Chapter 4. Energy Efficiency Policies

Saving energy through energy efficiency improvements can cost less than generating, transmitting, and distributing energy from power plants, and it provides multiple economic and environmental benefits. States have adopted many policies that support cost-effective energy efficiency programs by removing key market, regulatory, and institutional barriers that hinder investment in cost-effective energy efficiency. This chapter presents in-depth descriptions of five policies that states have used to support greater investment in and adoption of energy efficiency.

These policies, summarized in Table 4.1, were selected from among a larger universe of energy efficiency strategies because of their proven effectiveness and successful implementation by states. Each policy description is based on the experiences and best practices of states, as well as the following sources: local, regional, and federal agencies and organizations; research foundations and nonprofit organizations; universities; and utilities.

Table 4.1 also lists examples of states that have implemented programs for each policy and where to find more in-depth information on the policy in the *Guide to Action*.

States are also adopting complementary policies to fund and incentivize investment in energy efficiency and allow energy efficiency to be fully integrated into the delivery of and planning for electricity service. These policies are addressed in the following chapters of the *Guide to Action*:

- *Funding and Financial Incentive Policies* describes additional ways states provide funding for energy efficiency through loans, tax incentives, and other mechanisms (see Chapter 3).
- *Policy Considerations for Combined Heat and Power* highlights policy options that help states capture the environmental, energy, economic, and reliability benefits of combined heat and power technologies (see Chapter 6).
- *Electric Utility Policies* presents a number of policies that encourage electric utilities to invest in and encourage greater use of energy efficiency throughout all aspects of their business, including resource planning, ratemaking, offering service to customers, and modernizing electricity delivery (see Chapter 7).

State Policy Options in the *Guide to Action*

Type of Policy	For More Information
Funding	
Funding and Financial Incentive Policies	Chapter 3
Energy Efficiency Policies	
Energy Efficiency Resource Standards	Section 4.1
Energy Efficiency Programs	Section 4.2
Building Codes for Energy Efficiency	Section 4.3
State Appliance Efficiency Standards	Section 4.4
Lead by Example	Section 4.5
Renewable Portfolio Standards	
Renewable Portfolio Standards	Chapter 5
Combined Heat and Power	
Policy Considerations for Combined Heat and Power	Chapter 6
Electric Utility Policies	
Electricity Resource Planning and Procurement	Section 7.1
Policies That Sustain Utility Financial Health	Section 7.2
Interconnection and Net Metering Standards	Section 7.3
Customer Rates and Data Access	Section 7.4
Maximizing Grid Investments to Achieve Energy Efficiency and Improve Renewable Energy Integration	Section 7.5

Table 4.1: Energy Efficiency Policies and Programs

Policy	Description	State Examples	For More Information
Energy Efficiency Resource Standards (EERSs)	Similar to renewable portfolio standards (see Chapter 5), EERSs direct energy providers to meet a specific portion of their electricity demand through energy efficiency. A total of 27 states have some type of energy efficiency requirement or goal.	AR, AZ, CA, IL, VT	Section 4.1
Energy Efficiency Programs	Energy efficiency programs target a portfolio of related activities, such as energy efficiency investments and reduction of demand during peak periods, to reduce energy costs and meet power system capacity needs and energy savings goals. States rely on a combination of funding sources and authorities to administer and oversee such programs. Most energy efficiency programs are funded by ratepayers through a small charge on every customer's electricity bill. Forty-eight states and Washington, D.C., offer energy efficiency programs.	MA, MO, MS, VT	Section 4.2
Building Codes for Energy Efficiency	Building energy codes establish minimum energy efficiency requirements for new building construction and existing building major renovations. These codes can reduce building life-cycle costs and peak energy demand, as well as greenhouse gas emissions and other air pollutants. More than 40 states have implemented some level of building codes for residential buildings and/or commercial buildings.	AZ, CA, IL, MA, TX	Section 4.3
State Appliance Efficiency Standards	State appliance efficiency standards set minimum energy efficiency standards for appliances and other energy-consuming products. A total of 12 states have adopted appliance standards.	CA, CT, OR	Section 4.4
Lead by Example	Lead by example initiatives advance the use of clean energy within state and local government facilities, fleets, and operations. These programs can help governments achieve energy cost savings while promoting the adoption of energy-efficient technologies. States can adopt specific goals, establish energy efficiency specifications for products, or purchase and use renewable energy.	CA, NH, TX	Section 4.5

4.1 Energy Efficiency Resource Standards

Policy Description and Objective

Summary

Energy efficiency resource standards (EERSs) require obligated parties—usually retail distributors of electricity—to meet a specific portion of their electricity demand through energy efficiency (NCSL 2014). As of March 2015, 27 states have some type of energy efficiency requirement or goal. Twenty-three states have mandatory energy efficiency requirements, two states have voluntary targets, and two states allow energy efficiency as a compliance option for their renewable portfolio standard (RPS)[15] (ACEEE 2014d; DSIRE 2015).

EERS designs vary considerably across the states. They vary in terms of:

- The target type—incremental or annual, relative (percent) or absolute (gigawatt-hour, or GWh), rolling or fixed.
- Responsible entities.
- The portion of load covered.
- The stringency of targets.

EERS programs have been around since 1999. Among existing programs, relative incremental energy savings targets range from as low as 0.1 percent of energy demand for a new program to 2.5 percent for more established programs (ACEEE 2014d).

Depending on the state, EERSs generally apply to retail distributors of either electricity or natural gas, or both. Utilities or third-party program administrators are responsible for meeting multi-year targets for energy savings through energy efficiency programs targeting customer facilities. However, in some states, additional measures or programs, such as peak demand reductions, building code changes, increased onsite generation (e.g., fuel cells and combined heat and power[CHP]), and efficiency improvements to transmission and distribution systems, can also facilitate compliance (Nadel 2006).

Effectively designed and explicit energy efficiency standards can help ensure that energy efficiency opportunities are pursued to meet electricity demand at least cost while reducing peak loads, lowering electricity bills, supporting a reliable grid, reducing air emissions, and providing other non-energy-related benefits such as reduced adverse health impacts. (See Chapter 1, "Introduction and Background," for more on the benefits of energy efficiency.) The energy, environmental, and economic benefits of EERSs are well documented by retrospective evaluations, like those from the Efficiency Vermont program (Efficiency Vermont 2014a). To avoid double-counting reductions, many programs (including those in Colorado, Massachusetts, and Pennsylvania) report their net savings, which take into account secondary effects and exclude savings that would have occurred without the program (NREL 2014). The American Council for an Energy-Efficient Economy (ACEEE) found that states generally exceeded their savings targets with overall savings of 20 million megawatt-hours (MWh), surpassing combined 2012 targets of 18 million MWh. These savings could power around 2 million homes for a year (ACEEE 2014b).

[15] Delaware and Florida were not included in the totals. Delaware has enacted legislation to create EERSs, but final regulations have not yet been promulgated (DSIRE 2015). Florida has enacted EERSs, but program funding to date is considered to be "…far below what is necessary to meet targets" (ACEEE 2014d). Due to the wide variety of EERS programs with varying levels of stringency and funding, different sources may report different state counts of EERS programs.

Objective

Market barriers, regulatory disincentives, and/or insufficient information about the opportunities for energy efficiency or its benefits limit investment in cost-effective energy efficiency. Many states are overcoming these barriers and stimulating investment in cost-effective energy efficiency with EERSs, helping to realize a large amount of cost-effective efficiency potential available nationwide. Estimates vary, but recent studies show remaining achievable potential on the order of 15 to 20 percent of U.S. electricity demand that could be met through energy efficiency over the next 10 to 15 years (ACEEE 2008, 2014a; Sreedharan 2013). This potential exists in states with newer energy efficiency programs as well as those that have been offering programs for a decade or more.

Benefits

EERSs can result in significant reductions in both electricity and natural gas consumption. In addition, EERS programs are simple to administer and cost-effective, and they complement other energy policies by supporting policy development or compliance. They also reduce the strain on power grids. States have found the merits of these programs include:

- *Electricity savings*. Under an EERS, the amount of electricity savings required depends on the initial target and how quickly the target gets ramped up over time. Market forces affecting electricity demand may also affect targets. Electricity sector EERS targets range widely between programs. On the low end, Texas has an incremental target of 20 percent of forecasted electricity sales *growth* (0.1 percent of total sales); meanwhile, on the upper end, Massachusetts has a target of 2.6 percent of total annual electricity *sales*. See Table 4.1.1 for a summary of current targets.
- *Cost-effectiveness*. Energy efficiency remains one of the most cost-effective resources for addressing electricity system needs (ACEEE 2012). The aggregate EERS targets allow energy providers to combine savings across multiple end-uses and sectors, providing the flexibility to cost-effectively meet the overall savings goals. States have found the design of energy efficiency program portfolios can ensure that all customers who contribute through ratepayer funding have the opportunity to reduce energy bills directly by participating in energy efficiency programming (see Section 4.2, “Energy Efficiency Programs”).
- *Long-term rate benefits*. The savings associated with energy efficiency offer long-term bill savings and contribute to stability because they are typically realized on an ongoing basis throughout the measure lifetime. Energy efficiency investment costs may increase energy rates slightly in the initial years of a program; however, states have found reduced energy bills over the program’s lifetime provide a rapid payback on these investments and provide price moderation benefits. For example, Vermont’s Efficiency Vermont program reports savings of $2.30 for every dollar spent on electricity demand reduction programs (Efficiency Vermont 2014a). Moreover, states have found these costs compare favorably to the ongoing costs of new energy production and delivery infrastructure investments (NAPEE 2006). The levelized cost of electricity for energy efficiency programs has been estimated at three to five cents per kilowatt-hour (kWh) of electricity service demand, in which is lower than all forms of new electricity generation (ACEEE 2012).
- *Reduce the strain on the power grid.* In some regions, energy efficiency has been formally incorporated into the region’s forward capacity market (FCM), which procures electricity capacity through an auction a few years before the electricity actually needs to be delivered, lessening the short-term strain on power

grids and reducing the need for new electricity generation capacity.[16] In Independent System Operator (ISO) New England's FCM, energy efficiency efforts submitted by Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont combined to reduce electricity demand by 1,723 GWh and summer peak demand by 223 megawatts (MW) in 2012. ISO New England forecasts that during the 2018–2022 time period, these states will contribute annually an average of 1,563 GWh (about 1 percent) of forecast electricity demand and 212 MW of summer peak demand savings from energy efficiency into the FCM (ISO New England 2014).

- *Simplicity.* EERSs create a straightforward, quantified energy savings target for energy providers that can easily be measured against and modified over time.
- *Complements other energy policies.* EERS policies can also complement other policies, although they often contribute to the same energy efficiency savings. EERSs work in concert with market-based programs, such as emissions cap and trade programs like the Regional Greenhouse Gas Initiative (RGGI), because energy efficiency avoids greenhouse gases (GHGs) and lowers the cost of meeting the cap. EERSs encourage states to consider energy in their integrated resource plans. Other policies may complement and enhance the outcomes of an EERS including, for example, financial incentives in utility ratemaking (see Section 7.2, "Policies That Sustain Utility Financial Health").

States with EERSs

EERSs were first used primarily in restructured states as a policy approach to replace the integrated planning requirements that were often eliminated as part of restructuring.[17] (For more information about restructuring, see Chapter 7, "Electric Utility Policies.") However, they have recently been employed as an effective policy in nine states with a traditional regulatory model, and in six states that have suspended restructuring of their market. See Table 4.1.1 for more details. As shown in Figure 4.1.1, as of March 2015, 23 states have adopted mandatory EERS policies,[18] and another four states have adopted voluntary policies or enabled energy efficiency to count towards the state RPS (ACEEE 2014d; DSIRE 2015). These 27 states represent 64 percent of total electricity sales in the United States (EIA 2013).

[16] FCMs are a mechanism to ensure sufficient supply and demand resources are available when needed and reliability standards are met. Capacity markets reflect the value of electricity supply that is necessary to meet forecasted demand and reserves on a sufficiently forward planning horizon. They also provide a forecasted price signal to show the value and expected revenues that support financing for capital-intensive projects. In many markets, customer-sited resources, including energy efficiency, can participate in FCMs.

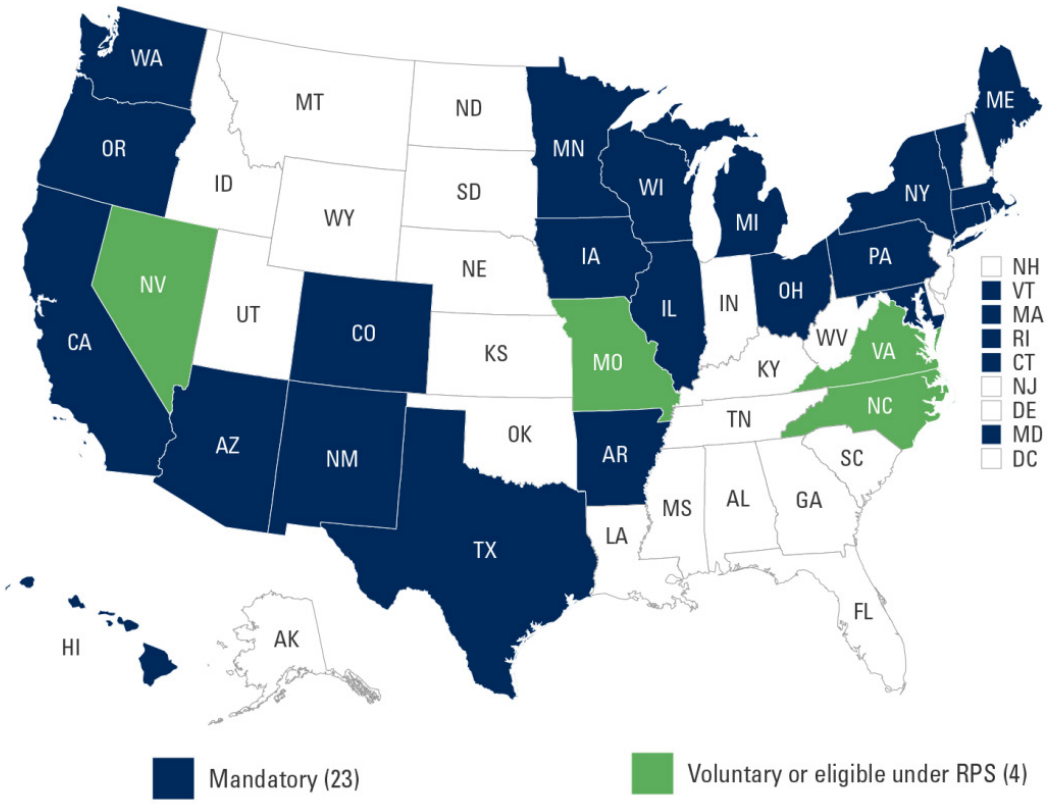
[17] From the 1920s to the 1990s, providers of electricity in the United States were vertically integrated entities providing generation, transmission, distribution, and retail supply services in franchised service territories. These natural monopolies were either state-owned or privately owned and subject to price and entry regulation. Many were subject to integrated resource planning requirements, including required filings to state authorities to demonstrate that all resources, including energy efficiency and renewable resources, were considered in planning for a least-cost resource mix to reliably meet electricity demand over a 20- or 30-year planning horizon. Beginning in the 1990s, a series of state and federal initiatives "restructured" electricity markets to reflect the observation that some of these functions, such as generation and retail service, were potentially competitive, while others, including transmission and distribution, were natural monopoly functions. Market restructuring took many forms, but the underlying concepts involved the divestiture of generation from utilities, the formation of organized wholesale spot energy markets, non-discriminatory mechanisms for rationing transmission resources, the introduction of retail choice programs, and the establishment of oversight and coordination functions.

[18] Included in this count is the Ohio EERS whose targets have been frozen for 2015 and 2016 before continuing, subject to a program review.

In addition, several states with public benefits funds[19] (PBFs) have conducted energy efficiency analyses, potential studies, and goal-setting exercises to explore the adoption of an EERS program.

Overall, states have been meeting or exceeding EERS targets while achieving other benefits. In 2012, overall state energy savings of 20 million megawatt-hours (MWh) surpassed combined energy efficiency targets of 18 million MWh (ACEEE 2015). For example, two of Illinois' electric utilities, the Commonwealth Edison Company (ComEd) and Ameren Illinois, both exceeded their electricity savings goals for each of the first 5 years of that state's EERS. In 2012, ComEd and Ameren Illinois reported net savings of 828 GWh and 331 GWh, respectively, amounting to about 1 percent of electricity sales in their combined service territories (ACEEE 2014b). From 2006 to 2014, California estimates its EERS achieved net savings[20] of $1.8 billion (CPUC 2014a). Cumulative peak electricity demand savings reached 1,300 MW from 2004 to 2009, avoiding the need to build three power plants (CPUC 2014a).

Figure 4.1.1: States That Have Adopted EERSs



Sources: ACEEE 2014d; VA, MO sourced from DSIRE 2015.

[19] PBFs (also called system benefits charges or Universal Systems Benefits Programs) were established in many states as a mechanism for ensuring continued investment in energy efficiency, renewable energy, and research and development in the face of market restructuring and diminished incentives for the market to provide these resources. The funds are collected either through a small charge on the bill of every electric customer or through specified contributions from utilities. The charge ensures that money is available to fund these investments.

[20] Net savings reflect utility savings above those that would have been achieved in the absence of the EERS program. Total savings are called gross savings.

Table 4.1.1: Current and Pending State EERS Policies

State	State Regulatory Status	EERS	Applies to	Savings Target
Arizona	Restructuring suspended	Mandatory	Electric and gas utilities	Incremental electricity savings starting at 1.25 percent in 2011 and rising to 2.5 percent in 2016. Annual energy savings of 22 percent from electricity and 6 percent from natural gas by 2020.
Arkansas	Restructuring suspended	Mandatory	Electric and gas utilities	Rises to 0.9 percent incremental savings by 2015 for electricity; 0.6 percent by 2015 for gas.
California	Restructuring suspended	Mandatory	Electric and gas utilities	0.85 percent incremental savings by 2020 for electricity.
Colorado	Regulated	Mandatory	Electric and gas utilities	Rises from 0.8 percent incremental savings in 2011 to 1.7 percent in 2020 for electricity. Gas IOUs must target spending at more than 0.5 percent of annual revenues.
Connecticut	Restructured	Mandatory	Electric and gas utilities	Incremental electricity savings targets of about 1.4 percent to 2015; cumulative natural gas savings of 60 million therms through 2015.
Hawaii	Regulated	Mandatory	Electric utilities	About 1.4 percent incremental savings each year through 2030 (about 30 percent of forecast electricity sales).
Illinois	Restructured	Mandatory	Electric and gas utilities	Rises from 0.2 percent incremental savings in 2008 to 2 percent in 2015 for electricity. Utilities with cost cap limitations can average incremental targets of 0.9 percent. Gas targets rise from 0.2 percent in 2011 to 1.5 percent in 2019, reaching 8.5 percent annual savings in 2020.
Iowa	Regulated	Mandatory	Electric and gas utilities	Incremental electricity savings of about 1.4 percent and gas savings of between 0.7 percent and 1.2 percent of retail sales between 2014 and 2018.
Maine	Restructured	Mandatory	Electric and gas utilities	Incremental savings targets of about 1.6 percent for electricity and 0.2 percent for gas; annual 20 percent reduction target for electricity and gas.
Maryland	Restructured	Mandatory	Electric utilities	Per capita electricity savings of 10 percent by 2015 compared to 2007 baseline.
Massachusetts	Restructured	Mandatory	Electric and gas utilities	Incremental savings rise from 1.4 percent in 2010 to 2.6 percent by 2015 for electricity; 0.63 percent in 2010 to 1.14 percent by 2015 for gas.
Michigan	Restructured	Mandatory	Electric and gas utilities	Ramps up to 1 percent incremental electricity savings from 2012; 0.75 percent incremental gas savings from 2012. Targets post-2015 are TBD.
Minnesota	Regulated	Mandatory	Electric and gas utilities	1.5 percent incremental electricity and gas savings from 2010 with flexibility to adjust down to as low as 1 percent.
Missouri	Regulated	Voluntary	Electric utilities	Annual electricity savings of 9.9 percent by 2020, 1.9 percent incremental savings thereafter.

