 30% reduction (from 1990 levels) by 2024.
  - 80% reduction (from 1990 levels) by 2050.

Seattle uses a citywide greenhouse gas (GHG) emission inventory to measure progress toward their near-term and long-term goals of reducing climate pollution. The city documents inventories of their three main GHG emission sources: (1) Transportation; (2) Residential and commercial buildings; and (3) Industry. Transportation-related emissions are 40% of total emissions and the city's biggest challenge in reducing GHG emissions. Some of the city's initiatives to address all sectors include (City of Seattle 2009):

- Increased bus service on the city's most congested routes;
- Expanded heavy and light rail commuter transit lines throughout the city;[3]
- Doubled the miles of marked and striped bicycle lanes;
- Increased use of biodiesel blend for public vehicles;
- Transitioned non-pursuit police department vehicles to efficient gas-electric hybrids;
- Increased the "walkability" of the city with pedestrian curb ramps and upgraded crosswalks;
- Implemented a 10% commercial parking tax, phased in over three years (began July 2007);
- Signed an agreement with Nissan North America that paved the way for the city to be one of the first markets to receive the forthcoming Nissan LEAF all-electric car, and is planning to install about 2,500 charging stations;
- Encouraged and incentivized the use of smaller, more fuel-efficient and gas-electric hybrid vehicles as taxicabs;
- Launched a "Smart Fleets" educational outreach program to encourage fleet owners to use the most fuel-efficient vehicles possible;
- Implemented a showerhead and faucet aerator program for all residential customers to conserve hot water;
- Prioritized the procurement of efficient city equipment, led by a newly created Department of Executive Administration Green Team;
- Launched a campaign to encourage all 10,000 city employees to reduce climate change pollution at work and at home;
- Launched public awareness programs (including training volunteers to be "Carbon Coaches") to educate and inspire residents and businesses to incorporate climate protection actions;

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3 According to the Seattle Climate Protection Initiative Progress Report 2009, by 2023, 85% of the jobs and 70% of households within the three-county region will live near rail transit.

- Developed a comprehensive approach to residential and commercial energy retrofit delivery:
  - Launched an energy audit pilot program in 5,000 homes, wherein audits are offered to homeowners at a deeply subsidized (by the local utility) rate of $95;
  - Paired this program with a new residential loan fund that will allow homeowners to access financing for retrofits recommended through the audit;
  - Incorporated a "Home Energy Performance Score"—a "miles per gallon" rating into all audits to allow homeowners to compare their energy consumption to regional averages, as well as to their neighbors;
  - Launched a direct installation program that will install compact fluorescent lamps (CFLs) and low-flow water fixtures in over 15,000 low-income homes throughout Seattle;
  - Delivered customized home energy reports to 20,000 Seattle residents as part of their standard utility bill, comparing their energy use to their neighbors, and offering tips for reducing energy use; and
  - Passed the most comprehensive commercial and multifamily energy performance disclosure legislation in the nation to date, requiring that building owners measure, rate and report energy performance on an annual basis.
- Implemented an "express lane" (faster service and lower fees) for those seeking building permits who are committed to building green and energy-efficient homes no larger than 2,400 square feet;
- Audited energy use in all city facilities and improved the efficiency of public facilities;[4]
- Expanded recycling efforts, which resulted in an increased recycling rate of 50% for households and reduced the amount of garbage shipped to one landfill by 36 metric tons;
- Launched a Web site to educate and engage the public by allowing individuals and businesses to track their carbon footprint;[5] and
- Continued to work with the municipal utility, Seattle City Light, which offers exemplary energy saving programs, including incentives for commercial and residential upgrades that systematically push the level of performance above the state minimum building code (WGA 2008).

The city measures progress toward its Climate Protection Initiative in these three ways:

- Annually, the Climate Protection Initiative Progress Report describes the significant accomplishments made in the city's climate protection strategy areas.
- Every three years, the city conducts an inventory of their GHG emission sources and the specific progress made toward meeting the Climate Protection Initiative goals.
- Annually the city analyzes a collection of measures that gives an early indication of progress.

As of its last inventory, conducted in 2008, the city had met its reduction target based on the Kyoto Protocol levels—GHG emissions were 7% below 1990 levels, and Seattle's per capita carbon footprint had shrunk 20% from 1990 levels (City of Seattle 2009). This is a remarkable achievement since the population of Seattle grew about 16% since 1990 (WGA 2008). It will be challenging for the city to continue to achieve such success as its population continues to grow.