Table 4.1.1: Current and Pending State EERS Policies

State	State Regulatory Status	EERS	Applies to	Savings Target
Nevada	Restructuring suspended	Voluntary (RPS)	Electric utilities	Energy efficiency can meet up to 25 percent of requirements towards Nevada's RPS.
New Mexico	Restructuring suspended	Mandatory	Electric utilities	5 percent annual reduction in electricity sales from 2005 by 2014, 8 percent by 2020.
New York	Restructured	Mandatory	Electric and gas utilities	About 1 percent incremental electricity savings and 0.5 percent incremental gas savings per year through 2015.
North Carolina	Regulated	Voluntary (RPS)	Electric utilities	Energy efficiency can meet up to 25 percent of requirements towards North Carolina RPS to 2018 and 40 percent of the 2021 targets.
Ohio	Restructured	Mandatory	Electric utilities	22 percent annual savings by 2027 (2 percent incrementally by 2021).
Oregon	Restructured	Mandatory	Electric and gas utilities	1.4 percent incremental electricity savings from 2013; 0.4 percent incremental gas savings by 2014.
Pennsylvania	Restructured	Mandatory	Electric utilities	3 percent annual electricity savings by 2013, rising to 5.3 percent by 2016.
Rhode Island	Restructured	Mandatory	Electric and gas utilities	Incremental savings rise to 2.6 percent by 2017 for electricity; 1.1 percent by 2017 for gas.
Texas	Restructured	Mandatory	Electric utilities	Savings of 20 percent of incremental load growth in 2011 (about 0.1 percent incremental savings) and 30 percent from 2013 onwards.
Vermont	Regulated	Mandatory	Electric and gas utilities	2.1 percent incremental savings for electricity each year from 2015 to 2017; 246,000 net MMBtu of incremental thermal efficiency savings each year from 2015 to 2017.
Virginia	Restructuring suspended	Voluntary	Electric utilities	Retail electric energy consumption target of 10 percent from 2006 levels by 2022.
Washington	Regulated	Mandatory	Electric utilities	About 1.4 percent incremental electricity savings from 2010.
Wisconsin	Regulated	Mandatory	Electric and gas utilities	About 1.8 billion kWh incremental electricity savings each year from 2011 to 2014 and about 73 million therms of incremental gas savings each year from 2011 to 2014.

IOUs = Investor-owned utilities

Note: "State regulatory status" refers to the way each state's electricity market is structured. In a regulated state, the public utility commission (PUC) regulates IOUs that generate, transmit, and distribute electricity. In a restructured state, electricity generation may be owned and operated by independent power producers, with the PUC regulating the distribution service that is still provided by IOUs. A few states began to restructure their markets but subsequently suspended this activity, so they are effectively still regulated markets. See the introduction to Chapter 7 for more information about utility regulation and restructuring. Also see *Examples of Legislation/Regulation* for each state at the end of this section.

Sources: ACEEE 2015; DSIRE 2015; EIA 2010

Designing Effective EERS

EERS policies include three basic features: quantitative targets that indicate the required amount of energy savings over a specific period, a designated entity or group of entities that is required to meet the targets and demonstrate compliance, and a set of activities that can be used to meet the targets. A number of key design elements have emerged from EERS efforts to date that influence the policy's flexibility; the balance of benefits, costs, and risks borne by utilities and customers; and the overall policy impact. These design considerations include:

- Participants in different aspects of the process.
- Target setting.
- Coverage.
- Eligible savings measures.
- Funding.
- Interaction with federal policies.
- Interaction with state policies.

States can typically draw from other states' experiences in considering approaches to these considerations. States have also drawn upon their own past experience with designing and administering energy efficiency programs.

Participants

- *State legislatures.* In most states, legislation is required to set EERS targets. Legislatures either set EERS targets in legislative language or direct an executive agency to do so. In either case, states designate an executive agency to administer implementation of the targets.
- *Public utility commissions (PUCs).* In some states, PUCs have the authority to set EERS targets directly. PUCs are often the agencies that administer and evaluate EERSs given their oversight of utilities.
- *Utilities*. Given the direct impact on the utility sector, when designing EERSs and developing accompanying ratemaking and other regulatory policies, legislatures and PUCs typically seek input on the potential impacts on utility profitability and ongoing operations. In most states, utilities are assigned specific energy efficiency goals and administer the ensuing energy efficiency programs. However, several states including Wisconsin, Maine, and Vermont, as well as Washington, D.C., have their own mechanisms for administration and oversight. Alternatively, some states designate third-party entities to serve in this capacity. Regardless of administrator, the program funding required to meet the resource standard typically comes from ratepayers.
- *State energy offices*. State energy offices can play a constructive role in the development of EERSs by collaborating with utilities to propose and implement energy efficiency programs. Since these offices do not rely on electricity sales for revenue, they do not have any inherent disincentive to invest in energy efficiency. The New York State Energy Research and Deployment Authority has been particularly active in the design and roll-out of the state's EERS (ACEEE 2014b).
- *Customers/general public.* States have held public workshops and created public comment processes to help inform topics such as potential economic impacts, costs, and benefits, including health benefits and other reduced emission effects. The Arkansas Public Service Commission (APSC) engaged the community

early on by holding 12 public workshops and filing over 250 testimonies, comments, and legal briefs to collect input and build support for their EERS (APSC 2010).

- *Public interest organizations.* Groups representing consumers, environmental interests, and other public interests have been involved to offer technical expertise as well as public perspectives.

Target Setting

Under EERSs, numerical energy savings targets are established by statute or by a state utility commission.

These targets may be defined in a number of different ways, including:

- Targets based on savings that are incremental, meaning new to that year, or annual (sometimes referred to as cumulative and including both incremental and past year savings).
- Targets measured in relative terms (percent of sales) or in absolute terms (e.g., GWh of savings per year).
- Targets specified as a portion of load growth or base year sales.
- The basis for the relative measure may be a fixed year (e.g., a percentage of 2010 sales) or a rolling period of time (e.g., a percentage of the previous 3 years' sales).
- Targets can address peak electricity demand (e.g., MW capacity).
- Targets may be specified on a "gross" basis or on a "net" basis. Gross savings include those savings that would have occurred in the absence of EERSs, while net savings net away estimates of baseline savings.

When setting targets, many states analyze their specific energy efficiency potential and estimate the benefits of energy efficiency; they then weigh these against the costs and the availability of funding. Analyzing the potential for energy efficiency will help policy-makers understand what may be realistically achieved cost-effectively. States have found that considering the additional benefits of increased energy efficiency provides a broader context for understanding the impacts of EERS policies. The share of state electricity and gas load that is covered by the target will directly affect the overall savings achieved. Timing and duration, as well as funding and related cost recovery issues, are also key considerations in setting the target.[21]

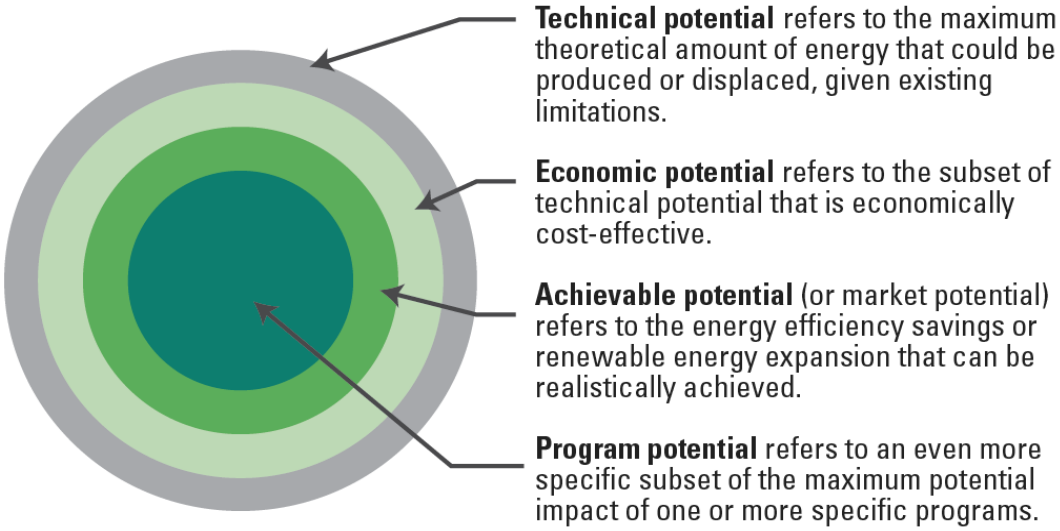
Analysis of Efficiency Potential

States have set EERSs based on analysis and program experience within the state or in states believed to be comparable. Described in Figure 4.1.2, state analysis typically includes a robust study of the technical, economic, and achievable potential for energy efficiency—the latter being the potential most typically considered in target setting—combined with a review of past program experience with energy efficiency measures (EPA 2007).

Energy efficiency potential studies consider what energy-efficient technologies and products are available, the degree to which those technologies and products may be further deployed in the market, and the cost-effectiveness of each. A potential study will help policy-makers understand what kind of electricity demand reductions can be achieved and at what cost (SEE Action 2011). States can also consider the potential for CHP to achieve savings, as described in the text box, "EERS and CHP."

[21] For more information about setting targets, see SEE Action papers by SEE Action (2011) and NREL (2014).

Figure 4.1.2: Energy Efficiency Savings Potential



In 2013, California commissioned a report on the technical, economical, and achievable potential for energy efficiency initiatives through 2024. The study found that in 2015 alone, California has an achievable potential of 2,244 GWh for energy efficiency programs, building codes, and equipment standards. This increases to a cumulative 21,844 GWh over the 10-year period (Navigant 2014). In a proposed ruling released in September 2014, the California Public Utilities Commission (CPUC) used this estimate to propose a 2015 statewide goal of 2,203 GWh, of which 1,562 GWh is set to come from energy efficiency programs and the rest from codes and standards (CPUC 2014b). These respective savings total 0.8 percent and 0.6 percent of statewide electricity consumption (EIA 2013).

EERS and CHP

Though all EERSs allow end-use energy savings to contribute to compliance, some states allow new CHP projects, a type of supply-side energy efficiency measure, to also contribute (EPA 2015). States that have explicitly identified CHP as a qualifying resource typically assign minimum efficiency requirements for the CHP project and assign separate, distinct targets for CHP. CHP projects in Massachusetts, Michigan, Pennsylvania, and Connecticut have contributed to meeting EERS objectives (SEE Action Network, 2013).

Analysis of the Benefits of Energy Efficiency

In addition to estimating efficiency resource potential, states have used power sector and economic impact models to estimate the benefits of energy efficiency, including emission reductions, lower long-term power prices and total power costs from avoided energy infrastructure investments, and net benefits to the economy (e.g., increased gross state product and increased jobs and wages). When determining its targets, California estimates multiple benefits associated with avoided electricity use. Benefits from avoided electricity use include the avoided cost of the energy, the avoided costs of building new peak generation capacity, the reduced costs of operating a reliable electricity grid, the avoided costs of expanding transmission and distribution lines, the value of avoided GHG emissions, the public health benefits associated with decreased emissions of air pollutants, and the reduced cost of compliance with the RPS resulting from lower sales (E3 2011).

Timing and Duration

States often determine the timing and duration of EERSs by considering how quickly targets can be ramped up to optimal levels from program initiation, and how long it will take to achieve the final program goal. Generally, only a portion of the total energy savings potential can be realized in a given year because of considerations like the time it takes for a technology or program to penetrate and transform the market, as well as limits on funding. States have found that reviewing regulatory compliance deadlines and developing an analysis of achievable efficiency potentials for specific years can help inform these considerations. To determine a realistic timeframe for ramping up and achieving energy efficiency program goals, states also usually consider their existing experience with energy efficiency programming, and for new types of programs, the experience of similar states.

Coverage

The options for achieving significant load coverage under an EERS depend on the entities under the state's jurisdiction. In the majority of states, PUCs typically do not have the authority to set requirements for municipally owned, federally owned, or rural cooperatively owned utilities. State legislation is often necessary to specify requirements and oversight for these entities. Vermont's EERS achieved 94 percent[22] coverage of its electricity load through a statewide energy efficiency provider rather than coordinating with the state's 22 municipally owned utilities. In 1999, the Vermont Public Service Board (PSB) created a statewide energy efficiency utility (EEU) known as Efficiency Vermont, funded through a per-kWh fee on customers' electricity bills (NREL 2014; Vermont PSB 2014). Arizona established its EERS to target a 22 percent annual savings in retail electricity sales from investor-owned utilities (IOUs) by 2020. Cooperatively owned utilities in Arizona are also subject to the EERS; however, they are obligated to achieve only 75 percent of the annual IOU targets (ACEEE 2015). Some EERSs have established targets for electric utilities alone, while others (e.g., California and Illinois) have set savings goals for both electric and gas utilities. States have sometimes included provisions to ensure that the energy efficiency measures used (and hence the energy bill savings) are distributed among customer classes (e.g., residential, industrial, commercial) and income levels.

Eligible Savings Measures

There are a wide variety of energy efficiency programs with varying levels of certainty that can be implemented. States must decide what types of programs will be eligible in their EERS. More traditional programs that have established measurement and verification methods may take the form of appliance rebate programs or energy audits with follow-up home efficiency improvements. To give states more flexibility in finding cost-effective efficiency savings, eligible programs can be expanded to include CHP, behavior change programs, supply-side efficiency improvements, and credit for advocacy work that promotes stronger building codes and appliance standards. These programs provide a greater challenge for savings verification, but as measurement and verification methods for these programs mature, the uncertainty associated with program savings is reduced (NREL 2014).

Funding

States establish funding sources to pay for utility or public programs that help achieve the efficiency resource goals. Different approaches include one or more of the following: utilizing funds from a state PBF to support energy efficiency investments, allowing utilities to recover program costs through adjusted rates, allowing

[22] The City of Burlington runs its own energy efficiency programs.

utilities to earn a return on investment on energy efficiency analogous to that earned on energy sales, and allocating allowance auction revenues to support energy efficiency.[23]

EERS design may involve defining how funds will be raised, spent, and accounted for in meeting goals. For example, California recognizes an electricity "loading order" where the PUC requires utilities to invest in cost-effective energy efficiency as a procurement resource using funds that would otherwise go to purchasing power; the utilities also use PBFs and efficiency resource acquisition funds to meet the overall goals.

Some states also include cost-containment provisions in their EERS. These provisions can either cap program expenditures as a percentage of electricity sales or limit the increase in electricity rates to recover program costs. Eight states currently have some form of cost-containment provision (NREL 2014).[24]

Interaction with Federal Policies

A variety of federal programs, partnerships, and technical assistance is available to help states achieve their energy efficiency goals. The U.S. Department of Energy (DOE), through the State Energy Program (SEP), provides funding to state energy offices for energy efficiency and renewable energy purposes. The SEP helps states establish and implement energy efficiency and renewable energy plans, policies, and programs to reduce energy costs, increase competitiveness, enhance economic development, improve emergency planning, and improve the environment. SEP provides state energy offices with formula-based grants that allow states and U.S. territories, as well as Washington, D.C., to advance their energy priorities by designing and implementing energy efficiency and renewable energy programs. SEP also provides funding on a competitive basis to state energy offices to create public-private partnerships geared towards addressing critical clean energy challenges. The ENERGY STAR® program offers energy program planning assistance and facilitates best practice exchange among programs. It also defines efficiency criteria for more than 70 product categories, as well as whole-building performance for new homes and commercial and industrial buildings (see Section 4.2, "Energy Efficiency Programs," for a broader discussion of ENERGY STAR activities). The EPA CHP Partnership and DOE Technical Assistance Programs can offer similar assistance on CHP (see Chapter 6, "Policy Considerations for Combined Heat and Power," for a broader discussion of CHP).

Federal incentives can also make it easier to comply with an EERS. Federal programs that include tax credits for energy-efficient measures or improved appliance standards can reduce the cost or support compliance with EERSs. EERSs that produce verifiable capacity savings can have favorable short and long-term electricity resource adequacy[25] implications reflected in a variety of organizations. These include federally jurisdictional wholesale markets overseen by the Federal Energy Regulatory Commission, the North American Electric Reliability Council, regional reliability organizations, regional transmission organizations, and transmission-owning companies.

Interaction with State Policies

States have found that EERSs can complement other energy efficiency policies and serve as a framework for a suite of policies and programs. Some of these policies include building codes, lead by example programs, appliance standards, energy savings performance contracting, and financing programs that promote energy efficiency. Moreover, complementary policies can improve the success of EERSs. Policies that address cost

[23] Some of the states participating in the RGGI use the latter funding mechanism.

[24] The eight states are California, Illinois, Maine, New Mexico, Pennsylvania, Rhode Island, Washington, and Wisconsin.

[25] Resource adequacy pertains to both the short-term reliability of the electricity grid and ensuring sufficient generation resources are available to meet longer term reliability concerns.

recovery for the lost sales associated with energy efficiency (such as lost revenue adjustment and decoupling mechanisms) remove the financial disincentive for pursuing energy efficiency, while additional performance incentives tied to EERS targets can provide positive incentives to utilities. All of these help program administrators achieve their targets.

Program Implementation and Evaluation

EERS implementation occurs primarily through designated utilities and other program implementers. However, continued state involvement is important in overseeing the development of implementation rules and may be important in ensuring the necessary funding is available. In Texas, for example, where the electric distribution utilities must meet the EERS goals, the utility commission is actively involved in determining how efficiency goals are met, approving plans submitted by utilities and awarding performance bonuses for energy savings (ACEEE 2015). State energy offices also play an important role, which can include analyzing the benefits of an existing or potential EERS and promoting measures that contribute to compliance. In Illinois, the EERS implementation is split between electric utilities and the Illinois Department of Commerce and Economic Opportunity (DCEO), with DCEO responsible for achieving 25 percent of the program's energy savings by targeting state and local governments, school districts, and low-income households (ACEEE 2014b).

Some utilities design and implement their own customer-funded programs using in-house staff. Others contract with third-party service providers who are responsible for installing energy efficiency measures at residences and businesses. These third-party energy efficiency providers may include air conditioning contractors, insulation installers, lighting contractors, retail electric providers, energy service companies, and other energy efficiency service contractors. The energy efficiency providers receive incentive payments from the utility for installing energy efficiency measures that result in peak demand reductions and electricity savings. Most large utilities contract out to full service, third-party implementers that manage all elements of their energy efficiency portfolios, including policy and planning, technical analysis, and implementation. See Section 4.2, "Energy Efficiency Programs," for more discussion on program implementation.

Best Practices: Implementing EERS

States have found the following best practices helpful when implementing an EERS:

- Use a clear basis for assessing compliance.
- Set a long-term goal with the opportunity to revisit every 5 to 10 years.
- Set strong goals.
- Coordinate EERS with market transformation programs, PBFs, and other programs to facilitate the market changes that are needed to reach EERS goals.
- Ensure that the electricity and natural gas demand forecasts used in supply-side resource filings reflect energy savings goals.
- Distinguish between energy efficiency programs aimed at new construction and equipment replacement upon failure and programs aimed at retrofitting existing, still operational equipment or facilities. Appropriate baselines may be based on building codes, equipment standards or common industry practice for the former, and program participants' pre-program efficiency levels or characteristics of the latter.

States have found that evaluation, measurement, and verification (EM&V) is a key element of a successful EERS. EM&V is used to provide accurate, transparent, and consistent measurements of program impacts, which help to assess the program's costs and benefits, design, and implementation. (See the *Approaches to Evaluation, Measurement, and Verification* section below for more detailed information on the approaches states are using for EM&V.)

As state programs mature, states are able to refine their programs based on past experience. In California, CPUC's 2015 savings targets were largely informed by a stakeholder-vetted report that CPUC commissioned to project the state's future energy efficiency savings potential. In addition to the potential study, CPUC considered the past performance of what utilities had been able to achieve (ex post savings) against the

original estimates that went into the targets for that period (ex ante savings) (CPUC 2014b). In Vermont, Efficiency Vermont has refined the operation of its statewide program based on various program evaluation activities. Program refinements include collecting additional customer data to provide a more accurate measurement of savings, allowing more flexible timelines for customers to take up projects while maintaining current incentives, and investing in new software to enhance customer engagement and improve the efficiency of data collection and feedback efforts (Efficiency Vermont 2014).

Oversight

States have found that some form of oversight is needed while implementing EERSs. For IOUs, the oversight organization is usually the PUC. PUCs may require that independent third-party evaluators conduct impact evaluations. Some PUCs have hired evaluators to guide the PUC. Some states have decided to establish official oversight or advisory bodies, typically composed of stakeholders who periodically review the EERS program to determine whether its goals are being met, whether its goals should be renewed or adjusted, and whether other aspects of implementation need modification. For example, the Massachusetts Energy Efficiency Advisory Council (EEAC) is a body that guides the development, implementation, and long-term direction of the state's efficiency programs. The EEAC is made up of representatives from a variety of stakeholder organizations, including residential consumers, energy efficiency experts, realtors, small businesses, nonprofits, non-voting utility representatives, and key government agency staff (ACEEE 2014b).

Approaches to Evaluation, Measurement, and Verification

The two principal approaches for evaluating, measuring, and verifying the energy efficiency measures that states use to meet their EERS targets are the "deemed savings" approach and the measurement-based approach. State PUCs are the entities typically charged with approving, overseeing, and verifying the application of these approaches by the independent companies hired to perform the evaluation work.

The deemed savings approach involves estimating energy savings by combining verification that the energy efficiency measure has been installed and can at least be partially attributed to the program with the pre-calculated or "deemed" savings from using that measure. Although this approach is not as accurate as the measurement-based approach, it can provide a defensible estimate of avoided consumption while minimizing the complexity and cost of EM&V by drawing on the extensive field experience from other states. The use of deemed savings is most appropriate for simpler measures, such as a residential refrigerator or other plug-in appliance, whose performance characteristics are well established and not highly interactive with other building characteristics.

Deemed savings are calculated by subtracting the energy-efficient measure's energy use from the energy use of a conventional measure. These savings estimates often take into account other key characteristics such as hours of use or local climate (i.e., heating and cooling degree days). It is also possible to adjust deemed savings methods to account for the following:

- *Persistence of savings*. How long the savings from measures should be counted. Persistence includes both the expected lifetime and the performance degradation of the measure. It also includes failure rates.
- *Free ridership*. Savings that program participants would have achieved regardless of program intervention. These savings would be netted out from gross deemed savings estimates.
- *Spillover effects*. Increased savings from indirect effects not directly covered in the deemed savings calculation. This could include additional measures by program participants not directly captured by the program, or measures from non-program participants who are influenced by the program.

- *Interactive effects with other measures.* For example, efficient lighting reduces waste heat and therefore interacts with heating and cooling systems.

While deemed savings approaches can provide greater certainty in program planning because the estimates are readily available, assumptions need to be reviewed periodically and programs need to invest in studies related to usage, persistence, and other key parameters. States often prioritize these evaluations to target measures that represent a large portion of program savings or where key uncertainties have arisen. Technical resource manuals are often used as a credible source for deemed savings methodologies and measurements. Deemed savings should be specific to recent state or regional technical resource manuals, as factors such as climate, behavioral, and equipment assumptions may vary by region and over time. At least 11 states have developed technical reference manuals to estimate savings from energy efficiency measures (ACEEE 2014c).

Best Practices: Evaluating, Measuring, and Verifying EERS Policies

States have found the following best practices helpful when evaluating, measuring, and verifying an EERS:

- Establish key baseline, tracking system, and reporting practices for affected markets and technologies prior to program implementation.
- Draw on other states' experiences and technical reference manuals to establish rigorous and workable measurement, verification, and reporting protocols.
- In addition to quantitative impact evaluation, provide for a qualitative evaluation process that enables program administrators to obtain useful feedback and improve program effectiveness over time.
- Evaluate programs operated under an EERS policy at appropriate intervals, so that agency overseers can gauge compliance with energy savings goals.
- Utilize an independent, third-party verifier to help build confidence in results. (See *Approaches to Evaluation, Measurement, and Verification* section.)
- Provide evaluation results to oversight agencies, program administrators, and other participants. Adjust future energy savings goals, as needed.

The other EM&V approach used to ensure that EERS targets are being achieved is a measurement-based approach. It is most widely used for larger and more complex energy efficiency projects. The most well-known and referenced example is the International Performance Measurement and Verification Protocol (IPMVP). The IPMVP provides an overview of current best practice techniques available for estimating results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. The IPMVP was developed with DOE sponsorship and is currently managed by a nonprofit organization that continually publishes new materials available to the public (EVO 2014).

The DOE Uniform Methods Project (UMP) is another example of a measurement-based EM&V approach. It provides a framework and set of protocols to assist in determining energy efficiency program savings. These protocols are targeted towards individual measures as well as entire energy efficiency programs. The UMP is designed to streamline the EM&V process by providing program administrators and policy-makers with a single, straightforward, and credible resource to use (DOE 2014).

In addition to the IPMVP and UMP, some states have developed their own EM&V resources to support the achievement of EERS targets and related goals. For example, California maintains a robust set of protocols that is maintained on the California Measurement Advisory Council (CALMAC) website (CALMAC 2014).

State Examples

Arizona

Arizona's EERS experience highlights the flexible options utilities can use to meet targets. In 2010, Arizona established their EERS at a cumulative 22 percent savings in retail electricity sales from IOUs by 2020. Incremental targets are also specified, starting with savings of 1.25 percent in 2011. Cooperatively owned utilities are also subject to the EERS; however, they are obligated to achieve only 75 percent of the annual IOU targets. Arizona also has a cumulative natural gas savings target of 6 percent by 2020 (ACEEE 2015).

While some states cap EERS expenditures as a percentage of electricity sales, Arizona's EERS does not have any cost caps for IOUs. To offer flexibility, savings in peak demand can count for up to 10 percent of the energy target annually and up to 2 percent of the overall 22 percent target. Peak savings are converted to estimated energy savings assuming a 50 percent annual load factor.[26] Energy efficiency from building codes where the affected utility has undertaken an EM&V study can provide additional sources of savings for utilities. CHP equipment that is not eligible for Arizona's Renewable Energy Standard can also be counted towards Arizona's EERS (ACC 2009). Utilities can meet savings requirements through a number of methods including demand-side management incentives, peak demand reductions, building codes, CHP systems, self-direction, and existing demand-side management programs that achieved energy savings between 2004 and 2011. To accommodate large industrial users with established energy efficiency programs, facilities may direct up to 85 percent of their program payments towards cost-effective onsite energy efficiency measures (ACEEE 2015).

The Arizona Public Service Company, the largest utility in Arizona, has been successful in the first years of the program. Arizona Public Service has reported cumulative energy savings equivalent to 3.2 percent of retail sales from 2011 to 2012, exceeding the 3 percent savings target. These savings have resulted in a net benefit to consumers of more than $200 million in 2012 alone (APS 2013). In 2012, Arizona electric utilities saved 693 GWh, or 1.66 percent of retail sales (ACEEE 2014d, 2015).

Website: http://www.azcc.gov/Divisions/Utilities/default.htm

Arkansas

Arkansas' EERS experience highlights the process the state went through to develop its program. Arkansas undertook a multiple-year development and engagement process before establishing their EERS in 2010. In October 2008, the APSC opened the Sustainability Energy Resources Docket (No. 08-144-U). This docket directed the APSC to explore the current status and potential for Arkansas' sustainable energy resources and technologies by looking at existing efforts within the state as well as nationwide. The APSC also established the Innovative Ratemaking Docket (No. 08-137-U) to explore how the utilization of new technologies and innovative regulatory frameworks can support energy efficiency efforts. From 2008 to 2010, the APSC engaged the community by holding 12 public workshops and filing over 250 testimonies, comments, and legal briefs in order to work towards the objectives put forward in the dockets (APSC 2010). During this time, APSC also directed electric and gas utilities to pilot a wide range of energy efficiency programs (ACEEE 2011).

[26] Load factors describes the relationship between annual peak end-use demand in MW (or peak output) and annual electricity sales (or generation) in MWh. The formula is *Annual Electricity Sales (MWh) / (Peak Demand (MW) * 8760 Hours per year).*

In December 2010, the APSC published the APSC Sustainable Energy Resources Action Plan for Arkansas (APSC 2010). The Action Plan established the EERS by including them in 10 orders designed to increase energy efficiency in Arkansas. The APSC issued orders to complement the EERS by:

- Aligning incentives of customers and utilities, accomplished by introducing utility performance incentives and a lost revenue adjustment mechanism to make up for decreased sales.
- Promoting a high standard for EM&V of energy efficiency programs.
- Promoting customized energy efficiency projects at large commercial and industrial facilities, enabling facilities to self-direct energy efficiency funds to which they are contributing (ACEEE 2011).

The Arkansas Action Plan established EERS incremental savings targets for utilities, rising from 0.25 percent of electricity sales in 2011 to 0.75 percent in 2013 and from 0.2 percent of gas sales in 2011 to 0.4 percent in 2013. Since then, targets have been scaled up to 0.9 percent of electricity sales and 0.6 percent of gas sales by 2015. The APSC is currently conducting an evaluation of the EERS to see how they can be improved before setting targets for 2016 and beyond (ACEEE 2015).[27]

Website: http://www.apscservices.info/ee.aspx

California

California's EERS experience highlights the state's reforms to align utility and other stakeholder incentives with EERS objectives. Since 2004, the California EERS programs have set ambitious energy savings goals for both electric and gas utilities. Following the passage of Assembly Bill 2021 in 2006, the California Energy Commission (CEC), CPUC, and other stakeholders were required to develop a statewide estimate of all cost-effective electricity and gas savings and to develop annual energy savings and demand reduction goals for the state's four largest IOUs. This study must be updated every 3 years (DSIRE 2014). Each IOU acts both as a portfolio manager and program administrator and seeks approval from CPUC (CPUC 2013). The energy efficiency program portfolio must meet California's cost-effectiveness tests, and CPUC must set energy savings goals for IOUs to achieve all cost-effective reductions identified by the IOUs. In addition, energy efficiency programs must align with CPUC strategic plan objectives, and 20 percent of the budget must be competitively bid on by third-party implementers (CPUC 2014a).

California found that the following mechanisms have led to the success of their EERS:

- A "loading order" for investing in energy resources, through which cost-effective energy efficiency and conservation resources are to be selected first, followed by onsite generation, then renewable generation. The cleanest available fossil fuel generation resources are acquired to meet any remaining resource needs (CPUC 2014a).
- Utilities are required to reduce their demand forecasts to reflect the adopted energy efficiency savings goals, and are therefore further motivated to ensure that reductions are achieved. The utilities' achievements are subject to rigorous EM&V, overseen by CPUC.

[27] In 2013, Arkansas was awarded $500,000 in competitive funding from DOE to help ensure that robust savings goals continue to be pursued during the second 3-year phase of the EERS rollout.

- CPUC also adopted decoupling ratemaking mechanisms that break the link between the utilities' revenues and sales, removing disincentives for utility investments in energy efficiency. (See Section 7.2, "Policies That Sustain Utility Financial Health.")
- The Energy Savings Performance Indicator provides financial incentives for achieving energy efficiency savings, setting strong goals, advocating for stronger building codes and appliance standards, and establishing "non-resource" programs that support the goals of cost-effective energy conservation but do not directly result in savings (DSIRE 2014).

The rules that govern all aspects of portfolio management and program administration are found in the CPUC energy efficiency policy manual (CPUC 2013). The energy savings goals were adopted by CPUC and established through a collaborative effort between the CEC and key stakeholders (CPUC 2004).

California has met its program targets and achieved considerable savings (ACEEE 2014b). In 2009, California IOUs invested $786 million in the state's EERS through ratepayer funds. This investment saved Californians 3,000 GWh of electricity (1.2 percent), 28 million therms of gas (0.2 percent), and over 540 MW of electricity demand (0.9 percent). Throughout the life of these measures, Californians are expected to save 30,000 GWh and 530 million therms. An estimated 60 percent of these savings and net savings would not have occurred without EERS program intervention (CPUC 2011; CEC 2015). From 2006 to 2014, accounting for program and customer costs, California's EERS program has resulted in overall savings of $1.8 billion (CPUC 2014a).

Websites:
http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm
http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/40212.pdf
http://www.cpuc.ca.gov/PUBLISHED/REPORT/28715.htm
http://www.cpuc.ca.gov/NR/rdonlyres/1E2FFBF2-E93D-4FEA-BD38-00D83576BB2E/0/CPUCEEPrimer_.pdf

Illinois

Illinois' EERS experience highlights a hybrid implementation approach between utilities and a state agency. The Illinois Power Agency Act of 2007 sets incremental electric and gas savings, ramping up from 0.2 percent electricity savings in 2008 to 2 percent in 2015 and thereafter. Gas savings of 0.2 percent start in 2011 and ramp up to 1.5 percent by 2019, with the goal of 8.5 percent cumulative savings for natural gas by 2020 (ACEEE 2015). This Act also divides the role of implementing the EERS between the electric utilities and the Illinois DCEO, with DCEO responsible for achieving 25 percent of the program's energy savings by targeting state and local governments, school districts, and low-income households. While targets have been set for each year of the program, expenditures are also now capped at 2 percent of the price per kWh, up from 0.5 percent at the start of the program. Due to the expenditure cap, the energy savings targets were revised downward for 2011–2013.

Illinois electric utilities ComEd and Ameren both exceeded their electricity savings goal for each of the first 5 years of the EERS. In 2012, ComEd and Ameren reported net savings of 828 GWh and 331 GWh respectively, amounting to around 1 percent of electricity use. In addition, gas utilities saved 24.5 million therms in 2012, just shy of their collective savings goal of 25.9 million therms (ACEEE 2014b).

The Illinois EERSs are part of a broader effort that includes an RPS requirement, and are intended to gain the combined benefits of reduced demand growth and increased clean generation. This twin approach has broad support from utilities, environmental and consumer groups, and other stakeholders.

Website: http://www.icc.illinois.gov/en/ecenergy.aspx

Vermont

Vermont's EERS experience highlights its program implementation through a single statewide administrator. Most EERS programs are created at the state level but implemented through state utilities. However, since Vermont has 22 municipally owned utilities, the state decided it was more efficient to implement its EERS through a single statewide administrator. In 1999, the Vermont PSB created a statewide EEU known as Efficiency Vermont, funded through a per-kWh fee on customers' electricity bills (Vermont PSB 2014). The state periodically issues a request for proposals to determine the statewide administrator for Efficiency Vermont. It also uses a performance-based contract to ensure performance against goals.

While Efficiency Vermont administers statewide energy efficiency programs, in 2000, the Vermont PSB allowed the City of Burlington Electric Department to implement these services in Burlington (BED 2014a). Each year, the Burlington Electric Department releases a plan coordinated with Efficiency Vermont to increase program efficacy and both EEUs are responsible for implementing energy efficiency measures for their respective areas.

Efficiency Vermont works with municipalities to improve energy efficiency by producing outreach and informational efficiency materials, such as the *Municipal Guide to Vermont Energy Codes and Above-Code Programs*. Efficiency Vermont also runs targeted programs, including:

- The Municipal Street Lighting Program, which offers financial incentives and guidance on switching to efficient LED technologies.
- The Light Meter Loan Program, which allows municipalities to borrow meters to determine appropriate street lighting levels and eliminate unnecessary lights (Efficiency Vermont 2014c).
- Energy competitions in schools and homes. For instance, the Whole School Energy Challenge reduced electricity consumption in 13 participating schools by 7 percent, while the Vermont Home Energy Challenge enlisted 79 communities in a competition to weatherize 3 percent of local homes in one year (Efficiency Vermont 2014a).

Efficiency Vermont has a 3-year electricity reduction target from 2012 to 2014 of 274,000 net MWh, equal to about 6.6 percent of total generation (ACEEE 2015). Through the end of 2013, savings totaled 198,150 kWh, or 72 percent of the target. Relative to a target of 41,920 kilowatts (kW) of saved peak summer demand, Vermont has achieved 25,724 kW (61 percent) of reductions. The program has also been cost-effective, with $2.30 of total electric benefits being generated for every dollar spent on the electricity demand programs. Efficiency Vermont is also 93 percent and 125 percent of the way towards meeting respective spending goals on programs geared towards low-income communities and the residential sector (Efficiency Vermont 2014a). As for regional targets, in 2013 the Burlington Electric Department reported electricity savings of 7,006 MWh, 95 percent of the way towards its goal of 7,334 MWh (BED 2014b). Efficiency Vermont has also set goals for specific towns with large peak demands to avoid the need for expensive new infrastructure that would raise rates statewide. For example, the St. Albans and Susie Wilson localities have achieved 71 percent and 104 percent of their respective goals to date (Efficiency Vermont 2014d).

Website: https://www.efficiencyvermont.com/About-Us

What States Can Do

States can look to other states for best practices, as both restructured and traditional utility markets have set EERS goals for utilities. For instance, in 2011, the District Department of Energy contracted with the Vermont Energy Investment Corporation to form the DC Sustainable Energy Partnership (DCSEU 2015). EERS goals can be administered in association with PBFs or regulated utility efficiency programs. Because an EERS can support multiple purposes, including Clean Air Act compliance plans, utility-sector resource plans, and climate action plans, states can set EERS goals within the context of broad energy and environmental policy goals. States with existing EERSs can continue to assess and refine the standards as new information about potential opportunities and successful approaches becomes available.

Action Steps for States

States have found that the key steps to establishing EERSs are:

- Conduct a robust analysis of energy efficiency potential, an economic assessment of potential benefits and costs, and a determination of the range of savings targets that would be realistic for the EERS.
- Establish a stakeholder engagement process to gather input and build support for the program.
- Design and develop the EERS program by determining appropriate goals and timeframes, the sectors covered by the goals, the way the program will be funded, the kinds of programs that can be implemented, and the interaction with other state and federal programs.
- Define an implementation and evaluation process that sets rules and procedures for identifying efficiency programs, funding sources, EM&V requirements and procedures, and general oversight.
- Provide for periodic evaluation and program review at specified intervals.
- Consider complementary policies that incentivize utilities to invest in energy efficiency.