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4 Retrofits to lighting in public facilities in 2009 alone resulted in the reduction of 160 metric tons of carbon dioxide per year; improvements such as pool coverings and efficient boilers and toilets reduced an additional 150 metric tons of GHGs. See the Seattle Climate Protection Initiative Progress Report 2009 for more information.

5 To use the business calculator, visit: http://scp.co2challenge.com. To use the residential calculator, visit: http://seattle.co2challenge.com

Seattle's former Mayor Greg Nickels encouraged other mayors to take a leadership role in addressing climate change. In fact, he designed the Mayor's Climate Protection Agreement and asked mayors across the country to sign on, committing to take actions to meet or beat the Kyoto Protocol targets in their own communities, and to encourage the states and federal government to do the same. By the end of 2009, more than 1,000 mayors, from cities in all 50 states and representing 87 million Americans, had signed on to the agreement (WGA 2008).

RESOURCES

City of Seattle, energy efficiency information: http://www.seattle.gov/environment/GBtaskforce.htm

City of Seattle, electric vehicles information: http://www.seattle.gov/environment/EV.htm

CONCLUSION

Climate change is a global problem, but a large part of the responsibility for climate mitigation action is fundamentally local and regional. With more than 50% of the world's population living in urban areas, cities are major contributors of greenhouse gas emissions. Such high concentrations of humans are also extremely vulnerable to the effects of climate change. It is therefore an important responsibility of local governments to address their global impacts as well as to protect their own citizens, who now make up the majority of the world's population.

State, provincial, and local governments wield tremendous influence in the global effort to address climate change by transforming the way energy is traditionally produced and consumed. By adopting innovative and well-crafted energy efficiency and renewable energy practices, these governments are working with a wide range of stakeholders to support the industries that will reduce greenhouse gas emissions via reduced demand for fossil-fuel derived energy, and at the same time are reducing energy costs and boosting local and regional economies.

Communities and states that take action at the local level drive results on their own terms and on their own timelines. Strategic energy and climate plans overcome key barriers to broader implementation of energy efficiency and renewable energy by providing funding, technical, and regulatory support for implementation. In addition, actions at the local level to lead by example create critical momentum that leads to self-sustaining energy efficiency and renewable energy industries by increasing demand for and acceptance of new technologies and practices.

This Compendium of Best Practices is not intended to be an exhaustive list of the best practices in the United States, but simply to provide readers with examples of successful efforts to increase the use of renewable energy and energy efficiency, so that these ideas and lessons learned might be considered for replication at the local level throughout the world. With more information on examples of successful programs and the steps taken to achieve them, cities and states can design programs that have a high chance of success given local circumstances, and that take advantage of the lessons learned by other cities and states.

It is the hope of the authors and contributors to this Compendium that this document be followed by similar compendia that highlight other successful policies and programs that promote energy efficiency and renewable energy at the local level throughout the world, in order to share the innovative best practices being carried out in every country, state, and city.

ACRONYMS

ACEEE	American Council for an Energy-Efficient Economy
ACP	alternative compliance payment
ARRA	American Recovery and Reinvestment Act of 2009
ASAP	Appliance Standards Awareness Project
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
Btu	British thermal unit
CHP	combined heat and power
CO_2	carbon dioxide
CWA	Clean Water Act
DOE	Department of Energy (U.S.)
DSIRE	Database of State Incentives for Renewables and Efficiency
EERS	Energy Efficiency Resource Standard
EO	executive order
EPA	Environmental Protection Agency (U.S.)
EPBB	expected performance-based buydown
FIT	feed-in tariff
GHG	greenhouse gas
GIS	geographic information system
ICLEI	International Council for Local Environmental Initiatives
IEEE	Institute of Electrical and Electronics Engineers
IREC	Interstate Renewable Energy Council
kW	kilowatt
kWh	kilowatt-hour
LBNL	Lawrence Berkeley National Laboratory
LED	light emitting diodes
LEED	Leadership in Energy and Environmental Design
MW	megawatt
MWh	megawatt-hour
NREL	National Renewable Energy Laboratory
PBF	public benefit fund
PBI	performance based incentive
PPA	power purchase agreement
PV	photovoltaics
REC	renewable energy certificate
REZ	renewable energy zone
RPS	renewable portfolio standard
SBC	systems benefit charge
UV	ultraviolet

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