Information Resources

Information about States

Title/Description	URL Address
ACEEE State and Local Policy Database. This database includes information on energy efficiency policies currently implemented at the state and local level. It tracks policy activity across multiple sectors, including government, utilities, transportation, buildings, and alternative approaches such as CHP and appliance standards.	http://database.aceee.org/
Arizona Corporation Commission (AZCC). The AZCC website contains information on Arizona's electric utilities, including an electronic docket for regulations, calendars, and current issues.	http://www.azcc.gov/Divisions/Utilities/default.htm
Energy Efficiency. This APSC website contains information on current energy efficiency rules, a Technical Reference Manual, and annual utility reports.	http://www.apscservices.info/ee.aspx
State of California Energy Action Plan. This website contains the text of the California Energy Action Plan.	http://docs.cpuc.ca.gov/published//REPORT/28715.htm
Energy Efficiency Potential and Goals Studies. This CPUC site has compiled information on the potential and goals set for energy efficiency in California, including the 2013 Navigant study.	http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm
CPUC Energy Efficiency Primer. This document provides an overview of CPUC regulation and goals for energy efficiency.	http://www.cpuc.ca.gov/NR/rdonlyres/1E2FFBF2-E93D-4FEA-BD38-00D83576BB2E/0/CPUCEEPrimer_.pdf
Illinois Commerce Commission. This site contains information on programs, services, hearings, workshops, and regulations related to electric utilities.	http://www.icc.illinois.gov/en/ecenergy.aspx
About Efficiency Vermont. This website provides resources to residences and businesses, including initiatives, plans, reports, and white papers.	https://www.efficiencyvermont.com/About-Us
Focus on Energy Program: Partnering with Wisconsin Utilities. This website provides resources for finding out about and participating in Wisconsin's energy efficiency programs.	https://focusonenergy.com/

EERS Policy Resources

Title/Description	URL Address
Measurement and Verification Portal. This website provides numerous resources, ranging from implementation guidelines to checklists and other resources, to help organizations implement an EM&V program.	http://ateam.lbl.gov/mv/
Guideline 14-2002 – Measurement of Energy and Demand Savings. This document provides guidelines for reliably measuring energy and demand savings of commercial equipment.	http://www.techstreet.com/ashrae/products/1645226
CALMAC. California's statewide CALMAC evaluation clearinghouse website contains resources for deemed savings and project-specific EM&V techniques.	http://www.calmac.org
The Efficiency Vermont Technical Reference Manual. Vermont provides a set of deemed-savings methods in this manual.	https://www.veic.org/resource-library/the-efficiency-vermont-technical-reference-manual-%28excerpts-from%29

Title/Description	URL Address
2005/2006 Biennial Plan: Minnesota Natural Gas and Electric Conservation Improvement Program. This plan was submitted to the Minnesota Department of Commerce by Xcel Energy on June 1, 2004.	http://pbadupws.nrc.gov/docs/ML0520/ML052010211.pdf
Interim Opinion: Updated Policy Rules for Post-2005 Energy Efficiency and Threshold Issues Related to Evaluation, Measurement and Verification of Energy Efficiency Programs. CPUC held several workshops on EM&V to discuss the performance basis, metrics, and protocols for energy efficiency program EM&V, including incentive, training, education, marketing, and outreach programs.	http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/45783.htm
IPMVP Public Library of Documents. IPMVP Inc. is a nonprofit organization that develops products and services to aid in the EM&V of energy and water savings resulting from energy/water efficiency projects—both retrofits and new construction. The site contains the IPMVP, a series of documents for use in developing an EM&V strategy, monitoring indoor environmental quality, and quantifying emission reductions.	http://www.evo-world.org/index.php?option=com_content&view=article&id=272&Itemid=379&lang=en
Energy Performance Contracts for Local Governments: Industry Standards and Best Practices Guide. EM&V guidelines are included in the New York State Energy Research and Development Authority's request for applications for performance contracting.	http://www.dec.ny.gov/docs/administration_pdf/epcguide.pdf
Sixth Northwest Conservation and Electric Power Plan. This document presents the 2010–2014 targeted conservation measures and economics.	http://www.nwcouncil.org/energy/powerplan/6/plan/
PA Knowledge Limited 2003: Standardized Methods for Free-Ridership and Spillover Evaluation-Task 5 Final Report. This 2003 report is used by Massachusetts utilities to estimate free ridership and spillover effects.	Contact PA Consulting at: http://www.paconsulting.com
Setting Energy Savings Targets for Utilities. This report reviews how states have set EERS targets, discusses the issues involved, and provides recommendations.	https://www4.eere.energy.gov/seeaction/system/files/documents/ratepayer_efficiency_targets.pdf
Southern California Edison's 2012 Demand Response Load Impact Evaluations Portfolio Summary. This report summarizes the load reduction capability from Southern California Edison's (SCE) portfolio of Demand Response (DR) programs.	http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/62A8F5E44C447F0688257B410052EC7B/$FILE/R.07-01-041_DR+OIR-SCE+DR+Portfolio+Summary+2012+-+Final.pdf
State Energy Efficiency Resource Standards: Design, Status, and Impacts. This 2014 report reviews the key design features of EERSs for electricity, explores state-level design variations in EERSs, and provides an estimate of the savings required by currently-specified EERSs in each state.	http://www.nrel.gov/docs/fy14osti/61023.pdf
Putting a Floor on Energy Savings: Comparing State Energy Efficiency Resource Standards. This study aggregates information about the requirements of existing EERS policies for electricity sales in the United States by converting quantitative goals into comparable terms across states and comparing U.S. policies to those of the European Union.	http://www.rff.org/RFF/Documents/RFF-DP-12-11.pdf

Examples of Legislation/Regulation

State	Title/Description	URL Address
Arizona	Arizona Administrative Code R14-2-2401. This code established an EERS target of 22 percent by 2020.	http://www.azsos.gov/public_services/Title_14/14-02.htm
Arkansas	Order Establishing a Collaborative to Develop an Evaluation, Measurement, and Verification Protocol and Propose EM&V Amendments to the Commission's Rules for Conservation and Energy Efficiency Programs. This document is part of a series of orders to update and further define energy efficiency programs.	http://www.apscservices.info/pdf/08/08-144-u_155_1.pdf
	APSC Sustainable Energy Resources (SER) Action Guide. This document established an initial EERS.	http://www.apscservices.info/pdf/08/08-144-U_153_1.pdf
California	California Interim Opinion: Administrative Structure for Energy Efficiency (Decision 05-01-055). This CPUC rule sets the administrative structure and process for energy efficiency programs.	http://docs.cpuc.ca.gov/published//FINAL_DECISION/43628.htm
	Decision establishing energy efficiency savings goals and approving 2015 energy efficiency programs and budgets. This decision, an EERS update, was released for public comment in September 2014.	http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M107/K150/107150165.PDF
Illinois	Interim Opinion on the Administrative Structure for Energy Efficiency: Threshold Issues. This act, also known as the Illinois Power Agency Act, established EERSs that require incremental annual electric and savings.	http://www.ilga.gov/legislation/ilcs/ilcs4.asp?DocName=002038550HArt%2E+1&ActID=2934&ChapterID=5&SeqStart=100000&SeqEnd=3700000
Vermont	Triennial Plan: 2015–2017. This Efficiency Vermont document outlines the triennial plan for reduction goals in Vermont.	https://www.efficiencyvermont.com/docs/about_efficiency_vermont/annual_plans/evt-triennial-plan-2015-2017.pdf

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4.2 Energy Efficiency Programs

Policy Description and Objective

Summary

States have found that well-designed and administered energy efficiency programs increase public and private sector investments in cost-effective energy efficiency, resulting in reduced energy costs for electricity customers, emission reductions, and enhanced reliability. Programs can be used in conjunction with other strategies to achieve market transformation, causing lasting change in the availability and demand for energy-efficient goods and services.

Energy efficiency programs provide a range of financial and other incentives to encourage investments in energy-efficient technologies, related services, and/or behavior change. These incentives range from simple cash rebates for the purchase of efficient products to bundled customized financial incentives and technical assistance.

State executive and legislative branches rely on a combination of authorities and funding sources to administer and oversee successful energy efficiency programs. State policy makers may allow state energy offices, utility companies and/or third-party administrators to deliver energy efficiency programs. In recent years, state funding for electricity energy efficiency programs has increased significantly from $1.6 billion in 2006 to $6.3 billion in 2013, with program administrators in all 50 states reporting savings. As a result, individual states have saved up to 2.1 percent of total electricity demand due to energy efficiency programs (ACEEE 2014b).

The majority of funding for energy efficiency programs comes directly from utility customers, also referred to as ratepayers.[28] State legislators and state utility commissions play a lead role in establishing public benefits funds (PBFs), also known as system benefits charges, to fund energy efficiency programs. PBFs are typically created by levying a small charge on every customer's electricity bill. Alternatively, some state utility commissions allow the utility to provide an annual revenue stream to fund energy efficiency programs by expensing or capitalizing the funds from the utility company's total revenue without itemizing a charge on the customer bills. According to a study by Lawrence Berkeley National Laboratory, ratepayer-funded electricity efficiency program spending is projected to continue growing at a substantial rate, reaching between $6.5 billion and $15.6 billion in 2025 (LBNL 2013).[29] Where there are comprehensive statewide programs in place, funding levels range from 2.83 to 8.55 percent of total utility revenues (ACEEE 2014b).

Objective

The objectives of energy efficiency programs include:

- Reducing customers' energy costs.
- Meeting customers' demand for electricity services without generating electricity at power plants.
- Meeting energy savings goals (see Section 4.1, "Energy Efficiency Resource Standards").
- Stimulating local economic development and new jobs.
- Reducing the environmental impacts of meeting electricity service needs.
- Supporting electricity system reliability by decreasing electricity demand.

[28] As discussed later in this section, in addition to ratepayer-funded programs, energy efficiency programs may also be funded through other sources, such as state budgets and proceeds from related auctions.

[29] Values for both electricity and natural gas programs provided in nominal dollars from LBNL (2013).

Most states use energy efficiency programs to reduce total overall energy consumption in buildings and homes. Energy efficiency programs also reduce energy waste in agricultural and industrial facilities, support efficiency by taking advantage of thermal energy applications (including combined heat and power [CHP]), reduce peak demand, support consumer education, and demonstrate new energy efficiency technologies and practices. Some of these objectives are also discussed in Chapter 6, "Policy Considerations for Combined Heat and Power," and Section 7.5, "Maximizing Grid Investments to Achieve Energy Efficiency and Improve Renewable Energy Integration."

Benefits

Well-designed and administered energy efficiency programs can reduce energy demand at a lower cost than supply options (see Figure 4.2.1) and deliver a variety of benefits. They lower energy costs for utility customers by reducing average bills and limiting future energy price increases. By reducing demand, they improve the reliability of the electricity grid and avoid emissions.

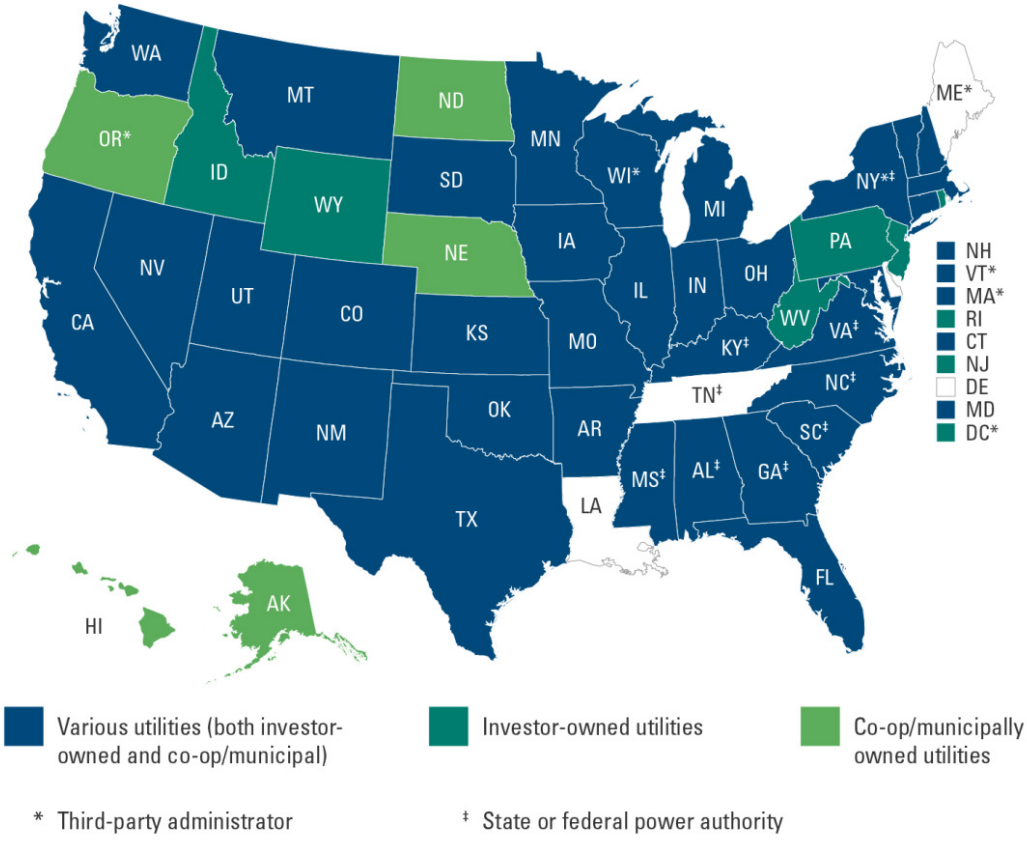
Energy efficiency programs play an important role in correcting market failures and addressing barriers to investment in cost-effective, beneficial energy efficiency opportunities.

Energy efficiency programs also help create local jobs by lowering energy costs and stimulating new public and private sector investments: initial investments in energy efficiency generated about 11 jobs per million dollars of investment (PNNL 2014).

States with Energy Efficiency Programs

Forty-eight states, as well as Washington, D.C., offer energy efficiency programs. These states have one or more entities administering programs in the state, such as statewide third-party program administrators, utility companies, and state energy offices. Figure 4.2.1 illustrates which entity in each state reported energy savings from programs during 2012. Investor-owned utilities reported approximately 75 percent of electricity savings, while third-party administrators and publicly owned utilities reported the majority of additional savings. Annual electricity savings were also reported by cooperatively owned utilities, as well as state and federal power authorities who administer energy efficiency programs (EIA 2012). States have found that coordination across entities administering programs can support greater energy savings and broader market transformation.

Figure 4.2.1: Entities Reporting Energy Savings from Energy Efficiency Programs by State, 2012



Source: Derived from EIA 2012 data, using annual electricity savings from energy efficiency programs for 2012.

Designing an Effective Policy for Energy Efficiency Programs

There are several key issues that states consider when establishing policies that support delivery of energy efficiency programs. These issues include identifying key participants and their roles, calculating appropriate funding levels, determining timing and duration, developing a portfolio of activities, and interacting with other state and federal policies.

Participants

- *State legislatures.* Legislation may be required to establish or expand energy efficiency programs, particularly if statewide program administrator and/or funding mechanisms, such as PBFs, are to be used. The state legislatures may also need to authorize and ensure periodic reviews of energy efficiency programs implemented by utilities and third-party administrators that are not otherwise under the jurisdiction of the state public utility commission (PUC). Legislation may also determine energy efficiency goals and objectives, establish funding, specify implementing and oversight organizations, and review program authorization at specified intervals.

- *State energy offices.* State energy officials, often on behalf of the state governor, play an important role in developing policies to support energy efficiency programs and in reporting on results of policies and programs. State energy offices may also administer energy efficiency programs, particularly those funded through state budgets and/or federal grants.
- *PUCs.* PUCs play a key role in authorizing, reviewing, and approving ratepayer-funded energy efficiency program plans, approving utility cost recovery and related ratemaking considerations (also see Section 7.2), approving methodologies used to evaluate savings, and ensuring that programs are achieving anticipated results. PUCs advance these roles through regulatory processes that allow for stakeholder participation. In some states, PUCs also have authority over specific aspects of cooperatively and publicly owned utilities that give them jurisdiction over energy efficiency programs. State PUCs that require ratepayer-funded energy efficiency programs to be administered by third-party entities, instead of the utility companies, may enter into the contractual arrangement with the third-party program administrators.
- *Other state agencies.* State environmental offices may play a role in supporting policy, establishing funding, and implementing energy efficiency programs. This is particularly true when these programs support environmental policy, such as greenhouse gas (GHG) markets (see more information on Regional Greenhouse Gas Initiative [RGGI] energy efficiency set-asides in Chapter 3, "Funding and Financial Incentive Policies") or Climate Action Plans. State agencies that deliver assistance from the Low-Income Home Energy Assistance Program (LIHEAP) also help implement energy efficiency programs to improve energy affordability. State energy offices may also administer all or part of the energy efficiency programs, including those that weatherize low-income homes.
- *Utilities.* In most states, utilities serve as program administrators for the energy efficiency programs. For those programs in which the utility does not directly serve as program administrator, the utility may still be involved in funding, such as processing PBF charges on customer bills and providing data sources for reporting results. Utilities may also coordinate with other energy efficiency program administrators, including the state energy office, LIHEAP office, and third-party administrators, during program design and implementation.
- *Customers.* Industrial customers and consumer advocates are typically active participants in energy efficiency program proceedings at state PUCs. They help determine the distribution of charges to customers to fund programs as well as which customer classes will be offered programs, such as low-income, residential, commercial and industrial customers.
- *Public and private sector organizations*. Businesses and other non-governmental organizations, including environmental groups, will also participate in policy design, adoption, and implementation.

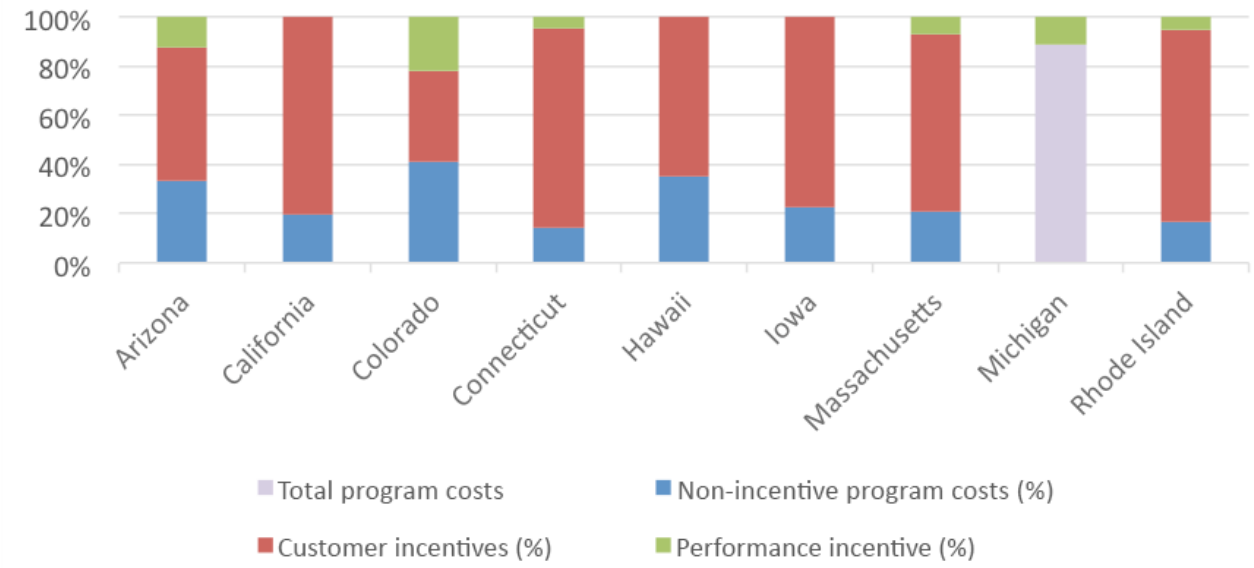
Responsibility and Coverage

States provide policy direction on which customer classes are to be offered programs (i.e., low-income, residential, commercial, and industrial). Policy direction is often provided at a portfolio level, leaving flexibility for program administrators to design and modify specific program offerings to meet policy goals. Energy efficiency program coverage may also in part be affected by the jurisdiction of the agency establishing and implementing the policy. For example, the PUCs in the majority of states do not have authority over cooperatively or municipally owned utilities, hence limiting state PUC implementation of energy efficiency program policies administered by investor-owned utilities. The board of directors or municipal agency overseeing the utility will typically determine energy efficiency program coverage for a cooperatively or municipally owned utility.

Funding

Energy efficiency program funding covers the costs incurred by the program administrators and the incentives paid to customers. Administrative costs are distributed across several activities, including marketing, design and planning, and measurement and verification. Cost distribution across activities varies, with some states setting policy direction on the level of funding directed to administration versus direct incentives. Figure 4.2.2 provides an illustrative overview of how the distribution of program costs varies across key activities.

Figure 4.2.2: Electricity Energy Efficiency Program Costs by Type



Note: "Customer incentives" refers to rebates, discounts, and other forms of financial incentives received by customers that participate in the energy efficiency program. "Performance incentives" refer to financial rewards that may be provided to the program administrator for reaching or exceeding pre-established performance targets, as further discussed in Section 7.2, "Policies That Sustain Utility Financial Health."

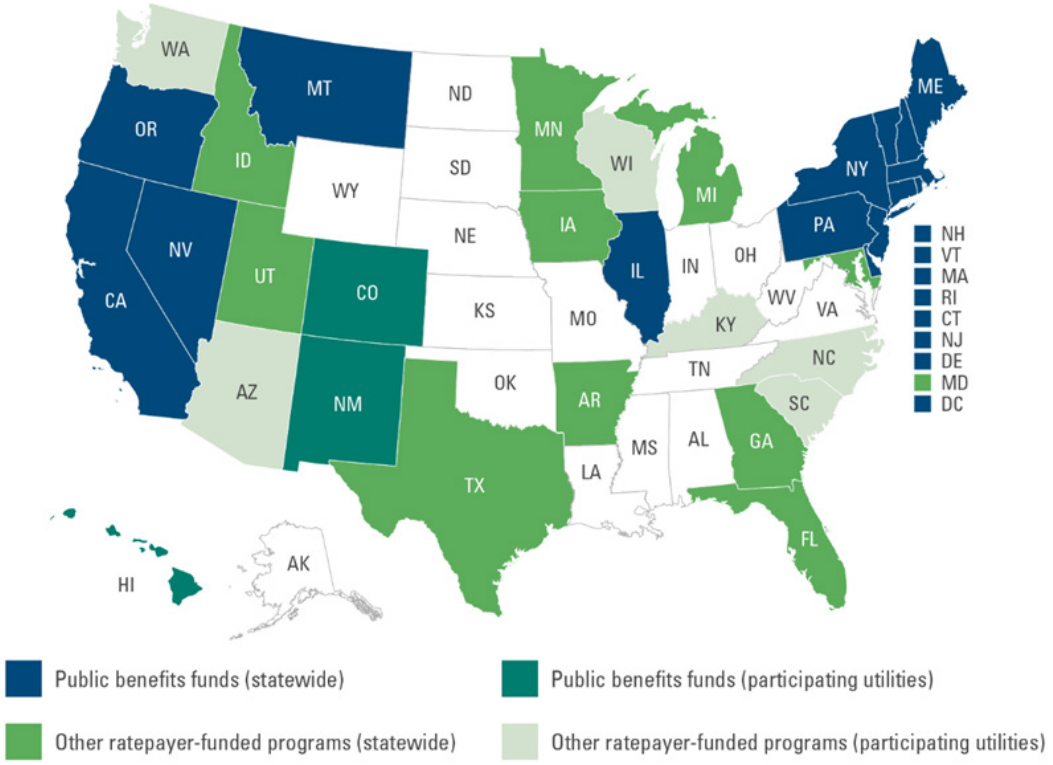
Source: ACEEE 2014c

There are two basic approaches for administering the energy efficiency program funds, both of which can affect how costs are recovered. Under the first and most common approach, money is collected and spent during the current year in an expenses-based mode. If there is an under- or over-collection, it floats in an account and is adjusted in the following year. This account may be controlled by a utility or a third-party administrator, depending upon the type of administering body. (See also "Administering Body" later in this section.) The second approach, which is less common, is to use the energy efficiency program funds to capitalize a revolving fund for grants and loans, which is replenished or expanded when new funds are available.

Funding sources for energy efficiency programs vary, but most states use money collected through customer utility bills. PBFs are a common funding approach; they apply surcharges on customer bills that typically range from $1 to $4 per megawatt-hour (MWh), which translates to well under a half-cent increase on each kilowatt-hour (kWh) of electricity usage (ACEEE 2013). As of March 2015, PBFs are used to fund energy efficiency programs in Washington D.C. and 18 states. In 15 of these states (plus D.C.), energy efficiency PBFs are required statewide, while in the other three, only certain participating utilities use PBFs. An additional 16

states offer energy efficiency programs through other ratepayer-funded mechanisms, but not through a PBF policy. Figure 4.2.3 summarizes these program funding approaches by state.

Figure 4.2.3: Energy Efficiency Incentive Mechanisms by State



Note: States with energy efficiency load funds supported by surcharges, tariffs, or riders were not included. Other ratepayer-funded programs include surcharges, tariffs, riders, and modified base rates that contribute to energy efficiency funds that are not considered PBFs.

Sources: ACEEE 2014a; DSIRE 2015

Utilities that run energy efficiency programs may also recover program costs from their operating budgets, with funding levels and cost distribution across customers determined as part of the broader ratemaking process. Other energy efficiency program funding sources include proceeds from emissions allowance auctions, such as in RGGI states;[30] from energy efficiency programs bidding into electricity capacity markets operated by the New England Independent System Operator and the PJM Interconnection; and from U.S. Department of Agriculture (USDA) grants and loans for energy efficiency programs in rural communities. State budgets and grants from foundations and the federal government (including formula grants and competitive awards from the U.S. Department of Energy [DOE]) fund programs administered by state energy offices. State energy efficiency programs can also coordinate with weatherization assistance programs to leverage an additional funding source while also ensuring complementary energy efficiency program design and implementation for low-income residential customers.

[30] Three states—Connecticut, Massachusetts, and New Hampshire—provide some funding for energy efficiency programs through proceeds from the RGGI auction (ACEEE 2014b).

Providing adequate, consistent, and stable funding is critical for the program's success and for ensuring the private sector's continued participation. There have been market interruptions in cases where some states facing budget shortfalls deferred resources from ratepayer energy efficiency funding sources for other purposes. Some states have developed legislative language to guard against this. For example, Vermont legislation states, "Funds collected through an energy efficiency charge shall not be funds of the state, shall not be available to meet the general obligations of the government, and shall not be included in the financial reports of the state" (State of Vermont 1999).

Best Practices: Developing and Adopting State Energy Efficiency Programs

The best practices identified below will help states develop effective energy efficiency programs. These best practices are based on the experiences of states that have longstanding, highly effective energy efficiency portfolios.

- Determine the cost-effective, achievable potential for energy efficiency in the state. A growing number of states consider non-energy benefits of energy efficiency programs when reviewing cost-effectiveness.
- Start with low-cost, well-established programs and efficiency investments, and build the program over time.
- Assess the level and diversity of support for energy efficiency programs. Engage key stakeholders (i.e., utilities; residential, commercial, and industrial customers; municipalities; trade allies; and environmental groups) and experts collaboratively to help design the program—including its administering organization, funding, duration, and evaluation methods.
- Establish long-term policy direction and funding approach. Consider specific provisions to prevent the energy efficiency program funds from being used for other purposes or to be comingled with general state budget funds. Make funding a minimum level, not a cap, on investment in energy efficiency.
- Ensure that the energy efficiency programs serve the needs of diverse customer classes and stakeholder groups. Managing efficiency programs through portfolios allows program administrators to match incentive types and program features to different customer types and market needs. Portfolios can evolve over time, from simpler and fewer incentive types early on to more feature-rich and diverse incentives and services later on.
- Determine the administering organization(s). The options include utilities, state agencies, or independent organizations. If utilities are selected to administer programs, it is advisable to develop policies that align the utility business model with the goal of achieving energy efficiency. (For more information and examples of these policies, see Section 7.2, "Policies That Sustain Utility Financial Health.")
- Establish effective evaluation methods that build on proven approaches and are appropriate given the chosen program design. Evaluation methods should be rigorous enough to estimate program impacts and other benefits and simple enough to minimize administrative costs.

Timing and Duration

Depending on the resources available to them, such as their ability to consult with outside experts, program administrators that do not already have programs can engage external stakeholders, design energy efficiency programs, and compile necessary documentation for state approval (e.g., through a PUC docket) within a 1 to 2 year timeframe. In reality, most states have some sort of ratepayer-funded energy efficiency programming, and those that have been offering programs for several years continuously evaluate their program offerings and performance as they plan for the next program cycle. Designing new programs may require 90 to 120 days, with a filing made to their PUC within 6 months for approval.

Because ratepayer-funded programs, including those funded by PBFs, require state PUC approval, many states approve multi-year program plans to reduce administrative costs and allow programs to operate more effectively in the market. Typically, states approve programs for 1 to 3 years, with most states conducting reviews at least annually to ensure costs and savings are on track.

To maintain funding and support for energy efficiency programs, it is also valuable for states to collect and share information on program performance and to educate stakeholders about the energy, economic, and environmental benefits of energy efficiency programs.

Developing a Portfolio of Activities

Targeting Efficiency Investments

Most program portfolios are informed by energy efficiency potential studies that identify cost-effective energy efficiency program opportunities. Usually some expert judgment is required to determine how much of that potential is achievable and at what cost. Depending on the program type, once program administrators have received regulatory approval, turnkey programs such as lighting and appliance programs can launch and begin to achieve results within a 6 to 12 month timeframe. Programs that require infrastructure development such as whole-home or whole-building programs will be slower to ramp up. Depending on market conditions, they may be best introduced as pilot programs that are scaled up once the program administrator has gained operational experience and developed relationships with critical trade allies.

State agencies, particularly PUCs, often provide policy direction on energy efficiency programming to meet short and longer term resource needs, maintain cost-effectiveness, and ensure equitable ratepayer treatment. Where state PUCs lack jurisdiction over energy efficiency programs administered by municipally and cooperatively owned utilities, the utility's board of directors or local government may provide similar direction. Key considerations for energy efficiency include the following:

- Customer classes that need to be served, including hard-to-reach customer classes. States may also distinguish between new and existing equipment and buildings within customer classes.
- Distribution of benefits across customer classes and service territories.
- Whether cost-effectiveness should be assessed at the portfolio level, program customer sector, or measure level, and what cost-effectiveness tests should be used to screen programs (see additional information on cost-effectiveness below).
- Other social and environmental benefits (e.g., serving low-income customers, reducing air pollutants, reducing water consumption, and improving reliability of the electricity grid).
- Supporting technology research, development, and demonstration by identifying and verifying the performance of emerging technologies, practices, or innovative program models.

States may also use energy efficiency programs to reduce electricity consumption during peak demand periods, thereby supporting greater system reliability. Since utilities incur higher costs to provide electricity during periods of high usage, peak hour reductions can also improve the program's cost-effectiveness. Programs that target energy use during peak periods may include rebates for high-efficiency air conditioners.

In addition, program administrators also invest in demand response programs that involve users curtailing or shifting consumption during specific times of the day (also see Section 7.5, "Maximizing Grid Investments to Achieve Energy Efficiency and Improve Renewable Energy Integration"). Though demand response programs may result in net reductions in total energy use, the magnitude is typically less than energy efficiency programs because load changes occur in more limited hours throughout the year.

Furthermore, some states target a portion of their efficiency investments to heavily populated areas or business districts; this helps alleviate transmission congestion and offsets or postpones transmission

infrastructure investments. By linking program savings to constrained areas, the cost-effectiveness of the energy efficiency program may improve, while all electricity customers benefit when reliable energy supply is provided without incurring costly capital investments in the system.

Cost-Effectiveness

Many states incorporate cost-effectiveness analysis into the design and evaluation of their programs to determine whether the benefits exceed the costs. This helps ensure the effective use of program funds and can be used to compare program and technology performance in developing effective future programs. Table 4.2.1 shows cost-effectiveness tests commonly used by states. These are often applied at the portfolio level, though individual measures and programs can be further screened based on both the extent to which benefits exceed costs and on other aforementioned portfolio considerations.

Table 4.2.1: Primary Cost-Effectiveness Test by State

All tests	TRC/SCT Primary Threshold	UCT Primary Threshold	Combined TRC/UCT threshold
IA, IN, NC	CO, DE, FL, IL, MA, ME, MN, MO, NH, NV, OH, OR, PA, RI, VT, WA, WI	CT, MI, NM, TX, UT	CA, OR

Sources: Cadmus and Hedman 2012; SWEEP 2014

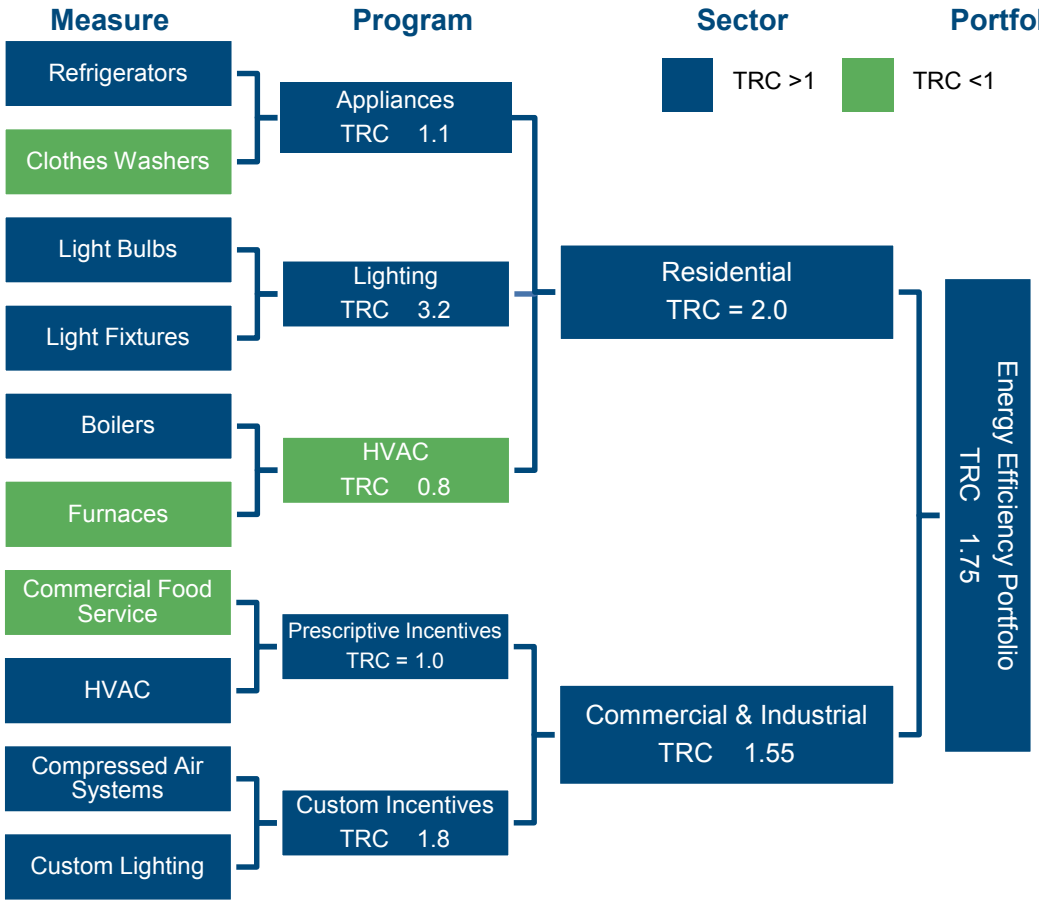
According to the American Council for an Energy-Efficient Economy (ACEEE), most states use multiple tests, although 29 states primarily use the Total Resource Cost (TRC) Test (ACEEE 2012). The TRC, as well as the Societal Cost Test (SCT), assess the net lifetime benefits and costs of a measure or program, accounting for both the utility and program participant perspectives. The SCT differs from the TRC in that it includes some non-energy benefits. As with other cost-effectiveness tests, if the benefit-cost ratio is greater than one, it is deemed to be cost-effective. In many cases, states require programs to assess cost-effectiveness from multiple perspectives, mainly because they provide useful insights into the range of issues a program might raise (ACEEE 2010). For example, the Participant Cost Test and the Program Administrator Cost Test, also known as the Utility Cost Test (UCT), are sometimes used to help design programs and incentive levels.

A longer term trend has been the movement away from the Ratepayer Impact Measure (RIM) test because it does not account for the interactive effect of reduced energy demand from efficiency investments on longer term rates and customer bills. Under the RIM test, any program that increases rates would not pass, even if total bills to customers are reduced.

Cost-effectiveness test results are typically reported in terms of the benefit-cost ratio. A larger benefit-cost ratio means that the program is more cost-effective. States may also express program costs and benefits in terms of $/kWh since such a metric may be effective when communicating to consumers and legislators. This metric also allows utilities and their regulators can compare energy efficiency to other resources, such as new generation.

As illustrated in Figure 4.2.4, cost-effectiveness is generally evaluated at the following four levels: measure, program, sector, and portfolio. Evaluation at the portfolio level is the most flexible; programs can be viewed together for cost-effectiveness purposes, allowing program planners to consider all customer classes, even though some measures and programs may not pass cost-effectiveness tests when looking at them discretely.

Figure 4.2.4: Illustrative Example of Cost-Effectiveness at Measure, Program, Sector, and Portfolio Levels



Source: NAPEE 2008

Interaction with Federal Programs

State energy efficiency programs interact with several federal programs, such as federal energy efficiency standards for equipment, appliances, and lighting. State programs complement federal standards by supporting broader adoption of newer, more efficient products and help bring down the costs for more efficient technologies. However, program administrators can only take credit for the energy savings above the minimum federal standards. Therefore, once a new federal standard advances, program administrators modify their programs to continue achieving cost-effective energy savings. For example, due to recent changes to lighting efficiency standards, state energy efficiency programs were modified to promote new lighting technologies such as LEDs (EPA 2011).

State policy-makers and energy efficiency program administrators should also be aware of other federal programs to avoid duplication and to help properly design programs that complement existing federal financial incentives and assistance. For example, if a federal tax credit is available in a given year, the magnitude of the program rebate or incentives should be recalculated to reflect the additional funding stream. Also, state energy efficiency program administrators may be able to leverage federal technical assistance and tools in their own program design to help reduce costs while also supporting a robust market for energy efficiency

products and services. Federal programs providing such technical assistance, tools, and guidance include, but are not limited to:

- *ENERGY STAR®.* EPA's ENERGY STAR program is the simple choice for energy efficiency. For more than 20 years, people across America have looked to ENERGY STAR for guidance on saving energy, saving money, and protecting the environment. Behind each blue label is a product, building, home, or facility that is independently certified to use less energy and cause fewer of the emissions that contribute to climate change. EPA offers technical assistance, tools, and resources to energy efficiency program administrators who leverage ENERGY STAR in their residential, commercial, and industrial efficiency programs.[31] Numerous tools and others resources are available free of charge to ENERGY STAR partners (ENERGY STAR 2014a, 2014b). Approximately 700 energy efficiency program administrators formally partner with ENERGY STAR to reduce program costs and implementation timelines while increasing program effectiveness. Implementation costs can be reduced because the ENERGY STAR program:
  - Defines efficiency through voluntary requirements adopted by more than 1,800 manufacturing partners and more than 4,800 home builders.
  - Develops standardized metrics to measure efficiency of commercial buildings and manufacturing plants, and recognizes the top performers through the EPA ENERGY STAR Portfolio Manager® tool32 for buildings and the ENERGY STAR Energy Performance Indicators for plants. 33
  - Ensures integrity through third-party certification and verification for products, homes, and buildings.
  - Makes it easy for consumers and businesses to identify and ask for efficient products, services, homes, and buildings.
  - Spurs supply and demand through channel marketing and consumer outreach.
  - Allows state and local energy efficiency programs to focus resources on other persistent barriers.
  - Facilitates energy efficiency program best practices and partner networking.

ENERGY STAR Industrial

Industrial plants can be large consumers of electricity. Therefore, many tools and resources exist to help states develop and deliver strong programs for industrial energy improvements. For example, ENERGY STAR for Industry provides industry, states, and utilities proven energy efficiency strategies and tools that are adoptable within any manufacturing sector. These cost-effective resources (such as sector energy guides, plant energy benchmarks, and the ENERGY STAR Guidelines for Energy Management) help states and utilities 1) evaluate, identify, and understand potential energy savings at specific types of manufacturing plants, 2) build strategic energy management capability at manufacturing plants, and 3) develop cost-effective programs that promote continuous energy-efficient improvements for sustained savings at manufacturing plants.

- *State and Local Energy Efficiency Action Network (SEE Action)*. SEE Action is a state- and local-led effort facilitated by DOE and EPA to achieve all cost-effective energy efficiency by 2020. SEE Action offers resources, discussion forums, and technical assistance to state and local decision-makers. State policy-makers and program administrators use SEE Action tools and resources to learn about policies and best practices from other states when adopting and implementing energy efficiency programs.

[31] www.energystar.gov.

[32] For more information on ENERGY STAR Portfolio Manager, see http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/learn-how-portfolio-manager.

[33] For more information on ENERGY STAR Energy Performance Indicators for plants, see www.energystar.gov/epis.

- *Better Buildings and Better Plants Programs.* Through the Better Buildings and Better Plants Programs, DOE is advancing several strategies designed to make state, local, commercial, industrial, and residential buildings 20 percent more energy-efficient over the next 10 years and accelerate private sector investment in energy efficiency (DOE 2014). State policy-makers and energy efficiency program administrators can take advantage of training, tools, and technical assistance, as well as demonstrate their leadership on energy efficiency through the Better Buildings Challenge. As of February 2015, eight states have committed to the goals of the Challenge. Better Buildings has also launched Accelerators to promote increased use of energy savings performance contracts with 14 state partners, as well as high-performance outdoor lighting with two state partners.

The federal government also provides direct financial support to states, local governments, and utilities which may be used to support energy efficiency programs. Financial support is available via loan, grant, and cooperative agreement programs, each with their own unique eligibility and funding requirements. Federal funding sources include, but are not limited to:

- *State Energy Program (SEP)*. The SEP helps states establish and implement energy efficiency and renewable energy plans, policies, and programs to reduce energy costs, increase competitiveness, enhance economic development, improve emergency planning, and improve the environment. SEP provides state energy offices with formula-based grants that allow states and U.S. territories, as well as Washington, D.C., to advance their energy priorities by designing and implementing energy efficiency and renewable energy programs. SEP also provides funding on a competitive basis to states, targeting transformational projects within state energy offices that create more public-private partnerships initiated by states within and outside of their borders to address critical clean energy challenges. In addition, the American Recovery and Reinvestment Act (ARRA) of 2009 supported an increase in energy efficiency and other energy programming via state energy offices. Many of these programs still exist and leverage ratepayer-funded energy efficiency programs, such as those funded by PBFs, by coordinating activities with utilities and other energy efficiency program administrators.
- *Rural Utilities Service Loans.* In December 2013, the USDA Rural Utilities Service finalized a rulemaking that established a new Energy Efficiency and Loan Conservation Program (USDA 2013). Through this program, utilities in rural areas may apply for financing support to administer customer programs for energy efficiency and renewable energy. These include, but not limited to, community awareness and outreach programs, energy audits, energy efficiency measures on a consumer premises, and re-lamping to more efficient lighting. States may look to leverage these loans to help fund energy efficiency programs run by cooperatively and municipally owned utilities serving rural communities.
- *Rural Energy for America Program (REAP).* Through REAP, USDA provides grants and loan guarantees to agricultural producers and rural businesses for energy efficiency and renewable energy. These funds are used to make direct energy efficiency improvements, install onsite renewable generation and CHP, and conduct energy audits and feasibility studies. State energy efficiency programs offered to rural communities and the agricultural sector may look to leverage and complement REAP funding opportunities.

As part of their efforts to reduce costs and comply with Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," federal facilities across the country may consider taking advantage of energy efficiency and demand response programs offered to them by the utility or state in which

they are located. [34] Energy efficiency program administrators offering programs to the federal sector may need to consider the unique ownership and fiscal characteristics of the sector.

Interaction with Local and State Policies

State energy efficiency programs can also support several of the local and state policies discussed in this report, including energy codes (see Section 4.3), standards (see Section 4.4), tax incentives and financing (see Chapter 3), and electric utility policy actions (see Chapter 7). Similar to the interactions with federal policies discussed above, program administrators can leverage existing state policies and programs to support broader market transformation and avoid duplicative efforts. For example, energy efficiency programs can support energy code implementation, encourage voluntary stretch codes that offer additional savings, and help document code compliance.

Even if the utility does not administer the energy efficiency program, the energy and peak demand savings from programs are typically reflected in utility integrated resource plans. Program savings and costs must be projected and measured in order to incorporate energy efficiency for least cost service (see Section 7.1). States are also adopting policies such as decoupling and performance incentives to address the utility's inherent financial disincentive to maximize energy savings. Successful energy efficiency programs will reduce sales, making it difficult for the utility to recover their fixed costs under traditional utility regulation (see Section 7.2). Some states have required that utilities offer customers programs to take advantage of data from new electricity grid technologies, such as advanced meters and distribution automation systems. Offering energy efficiency and/or demand response programs can help make the business case for infrastructure investments and support customer acceptance of modern grid investments (see Section 7.5 for more information).

Over the last several years, more than 10 local jurisdictions and the states of California and Washington have adopted policies requiring building owners to measure and share their energy use. These policies can benefit other state energy efficiency programs and may also provide direct efficiency improvements (EPA 2012). They increase customer awareness of the opportunity to make energy efficiency investments in their facilities, priming the marketplace for customers to actively participate in energy efficiency programs. In many jurisdictions, the building energy use is to be disclosed publicly, providing energy efficiency program administrators with a new dataset to inform program design and delivery.

[34] See http://sustainability.performance.gov/.

Benchmarking/Disclosure Policies Example

In 2010, the Seattle City Council unanimously passed an ordinance requiring owners of commercial and multifamily buildings with four or more units to benchmark energy performance in the EPA ENERGY STAR Portfolio Manager tool. They were also required to disclose current benchmarking to the city, as well as prospective tenants, buyers, and financers (note that similar mandates in Washington, D.C., New York City, and other jurisdictions require annual public disclosure of benchmarking results). Compliance and reporting are being phased in over time based on building square footage.

The benchmarking policy was developed with guidance from local industry leaders and enacted as part of the 2009–2013 Climate Action Plan. By 2030, the policy aims to reduce commercial buildings energy use by 10 percent, residential building energy use (including multifamily) by 20 percent, and GHG intensity of all fuels by 25 percent (http://www.seattle.gov/Documents/Departments/OSE/EBR-2011-2012-report.pdf).

As of January 2014, the compliance rate was an astounding 93 percent of all affected buildings, and the city has found that performance data use by building owners is spurring local competition. The city estimates that if the worst performing buildings improved energy performance to median performance levels, total annual bill savings would surpass $55 million and annual energy use would decline 25 percent.

In 2014, DOE awarded an SEP competitive grant to Washington State in order to develop uniform, mandatory statewide benchmarking and disclosure policies.

Program Implementation and Evaluation

Energy efficiency program implementation and evaluation involves several key elements. Additional guidance and other resources for program implementation and evaluation are summarized at the end of this section. Given the long history of energy efficiency program offerings across the country, several program best practices have emerged, as well as existing networks and organizations for sharing model practices and lessons learned at the regional and national level, as listed in the Resources tables at the end of this chapter.

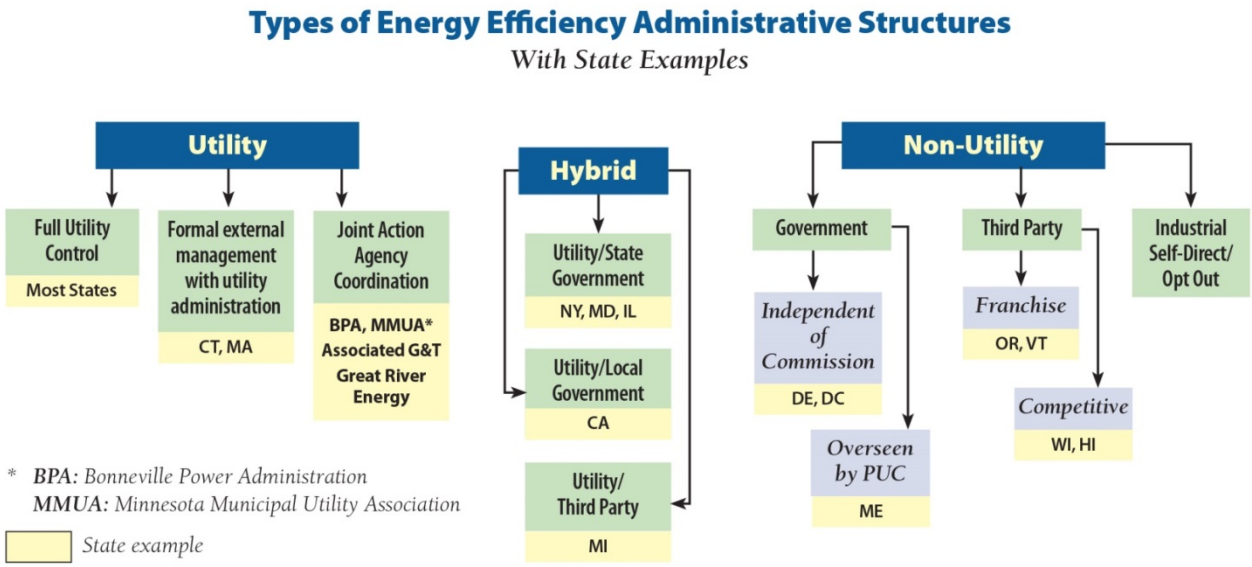
Administering Body

The administrative structure for energy efficiency programs varies by the type of funding source and state. For programs run by the state government, either a state energy office or energy efficiency program-specific state entity serves as program administrator. For programs funded by customers via their utility rates or PBFs, also referred to as ratepayer-funded programs, the utility or a state-designated third-party administrator typically administers programs under the oversight of the state utility commission or utility board of directors. Figure 4.2.5 provides an overview of different administrator options for ratepayer-funded programs.

States have developed effective programs using each administrative model; institutional history typically determines the entities best suited to administer programs. In many states, utilities have the capital, personnel, and customer relations channels that enable them to reach broad customer markets effectively. Thus, they are the most common administering entity.

However, in some states, particularly those served by numerous smaller utilities, a statewide effort may enable programs to develop a strong management capacity for designing and implementing programs and to more cost-effectively engage trade allies and educate consumers.

Figure 4.2.5: Types of Ratepayer-Funded Energy Efficiency Administrative Structures with State Examples



Note: This figure refers to types of administrative structures for consumer-funded energy efficiency programs. State examples refer to the primary administrative structure existing in each state.

Source: Adapted from RAP 2011.

Energy Efficiency Program Planning and Design

Developing Program Plans

The program oversight authority typically requires program administrators to submit detailed program plans for approval before beginning program implementation. At a minimum, good program plans include the following information for the overall program and for the individual programs that comprise the overall approach:

- Program descriptions, including target market(s), eligible participants and technologies, and financial incentives.
- Program goals and objectives.
- Budgets.
- Kilowatt and kWh goals, including anticipated annual energy savings and lifetime energy savings.
- Benefits and costs.
- Marketing and implementation strategies.
- Major milestones.
- Evaluation plans, including identification of metrics for program success (EPA 2006).

Program administrators usually have about 3 months to develop and submit their program plans. Similarly, oversight authorities typically need about 3 months to review and approve or suggest modifications to plans. In order to ensure programs are implemented as quickly as possible once approved, program administrators issue requests for proposals during this time period (if they did not do so earlier) and contract decisions are made contingent upon approval by the oversight authority.

Designing Programs to Overcome Barriers to Energy Efficiency

The ability to help address persistent barriers to the investment and adoption of socially and cost-beneficial energy efficiency opportunities is key to successful energy efficiency program design. Programs often offer the following strategies to address market failures and other barriers that lead to inefficient energy use:

- *Provide better information*. Energy users often lack accurate information about energy savings and other characteristics of energy-efficient products or practices, which would allow them to understand the costs and benefits of energy efficiency investments. Market failure due to information imperfection leads to underinvestment in energy efficiency by consumers.
- *Address split incentives (also referred to as addressing the "principal-agent problem")*. The incentives of individuals who make energy efficiency investment decisions are not always aligned with the incentives of those who use and pay for energy. Examples include misalignment between landlords and tenants and between builders and homeowners. Split incentives also persist within organizations and institutions that lead to underinvestment in energy efficiency in both the public and private sectors.
- *Reduce risk and uncertainty*. Adopting an unfamiliar, typically more expensive energy efficiency technology can be an uncertain undertaking. This is due to the lack of credible information on product performance and future energy prices, and the irreversibility of the investment. Imperfect or asymmetric information can exacerbate the perceived risk of energy efficiency investments and help explain why consumers and firms do not always invest in energy efficiency measures. Suppliers also face risk and uncertainty because they lack perfect information on consumer preferences for energy efficiency. In the presence of risk and uncertainties, consumers and suppliers alike will underinvest in energy efficiency.
- *Lower transaction costs*. Consumers face transaction costs in searching, assessing, and acquiring energy-efficient technologies and services. It can be time-consuming and difficult for consumers to estimate a product's lifetime operating costs. The complexity of the search process puts many efficient products at a disadvantage relative to less-efficient products with lower upfront costs.
- *Provide access to low-cost financing*. Consumers sometimes face higher interest rates to finance energy efficiency investments compared to other investments. Lenders can be reluctant to invest in energy efficiency loan portfolios in part because energy efficiency loans may lack standardization and financial markets have difficulty ascertaining the likely payoff from such investments. Limited access to credit may prevent some consumers, especially low-income consumers, from making cost-effective energy efficiency improvement decisions due to the higher upfront cost of energy-efficient products or practices.
- *Reduce environmental externalities that are not reflected in energy prices*. Bill savings that do not reflect environmental externalities lead to investments in energy efficiency below socially optimal levels.
- *Influence behavior*. Behavioral economics and psychology have identified potential behavioral impediments preventing individuals and organizations from always making cost-effective energy efficiency

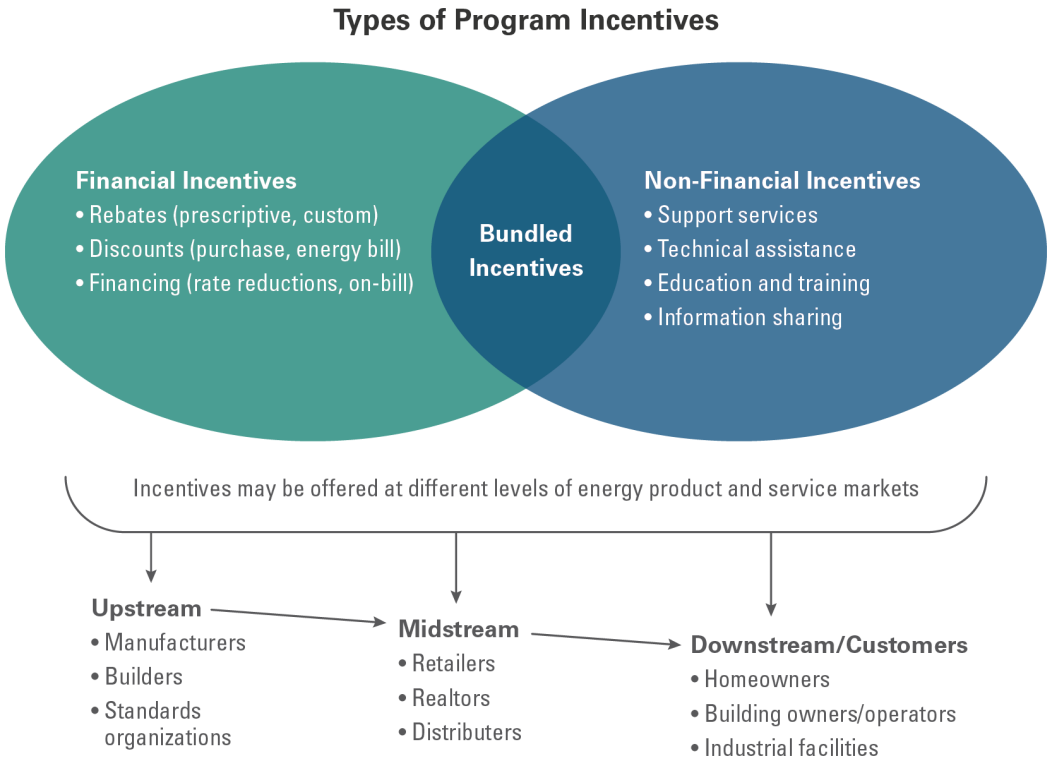
Best Practices: Implementing Energy Efficiency Programs

- Learn from other states' experiences to identify most cost-effective ways to achieve energy savings through programs.
- Consider a range of potential organization(s) for program delivery and select the most appropriate.
- Approve long-term funding cycles (5 to 10 years) to let programs build market experience and capture return on investment.
- Involve key stakeholders and experts in a program design.
- Base program designs on market characteristics and customer needs.
- Keep program designs simple and clear.

investments. Behavioral economics posits possible explanations, including bounded rationality, heuristic decision-making, and non-standard preference and belief.

Program administrators may offer a range of financial and other incentives to help address information, financial, and behavioral barriers. These incentives range from simple cash rebates for the purchase of efficient products to bundled customized financial incentives and technical assistance. Incentives can be targeted to individual customers and purchase transactions, or can be directed further upstream in market supply chains to encourage manufacturers, retailers, or contractors to affect how customers choose products, building designs, or building operating methods. Figure 4.2.6 provides an overview of the types of incentives in energy efficiency programs.

Figure 4.2.6: Overview of Energy Efficiency Incentive Types



Source: EPA 2010

Evaluation, Measurement, and Verification

Energy efficiency program evaluation includes conducting a wide range of assessment studies and other activities to determine a program's effects and to understand or document program performance, program or program-related markets and market operations, program-induced changes in energy efficiency markets, levels of demand or energy savings, or program cost-effectiveness. Market assessment, monitoring and evaluation, and measurement and verification are aspects of evaluation (SEE Action 2012).

States require robust evaluation, measurement, and verification (EM&V) in order to:

- Document a program's energy savings and other benefits, and determine whether the program (or portfolio of programs) met its goals.
- Inform ongoing decision-making and improve program delivery. In particular, evaluation during the early stages of program development can save time and money by identifying program inefficiencies and suggesting how to optimize program funding.
- Support energy demand forecasting and resources planning by understanding the contributions and costs of energy efficiency programs as compared to other energy resources. (See Section 7.1 for more information on electricity resource planning.)
- Ensure policy and public support for energy efficiency programs continues.
- Enable the calculation of other benefits, such as reductions in GHGs and other air pollutants.

Best Practices: Evaluating Energy Efficiency Programs

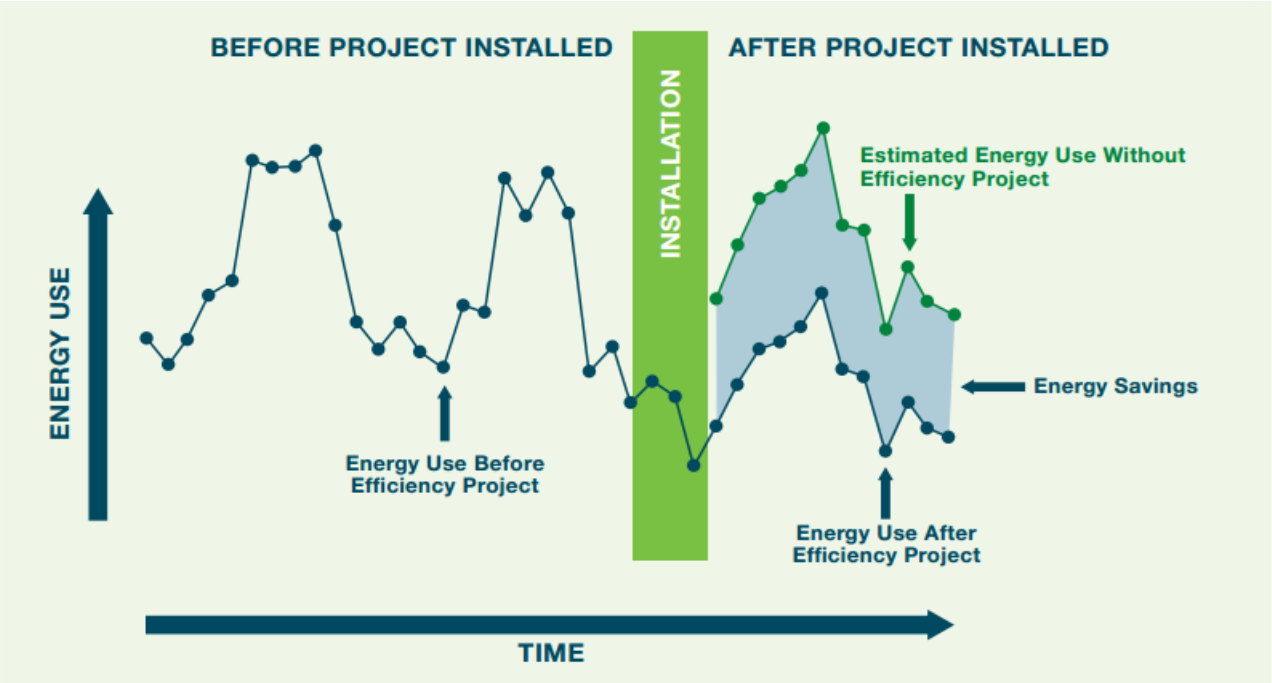
State policy-makers are promoting evaluation requirements both during program development and after program implementation. EM&V requirements in states with the most experience implementing and overseeing energy efficiency programs are typically based upon the following industry best practices:

- Use one or more of the industry-standard EM&V protocols or guidelines, and use deemed savings values for well-understood energy efficiency programs and measures.
- Consider local factors, such as climate, building type, and occupancy.
- Involve stakeholders and solicit expert advice regarding EM&V processes and resulting energy savings impacts.
- Conduct EM&V activities (e.g., direct equipment measurements, application of deemed savings, and reporting of impacts) on a regular basis.
- Provide interim and annual reporting of achieved energy savings.
- Update protocols and deemed savings to reflect new developments and improved information.

When evaluating an energy efficiency program's impact, the key metric of interest is energy savings, which is often evaluated in terms of both total reduction and peak reduction. Savings cannot be directly measured. Instead, efficiency program impacts are estimated by calculating the difference between actual energy consumption after program implementation and energy consumption that would have occurred during the same period without the program (i.e., the baseline). Figure 4.2.7 provides an example of this comparison.

States are measuring their energy efficiency savings using strategies and protocols that are increasingly credible, transparent, and consistently applied, as further discussed in this section. Because different types of evaluation are needed at various states of program design and implementation, states may establish a process for obtaining expert advice on EM&V, such as by forming a separate evaluation advisory group or hiring a professional advisor to guide evaluation investments. These entities can help assess available resources, identify and help prioritize evaluation activities, determine areas of uncertainty in a program or portfolio, and assess a program's maturity. Such processes may also address key methodological issues related to impact evaluation as described below.

Figure 4.2.7: Energy Consumption Before, During, and After Project Implementation



Source: SEE Action 2012

Determining the Baseline

During the program planning process, program administrators should develop a baseline forecast of efficient technology or service adoption absent the program and with the program. This baseline will allow program managers to set realistic savings goals and design programs that are well-suited for the target market. Understanding market potential and the market penetration of energy-efficient equipment and practices also provides valuable insights into how the program should be delivered, and what incentive levels would be cost-effective and successful at moving the market. Depending on the technology or service, evaluating baselines by market subsector can be valuable. Some market assessments employ a survey process to develop baseline assumptions. Baselines should be revisited as needed to account for changes in program design or changes to state or federal standards.

Establishing a Program Tracking System

A program tracking system is used to collect detailed information needed for program evaluation and implementation. Data collection can vary by program type, technologies and systems addressed, and customer segment. Well-designed program tracking systems include:

- *Participating customer information.* At a minimum, create a unique customer identifier that can be linked to other customer information systems. Other customer or site specific information might be valuable.
- *Measure specific information.* Record equipment type, equipment size or quantity, efficiency level, and estimated savings. Table 4.2.2 provides an overview of information typically tracked for each measure in a commercial facility.

- *Program tracking information.* Track rebates or other program services provided (for each participant) and key program dates.
- *All program cost information.* Include internal staffing and marketing costs, subcontractor and vendor costs, and program incentives.

Table 4.2.2: Typical Energy Efficiency Program Tracking Information for a Commercial Product Program

Measure Level Information	Power Consumption Information	UCT Primary Threshold Combined TRC/UCT threshold
o Measure type – Brand – Model number – Description – Capacity o Percent of load on measure o Quantity of measure o Level of incentive o Installation date	o Power draw of installed equipment o Power draw of typical equipment Installed at time of purchase o Power draw of old equipment description	o Energy savings o Summer demand savings o Winter demand savings o Years of useful life remaining on old equipment o Years of useful life for installed equipment

Ensuring Transparency and Documentation

Many states with active energy efficiency programs rely on accepted practices and methods approved by their respective regulatory commissions as the basis for measuring and verifying energy efficiency savings. Some states have gone further and documented the key assumptions used to calculate energy and demand savings in a technical reference manual (TRM), providing transparency.

Many technical reference manuals include predetermined estimated (or deemed) savings, derived from historical evaluations, to estimate energy and demand savings. Deemed savings are appropriate for evaluating programs that focus on relatively straightforward efficiency measures with well-known and consistent performance characteristics—for example, duct sealing or replacing standard incandescent light bulbs with compact fluorescent bulbs. Though there may be consistency across state deemed savings values due to common sources, the values are typically calculated by state PUCs. For instance, the PUC of Texas' EM&V contractor develops and maintains deemed savings values in a statewide TRM.

Adopting Standard Protocols for EM&V

Several national and regional efforts have focused on developing standard EM&V definitions and protocols. By adopting these approaches, states and other stakeholders can improve the consistency and accuracy of their evaluations and make it possible to compare efficiency initiatives across states. These initiatives also promote transparency in reporting. Examples of standard protocol efforts include:

- *The International Performance Measurement and Verification Protocol (IPMVP).* The IPMVP is an accepted industry standard that provides an overview of best practice techniques for verifying energy savings from facility-level and other efficiency initiatives. The objectives of the IPMVP are to:
  - Increase certainty, reliability, and savings level (with a focus on the persistence of savings several years after installation).

- Reduce transaction costs by providing an international, industry consensus approach and methodology.
- Reduce financing costs by providing project EM&V standardization, thereby allowing project bundling and pooled project financing.
- Provide a basis for demonstrating emissions reduction and delivering enhanced environmental quality.
- Provide a basis for negotiating contractual terms to ensure that energy efficiency projects achieve or exceed program goals of saving money and improving energy efficiency (Seattle 2006).

Northeast Energy Efficiency Partnerships (NEEP) EM&V Forum

NEEP works across the Northeast and Mid-Atlantic to accelerate energy efficiency in the building sector and improve transparency and consistency in EM&V reporting. NEEP's Regional Evaluation, Measurement, and Verification Forum develops and supports the use of consistent savings assumptions and standardized, transparent guidelines and tools to evaluate, measure, verify, and report the energy demand savings, costs, and avoided emission impacts of energy efficiency. The Forum has developed the Regional Energy Efficiency Database, which includes electric and gas energy efficiency program data for 10 jurisdictions and can be used to analyze program and policy design, air quality reporting and planning, system planning, and comparisons of state energy efficiency impacts to promote cross-state consistency.

The IPMVP provides a flexible set of EM&V approaches for evaluating energy savings in buildings. Several states—including California, Texas, and New York—have adopted the IPMVP to support system planning needs, clean energy portfolio standards, and carbon reduction programs (SEE Action 2011).

- *DOE Uniform Methods.* Technical experts developed the Uniform Methods Project to provide a straightforward method for evaluating gross energy savings for common residential and commercial measures offered in ratepayer-funded initiatives in the United States. The first set of protocols for determining energy savings from energy efficiency measures and programs was published in April 2013.

State Examples

Massachusetts

Massachusetts' long, successful track record of implementing energy efficiency programs across customer sectors has been funded by a combination of utility programs, PBFs, and the RGGI. Utility programs, dating back to the 1980s, have evolved with utility regulation and other policies. Most recently, the Green Communities Act of 2008 established a process through which all electric and gas utilities work collaboratively to design and implement statewide energy efficiency programs. The program administrators across the state develop program designs that are reviewed and approved by an oversight committee called the Massachusetts Energy Efficiency Advisory Council. Once statewide program designs are approved, the individual utility companies submit annual energy savings goals and annual budgets based on service territory size. Programs are designed for 3-year cycles and allow for annual modifications as needed. Marketing and evaluation are conducted jointly to support statewide consistency. Utility program administrators manage and implement efficiency programs, with the exception of low-income programs. The state's low-income weatherization and fuel assistance program implements low-income residential demand-side management and education programs.

In January 2013, the Department of Public Utilities approved the second 3-year (2013–2015) electric and gas energy efficiency plans under the Green Communities Act, continuing the state's progress toward ambitious energy savings targets in the country. The first electric efficiency procurement plan called for savings of 1.0 percent in 2009, 1.4 percent in 2010, 2.0 percent in 2011, and 2.4 percent in 2012. The state's second 3-year

plan calls for savings to increase to 2.6 percent in 2015. The energy efficiency investments from 2013 to 2015 are expected to save 3,703 gigawatt-hours of electricity in 2015.

The state's natural gas plan will save 24.75 million therms in 2015, equivalent to 1.14 percent of retail natural gas sales in 2015. Overall, the fully funded 2013–2015 electric and natural gas efficiency procurement plans will yield net consumer savings of more than $6.2 billion. The energy savings proposed in the current 3-year plan represent a 55 percent increase compared to the energy savings achieved in previous 3-year plans.

These efforts have placed the state among the nation's leaders in energy efficiency. The 2014 ACEEE State Energy Efficiency Scorecard placed Massachusetts first in its annual rankings. The Energy Efficiency Advisory Council won ACEEE's Champion of Energy Efficiency in Buildings Award in 2014 in public recognition of the continued accomplishments and leadership provided by the Council.

Vermont

Vermont is another example of a state that has been a pioneer of energy efficiency programs for several decades, and is also the pioneer of the energy efficiency utility concept known as Efficiency Vermont. Efficiency Vermont was created in 1999 by the Vermont Public Service Board and the Vermont Legislature in response to a request for statewide energy programs from the Vermont Department of Public Service, the state's 22 electric utilities, and a dozen consumer and environmental groups. Under the efficiency utility concept, a third-party organization is responsible for designing the efficiency program and is under contract to deliver results for the entire state. Efficiency Vermont's funding comes from a public benefit charge as a fixed amount per kWh sold on all electric utility customers' bills. Beginning in 2008, RGGI carbon allowance auction proceeds were combined with established funding sources to offer a wider range of services and incentives.

Efficiency Vermont currently operates primarily as an electricity efficiency utility to deliver energy efficiency services throughout most of the state; the City of Burlington Electric Department operates as an energy efficiency utility in its service territory. In 2014, the Board is considering whether to appoint an energy efficiency utility to deliver natural gas efficiency services, as gas efficiency programs have been operated by gas utilities since 1993.

In 2007, the Board initiated a yearlong workshop process to consider changing the energy efficiency utility. As a result, the structure of an Order of Appointment model was changed in 2009. This moved Efficiency Vermont to a 12-year rolling program model that provides additional stability. Additionally, the state conducts a demand resources plan, which is a statewide plan that identifies short- and long-term energy efficiency budgets and savings goals, as well as other compensation matters related to delivering energy efficiency services.

In 2013, Vermont's budget for electricity efficiency programs was over $35 million with projected savings of 92,520 MWh. The budget for thermal efficiency programs was nearly $5 million.

Missouri

Missouri is a good example of a state in the early processes of funding and delivering energy efficiency programs. Missouri began a major transformation in the scope and role of utility-sector energy efficiency programs in 2009 when it enacted SB 376, the Missouri Energy Efficiency Investment Act (MEEIA). Among its many provisions, MEEIA requires Missouri's investor-owned electric utilities to capture all cost-effective energy efficiency opportunities and allows them to recover costs. The Missouri Department of Economic Development's Division of Energy reviews and intervenes in dockets and utility regulatory cases for demand-side management programs, integrated resource planning, and incentive mechanisms pursuant to the MEEIA.

The Missouri Public Service Commission's (MPSC's) implementation of MEEIA sets out voluntary goals for electric utilities to achieve. These include 0.3 percent annual savings in 2012, ramping up annually to 0.9 percent in 2015, and 1.7 percent in 2019 for cumulative annual savings of 9.9 percent by 2020. Ameren Missouri was the first large investor-owned utility to win approval from the MPSC for a comprehensive energy efficiency portfolio to recover costs and lost revenue. Its programs launched in late 2012. Kansas City Power and Light ran limited programs in its Greater Kansas City service territory and plans to expand programs to its entire service territory in 2015.

In 2012, Missouri's budget for electricity efficiency programs was more than $35 million, making up 0.38 percent of statewide utility revenues; their budget for natural gas efficiency programs was $9.2 million. The state's 2011 efforts resulted in savings of 369,000 MWh.

Utility ratepayer-funded efficiency programs are working alongside other energy efficiency policies, including state government lead-by-example, financing, and local government programs. Governor Nixon signed Executive Order 09-18 in 2009, which mandated that all state agencies adopt policies designed to reduce energy consumption by 2 percent each year for the following 10 years. The Missouri Department of Economic Development's Division of Energy has provided energy efficiency loans since 1989. In 2010, an additional $14.3 million in ARRA SEP revolving loan funds were added to the loan portfolio to specifically address energy efficiency in public and institutional facilities. Since the program's inception, loans totaling over $89 million have been made through this program, resulting in an estimated cumulative savings of $167 million.

On April 18, 2014, Governor Nixon announced that the Missouri Department of Economic Development's Division of Energy will lead a statewide initiative to develop a comprehensive energy plan for Missouri. In public meetings across the state, the initiative solicited input from energy stakeholders including consumers, businesses, publicly owned utilities, renewable energy companies, academic researchers, and environmental advocates. The comprehensive energy plan is targeted for release in summer 2015.

At the local level, Kansas City is currently crafting plans, through the City Energy Project,[35] to benchmark buildings' energy consumption, provide building operator training and certification, recognize building owners/managers who implement energy efficiency improvements, and help building owners/managers identify local, technical, and financial resources to implement energy efficiency measures. Kansas City's participation will focus on reducing energy use in large buildings, saving money on utility bills, putting local people to work making energy efficiency improvements to local buildings, and reducing GHG emissions in order to achieve the goals of the Kansas City Manager's Office climate protection plan. Kansas City Power and Light has supported the city's efforts.

Mississippi

In 2013, ACEEE recognized Mississippi as one of the country's most improved states with regard to energy efficiency. Previously falling at the bottom of the ACEEE State Energy Efficiency Scorecard rankings based on policy actions and program efforts, Mississippi has become more active in promoting energy efficiency as a state policy priority. In addition to its Scorecard, ACEEE released a report stating that Mississippi could create 32,000 jobs and free up $4.3 billion over the next decade from energy efficiency policy and program action. Such economic development arguments appear to have been persuasive. As summarized in Energy Works: Mississippi's Energy Roadmap, Governor Phil Bryant has prioritized energy efficiency in the state's energy

[35] For more information on the City Energy Project, see http://kcmo.gov/city-energy-project/; http://www.cityenergyproject.org/.

strategy, and is working with other state officials to leverage energy efficiency as an economic development opportunity.

The Mississippi Public Service Commission initiated an energy efficiency collaborative process, supported by federal stimulus funds, through which Energy Efficiency and Conservation Rule 29 was established. Rule 29 requires utilities to implement energy efficiency programs and standards. The collaboration included a range of stakeholders and interested parties, as well as jurisdictional electric and natural gas utilities and electric power associations. This resulted in comprehensive utility filings, which included such program elements as customer education, energy audits, rebates for home retrofits, and business and industrial technical assistance. The Commission approved the program filings in 2014 for a 3-year period, and programs are in the early stages of implementation. The Mississippi State Energy Office also received a competitive SEP grant award from DOE in 2013 to build and expand upon its energy efficiency success to date.

Additional state actions related to energy efficiency programs are also expected to be taken in the future. Such actions may include evolving more comprehensive program portfolio plans, developing more detailed guidelines for EM&V, and developing stakeholder working group processes that facilitate program improvements outside the formal regulatory process.

What States Can Do

Experience from the states with energy efficiency programs demonstrates that the policy is an effective mechanism for securing investment in cost-effective energy efficiency and meeting important state energy objectives. States can use the best practices and information resources in this guide to establish new energy efficiency programs or strengthen existing programs to deliver even greater benefits.

Action Steps for States

The following four steps can be used both by states interested in developing a new PBF program or those interested in strengthening an existing program:

- Assess energy efficiency potential. States can begin the process by assessing current levels of energy efficiency spending within their state, analyzing all of their options for achieving greater levels of efficiency, and analyzing the energy and cost savings that energy efficiency programs would offer.
- Determine program funding needed to capture cost-effective energy efficiency. Consider appropriate program funding levels and establish funding mechanisms that can avoid the potential for funds to be diverted to other purposes. Studies show energy efficiency spending could be increased significantly and still be used cost-effectively. Conduct an efficiency potential analysis and economic screening process to identify the most cost-effective mix of new program targets. Include consideration of energy efficiency's role as a potential reliability tool and how its costs in that context compare to other options.
- Leverage federal, state, and local programs. Explore opportunities to leverage federal and state grant funds, as well as technical assistance and tools available from federal programs such as ENERGY STAR. States should also coordinate with other federal, state, and local energy efficiency policies and programs for effective program implementation and design.
- Measure and communicate results. Measure results, evaluate the effectiveness of energy efficiency programs, and report progress annually. Communicate the benefits of energy efficiency programs to state legislatures, PUCs, and other stakeholders. Document lessons learned and opportunities to enhance the program's effectiveness.

Information Resources

Funding, Administration, and Cost-Effectiveness

Title/Description	URL Address
Who Should Deliver Ratepayer-Funded Energy Efficiency? A 2011 Update. This report, updating a 2003 report for the Colorado Public Utilities Commission by the Regulatory Assistance Project, offers guidance to state legislators and utility regulators as they consider ways to make the administration and delivery of energy efficiency more effective.	https://www4.eere.energy.gov/seeaction/system/files/documents/rap_sedano_whoshoulddeliverratepayerfundedee_2011__11_15.pdf
Whose Perspective? The Impact of the Utility Cost Test. This study for the 2012 International Energy Program Evaluation Conference examines the theory behind different utility cost test perspectives, the rationale for adopting each test, and key outcomes.	http://www.cadmusgroup.com/wp-content/uploads/2012/11/TRC_UCT-Paper_12DEC11.pdf
ACEEE State and Local Policy Database. This ACEEE database includes comprehensive information on energy efficiency policies and programs currently implemented at the state and local level. The database tracks policy activity across multiple sectors, including government, transportation, buildings, CHP, and appliance standards.	http://database.aceee.org/
Energy Efficiency Cost-Effectiveness Screening in the Northeast and Mid-Atlantic States. This survey, prepared for NEEP's Regional EM&V Forum, describes key issues and differences related to current cost-effectiveness testing practices, and it identifies areas where guidance can on cost-effectiveness testing can be improved.	http://www.neep.org/sites/default/files/resources/EMV_Forum_C-E-Testing_Report_Synapse_2013%2010%2002%20Final.pdf

Program Design

Title/Description	URL Address
ENERGY STAR Utility and Regional Energy Efficiency Program Sponsors (EEPS) Resources. This website provides resources for EEPS on home improvement, residential and commercial products and programs, residential new construction, and commercial and industrial programs.	http://www.energystar.gov/index.cfm?c=reps.pt_reps
Regional Energy Efficiency Organizations (REEOs). REEOs provide technical assistance to states and municipalities to support efficiency policy development and adoption, along with program design and implementation. This policy brief provides an overview on and Web links to the six REEOs.	http://www.seealliance.org/wp-content/uploads/REEO-GeneralEEPolicyBrief-2014.pdf
Database for Energy Efficiency Resources. This California Public Utilities Commission (CPUC) database contains information on selected energy-efficient technologies and measures, including estimates of the energy-savings potential for these technologies in residential and nonresidential applications and data on the costs and benefits of energy-efficient measures.	http://www.deeresources.com/
Demonstration of Energy and Efficiency Developments (DEED) Program. The American Public Power Association's DEED Program is a research demonstration program dedicated to improving the operations and services of public power utilities by supporting and demonstrating innovative developments.	http://www.publicpower.org/Programs/Landing.cfm?ItemNumber=31245&navItemNumber=37529

Title/Description	URL Address
Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs This 2013 presents the results of ACEEE's third national review of exemplary programs. The report identifies and profiles 63 leading programs that span the wide array of program types offered to utility customers.	http://aceee.org/research-report/u132
ENERGY STAR Industrial Energy Efficiency Resources for State and Utility Programs. This website contains tools and resources to help states and utilities understand energy use in the industrial sector and learn how to work with manufacturers to improve energy efficiency, develop stronger energy efficiency programs, and promote industrial energy performance improvement.	https://www.energystar.gov/buildings/industrial-energy-effiicency-resources-state-utility-programs
ENERGY STAR Partner of the Year Awards Winners. This website contains descriptions of energy efficiency programs which have received ENERGY STAR awards for promotion of ENERGY STAR products, homes and tools to support broader market transformation for energy efficiency.	www.energystar.gov/awards
California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects. CPUC's 2001 Standard Practice Manual provides guidelines for utility-sponsored energy efficiency programs. This report is an updated version of CPUC's *Standard Practice for Cost-Benefit Analysis of Conservation and Load Management Programs*, first written in 1983.	http://www.cpuc.ca.gov/NR/rdonlyres/004ABF9D-027C-4BE1-9AE1-CE56ADF8DADC/0/CPUC_STANDARD_PRACTICE_MANUAL.pdf
Consortium for Energy Efficiency (CEE) Program Resources. CEE releases resources that are the result of CEE members analyzing business prospects, identifying energy efficient products and services, and engaging manufacturers and other market stakeholders to develop credible approaches for encouraging market uptake and achieving verifiable energy savings.	http://www.cee1.org/content/cee-program-resources
Energy Efficiency Policy and Program Resources. This SEE Action website offers resources and discussion forums for the design and implementation of policies and programs that can drive investment in energy efficiency.	https://www4.eere.energy.gov/seeaction/resources
Regional Energy Efficiency Database (REED). NEEP's REED is a public resource that contains electric and natural gas energy efficiency program data for 10 jurisdictions in the Northeast. NEEP has also developed annual reports to provide an overview of the high-level impacts of energy efficiency programs at the state and regional level.	http://www.neep.org/initiatives/emv-forum/regional-energy-efficiency-database
Energy Efficiency Quick Start Programs: A Guide to Best Practices. The Southeast Energy Efficiency Alliance, the REEO serving the Southeastern states, released this guide to share best practices for designing and implementing energy efficiency programs quickly. This information can also be helpful to other regions as well.	http://www.seealliance.org/wp-content/uploads/Quick-Start-Best-Practices-041414-FINAL.pdf
Midwest Energy Efficiency Alliance (MEEA) Program Best Practices Information. MEEA, the REEO serving the Midwestern states, shares case studies and best practices information with energy efficiency program administrators. This information can also be helpful to other regions as well.	http://www.mwalliance.org/newsletter/meea-minute-monthly-newsletter-january-2014 http://www.mwalliance.org/resources/case-studies-best-practices
Association of Energy Service Professionals (AESP). AESP is a member-based association dedicated to improving the delivery and implementation of energy efficiency, energy management and distributed renewable resources. AESP also recognizes outstanding achievement in program design.	http://www.aesp.org/ https://c.ymcdn.com/sites/aesp.site-ym.com/resource/resmgr/Awards/AESP_Energy_Awards_POSTERS.pdf

Evaluation

Title/Description	URL Address
The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Under the Uniform Methods Project, DOE is developing a framework and a set of protocols for determining the energy savings from specific energy efficiency measures and programs. In 2013, DOE published the first set of protocols.	http://energy.gov/eere/downloads/uniform-methods-project-methods-determining-energy-efficiency-savings-specific
ENERGY STAR Unit Shipment Data. This website collects information on qualified product unit shipment data to determine the market penetration of ENERGY STAR products and evaluate the overall performance of the program.	http://www.energystar.gov/index.cfm?c=partners.unit_shipment_data
FedStats. FedStats provides data and trend information for more than 100 federal agencies that are engaged in production and dissemination of official federal statistics, including the Energy Information Administration (EIA) and EPA.	http://fedstats.sites.usa.gov/
A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs. This ACEEE report provides the results of a comprehensive survey and assessment of the current state of the practice of utility-sector energy efficiency program evaluation across the 50 states and the District of Columbia.	http://www.aceee.org/sites/default/files/publications/researchreports/u122.pdf
Efficiency Valuation Organization (EVO). EVO is a non-profit organization that develops and promotes the use of standardized protocols, methods and tools to quantify and manage the performance risks and benefits associated with end-use energy efficiency, renewable-energy, and water-efficiency business transaction.	http://www.evo-world.org
Proceedings of the International Energy Program Evaluation Conference (IEPEC). The IEPEC is an annual professional conference for energy program implementers; evaluators of those programs; local, state, national, and international representatives; and academic researchers involved in evaluation. This website contains proceedings from past conferences, beginning with the 1997 IEPEC.	http://www.iepec.org/?page_id=26
State Energy Efficiency Program Evaluation Inventory. The U.S. Energy Information Administration released this 2013 inventory of state program evaluations to support their long-term energy forecasts, though the summary of information may also be helpful to states designing their own energy efficiency program evaluations.	http://www.eia.gov/efficiency/programs/inventory/
EM&V. This SEE Action website provides policy and program resources for EM&V, including the EM&V Resource Portal, which serves as a compendium for energy efficiency program administrators and project managers.	https://www4.eere.energy.gov/seeaction/topic-category/evaluation-measurement-and-verification
Energy Efficiency Program Impact Evaluation Guide. This 2012 guide, prepared by SEE Action's EM&V Working Group, describes and provides guidance on approaches for determining and documenting energy and non-energy benefits resulting from end-use energy efficiency programs.	https://www4.eere.energy.gov/seeaction/publication/energy-efficiency-program-impact-evaluation-guide

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4.3 Building Codes for Energy Efficiency

Policy Description and Objective

Summary

Building energy codes require new construction and major renovations in existing buildings to meet minimum energy efficiency requirements. Well-designed and enforced codes can institute construction practices that reduce building life-cycle costs and occupants' total housing or commercial costs. Building energy code requirements can also help reduce peak energy demand, as well as greenhouse gas (GHG) emissions and other air pollutants. Recognizing these benefits, a majority of states have adopted building energy codes for residential and commercial buildings.

Building energy codes improve energy efficiency in new building construction and major renovations by setting thermal performance standards for building envelope components and efficiency criteria for building systems and equipment. Developed at the national level through model code and standards processes, energy codes are typically adopted at the state level and enforced by code officials at the local level.

Broadly speaking, building codes include an array of specifications and standards that address safety and functionality. In 1978, California became the first state to include energy requirements in its code. As of March 1 2015, 40 states plus Washington, D.C., have state-level residential building energy codes equal to or better than the 2006 International Energy Conservation Code (IECC), and 41 states plus D.C. have state-level commercial building energy codes equal to or better than ASHRAE 90.1-2004 (BCAP 2015a).

To be successful with codes, state and local governments have found they must ensure that the most efficient model energy codes are adopted and that compliance is rigorous. States and localities are taking steps in this direction by adopting updated versions of energy codes and are improving compliance by monitoring, evaluating, and enforcing their codes. States and localities without building energy codes can leverage these existing best practices when adopting energy codes in their jurisdictions.

The potential energy savings from further state action can be significant. If the most recent commercial and residential model energy codes—i.e., the 2012 IECC—are adopted, states can reduce their energy usage by 30 percent compared to the 2006 IECC (DOE 2013). If states comply with existing codes, the projected national savings from bringing a year's worth of new residential and commercial construction in the U.S. up to full compliance is 2.8–7.9 quadrillion British thermal units annually, or $63–$174 million in annual energy cost savings (IMT 2013).

Why Building Energy Codes Matter

Incorporating efficiency at the time of construction is typically the most cost-effective way to improve building energy performance. However, market barriers result in underinvestment, leading to "lost opportunities" in inefficient structures that are expensive or impractical to improve later in the building life cycle. Two such barriers are:

- *Split incentives*. Whereas builders are motivated to minimize capital costs, homeowners and building tenants are motivated to minimize total occupancy costs, including energy bills. When builders invest in energy efficiency, the benefits in lower energy bills flow to occupants and not to them.
- *Customer preferences*. Most home purchase decisions and feature choices are driven by non-energy factors. In selecting optional features for the home, buyers often focus on amenities like kitchen upgrades, extra bathrooms, and new flooring. Efficiency competes with these priorities.

In the face of multiple barriers, energy codes can ensure that new buildings achieve a basic level of energy efficiency performance that is cost-effective and delivers related benefits.

Objective

Building energy codes establish legal requirements for a minimum level of energy efficiency for residential and commercial buildings.

Benefits

State and local governments see a range of benefits from building codes, including lower energy use, reduced energy costs, reduced pollutant emissions, stronger local economies, improved energy resource reliability and improved health. For example, the U.S. Department of Energy (DOE) estimates that upgrading from the 2006 to the 2012 IECC would reduce the energy costs to the homeowner by an average of 32.1 percent (DOE 2012).

The DOE analysis also estimates that cumulative energy savings from 1992–2012 were approximately 4.2 quads and cost savings to consumers have been more than $44 billion. These savings resulted primarily from DOE-supported activities that help upgrade model energy codes; accelerate their adoption by states and localities; and improve code compliance via software tools, training, and technical support. At an estimated 20-year federal budget cost of some $110 million, energy codes have realized more than $400 in cost savings for each DOE program dollar spent (DOE 2014).

Looking forward, the estimated cumulative benefits from DOE program support total nearly 46 quads of full-fuel-cycle energy—or 44 quads of primary energy—through 2040, equivalent to almost an entire year's worth of current U.S. residential and commercial primary energy consumption. These energy savings correspond with consumer dollar savings of up to $230 billion on utility bills through 2040. In terms of emission prevention benefits, annual carbon savings are estimated at 36 million tons through 2012, with expected cumulative savings through 2040 of 3,478 million tons (DOE 2014f).

Building energy codes can also strengthen state and local economies by increasing investment in energy-efficient capital equipment and increasing employment for technical experts, duct and air leakage professionals, quality control assessors, building and system commissioning agents, energy auditors, and compliance officers (DOE 2014f).

Other key benefits of building energy codes include improved regional energy reliability and energy self-reliance. Codes reduce energy usage and therefore decrease peak loads, which increases grid reliability. They also help reduce our nation's dependency on foreign energy sources (DOE 2014f).

States and municipalities may also see benefits from building energy codes ability to reduce energy use and reduce pollutants. Energy-efficient buildings reduce GHG emissions and other air pollution and thus lower the risk of related health issues (DOE 2014f). In addition to improved outdoor air quality, building energy codes help improve indoor air quality—which can be more polluted than outdoor air—by reducing particulate matter, radon, carbon monoxide and other harmful pollutants (CPSC 2014).

States with Building Energy Codes

Because new construction is a key driver of energy demand growth in the buildings sector, states often use energy codes as a key energy and environmental strategy. Some states and utilities are promoting "beyond code" building programs to achieve additional cost-effective energy efficiency.

For residential buildings, as of March 2015, 40 states plus Washington, D.C., use a version of the 2006 IECC or better building energy code. Eleven of these states (plus D.C.) are using the 2012 IECC version that DOE has determined would improve the energy efficiency of residential buildings by approximately 30 percent compared to the 2006 IECC. Only 10 states have not adopted a statewide code, although many jurisdictions in these states have adopted the 2009 IECC (BCAP 2015a).

For commercial buildings, as of June 2014, 41 states plus Washington, D.C., use a version of ASHRAE 90.1-2004 or a more stringent building energy code. Seventeen of these states (plus D.C.) are using the ASHRAE 90.1-2010 version that DOE has determined would improve energy efficiency in commercial buildings compared to ASHRAE 90.1-2004. Nine states have not adopted commercial building codes, although many jurisdictions within these states have adopted ASHRAE 90.1-2010 (BCAP 2015a).

Residential and Commercial Building Energy Codes

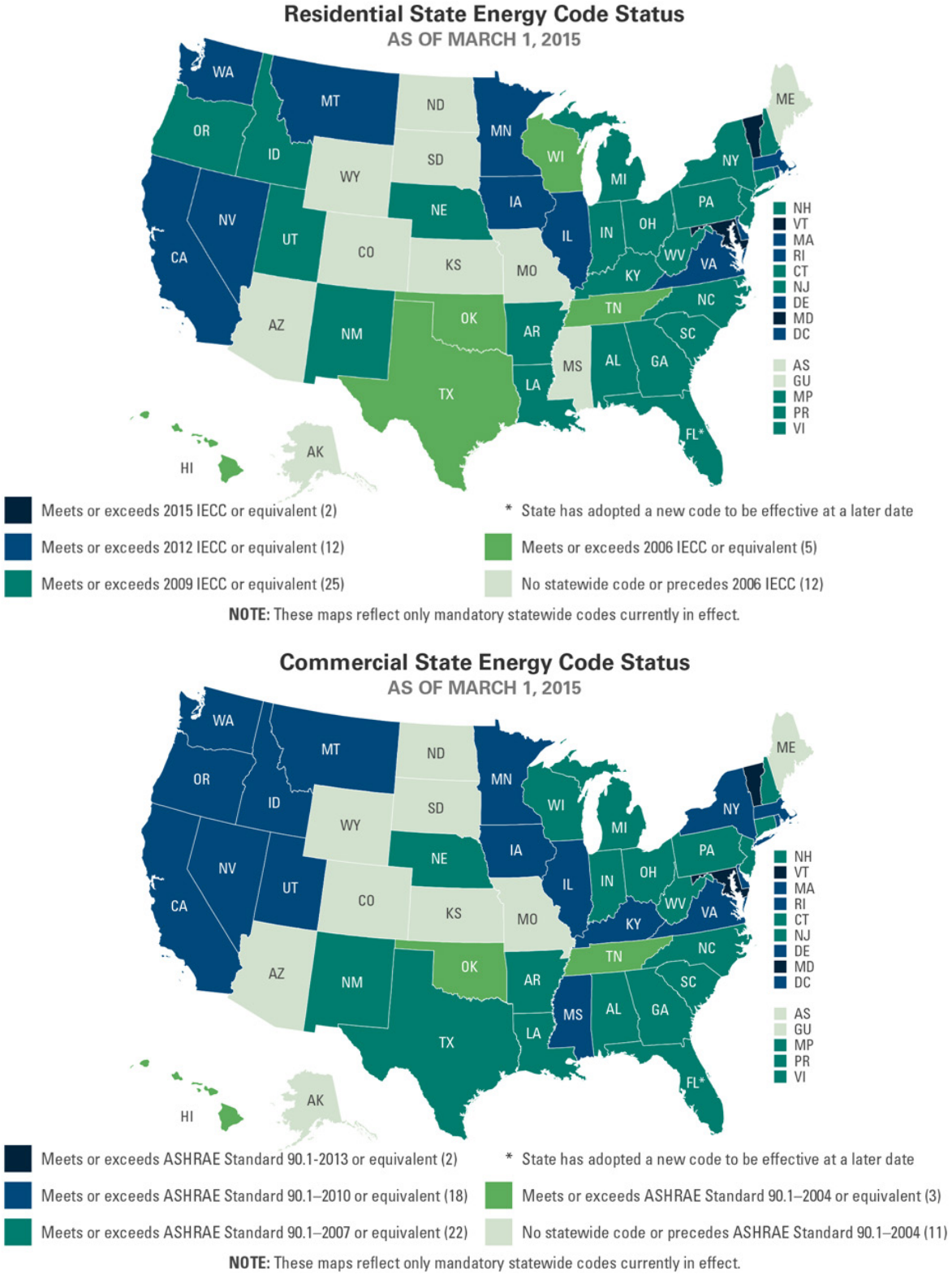
The energy code that applies to most *residential* buildings is the applicable version of the IECC, which supersedes the Model Energy Code. The 2012 IECC is the most recent version for which DOE has issued a positive determination. However, different versions of the IECC have been adopted by states, creating a patchwork of residential codes across the country. The federal Energy Conservation and Production Act (ECPA) was amended in 1992 to require states to review and adopt the most recent model code, or submit to the Secretary of Energy its reasons for not doing so.

Most *commercial* building energy codes are based on ANSI/ASHRAE/IES Standard 90.1, jointly developed through the American National Standards Institute, ASHRAE, and the Illuminating Engineering Society, and commonly referred to as ASHRAE 90.1. ECPA requires states to adopt the most recent version of ASHRAE Standard 90.1 for which DOE has made a positive determination for energy savings, currently 90.1-2013. The IECC also contains prescriptive and performance commercial building provisions. By referencing Standard 90.1 for commercial buildings, IECC offers designers alternate compliance paths.

State and local experience has shown that a code must be properly implemented, evaluated, and enforced after being adopted to achieve energy savings. In states where these components are missing, compliance rates can fall short. But recent studies, including a 2011 Illinois study (IEE 2011) and a 2013 Minnesota study, show that improved enforcement is leading to increased compliance—more than 80 percent compliance in the new homes and new commercial building markets (BCAP 2015b). Leading states are not only monitoring and evaluating their energy codes, but also using the findings from these analyses to take corrective action.

Most states and municipalities periodically update their building energy codes to ensure that they incorporate improvements in technology and design that offer increased energy efficiency and cost-effectiveness. Code reviews are often triggered by DOE's Congressionally mandated determination as to whether each new code version saves energy relative to the previous version (ASHRAE 90.1 or IECC). For residential codes, federal law requires states to consider adoption of each new IECC version for which DOE issues a positive determination.

Figure 4.3.1: States with Residential and Commercial Building Energy Codes



Source: BCAP 2015a

Establishing Effective Building Energy Codes

When adopting, implementing, enforcing, or updating energy codes, states identify key participants, review code implementation costs, analyze building life-cycle costs, determine a timeframe for action, and evaluate interactions with federal and state policies.

Participants

- *Government officials*. Some states and local jurisdiction government officials have been active participants in updating the national model energy codes. State and local governments are the front-line actors in code implementation and enforcement (DOE 2005). States and local jurisdictions often modify the national model codes during the state/local adoption process to account for their specific needs and opportunities.

  In national model code development processes conducted by the International Code Council (ICC) and ASHRAE, federal government officials from DOE and many other stakeholders participate in the multi-year code development cycles. Each time a new version of the IECC or ASHRAE 90.1 is issued, DOE makes a determination on whether the new version saves energy compared to the previous version. If DOE makes a positive determination on a new residential code, federal law gives states 2 years to consider adopting it. If they elect not to adopt the code, state officials are required to submit their reasoning to the U.S. Secretary of Energy. State adoption of the ASHRAE 90.1 commercial building energy code, by contrast, is not optional. If DOE makes a positive determination on a new commercial building energy code, states are required to update their current code with either the applicable ASHRAE 90.1 version or an equally stringent code within 2 years. DOE also provides technical assistance to states to support building code adoption and implementation. More information is available at http://www.energycodes.gov.

- *Code development organizations.* The ICC, ASHRAE, and the National Fire Protection Association (NFPA) develop model energy codes and standards. The ICC develops the IECC for residential and commercial buildings, while ASHRAE maintains the 90.1 standards for commercial buildings and 90.2 for residential buildings. Both ICC and NFPA provide a reference to ASHRAE Standard 90.1 as an alternate compliance path for commercial buildings. The ICC also provides training and technical support to code officials to assist with interpretation and implementation of codes.

- *Nongovernmental organizations (NGOs).* NGOs support building energy code adoption and implementation by fostering peer exchange, serving as information sources, and providing expert assistance. For example, the Building Codes Assistance Project (BCAP) offers tailored technical assistance to states and municipalities. In states seeking to adopt the IECC or ASHRAE 90.1, BCAP provides services such as educational support and implementation assistance for code officials and legislators. BCAP was founded as a joint initiative of the Alliance to Save Energy, the American Council for an Energy-Efficient Economy, and the Natural Resources Defense Council. Other active NGOs in the building codes arena include the regional energy efficiency organizations (comprising six regional groups), the New Buildings Institute (NBI), and the Institute for Market Transformation (IMT).

- *Utilities and utility regulators.* Utilities and regulators can also be key participants in improving building energy code implementation and compliance (EPA 2009). IMT, the Institute for Electric Efficiency, and the Northeast Energy Efficiency Partnership list five recommended roles for utilities: 1) advancing measurement and translation of baseline compliance levels to target education and training efforts, 2) developing a mechanism for evaluating and attributing the energy savings impacts, 3) promoting the inclusion of energy codes into integrated resource planning, 4) securing regulatory approval for expenditures on code activities, and 5) advancing knowledge on the interaction of codes with existing energy efficiency programs (Stellberg et al. 2012).

- *Builders, developers, and building owners.* Builders, developers, owners, and managers are becoming more involved with the development of the national model energy codes as they are responsible for implementing provisions in the code. States and municipalities are also finding that active collaboration with these groups improves understanding, creates buy-in, and can lead to greater levels of compliance.
- *Industry professionals.* Building scientists, manufacturer representatives, and other industry experts are involved in the code development and implementation process to ensure that the code language and requirements are in coordination with available technologies and building science. The Residential Energy Services Network (RESNET) promotes codes by fostering national markets for home energy rating systems, accrediting home energy raters and providers, promoting residential energy efficiency financing products, and conducting educational programs. To encourage consistency across rating systems, the organization works to harmonize its standards with the IECC.

Building Life-Cycle Costs

Incorporating efficiency into building design and construction is more cost-effective than trying to upgrade efficiency after the building is in operation. Decisions made during design and construction often cannot be remedied later or can only be improved at significant cost. Moreover, because building components and systems can last 15, 20, 50 years, or longer, inefficient technologies can waste energy for decades until a replacement or upgrade occurs.

For example, a recent study estimated that upgrading the energy efficiency of a typical new home in Arizona from the 2006 IECC would save homeowners an average of $3,245 over 30 years with the 2009 IECC and $6,550 over 30 years with the 2012 IECC (DOE 2012). The cost to install the measures in the 2012 IECC, including improved ducts, air sealing, and insulation, makes it very difficult to upgrade after the home construction is complete.

Code Implementation Costs

National code development processes can spare a state the full cost of developing its own codes. While ICC, ASHRAE, and NFPA offer model energy codes that can be adopted in their entirety, it is common for states to initiate an adoption and modification process that amends the model codes to reflect state-specific considerations. However, some states (e.g., California) and municipalities maintain their own code development processes. State and local governments can also lower development, adoption, and enforcement costs by taking advantage of resources offered by DOE.

When adopting a model code, some states provide resources to municipalities to support implementation and enforcement. In some cases local funds are available to help code officials and builders understand and comply with the code's requirements. However, even when such resources are available, localities are finding that staff resources for code enforcement are often stretched thin. To overcome this barrier, some local governments collaborate with state officials, utilities, or third-party technical experts such as energy raters to help meet resource and assistance needs.

Timing and Duration

States are finding that a periodic review of energy code requirements helps ensure that new efficiency opportunities are realized in their jurisdictions. States often conduct their code reviews following national-level model codes updates or the issuance of a DOE determination. Other states call for updates on their own regular schedules. For example, some states take action if the code is more than 5 years old, if there is no evidence of consistent enforcement, or if there is no state energy code.

When DOE makes a positive determination on a new version of a model code, states are required by federal law to complete an adoption consideration process within 2 years. State adoption is not required for the IECC residential building energy code (though states choosing not to update their codes must publicly submit their reasoning to DOE), which has recently been updated and is released every 3 years (e.g., 2009, 2012, 2015). State adoption is mandatory for the ASHRAE 90.1 commercial building energy code, which has recently been updated and is also on a 3-year cycle (e.g., 2007, 2010, 2013).

State experience with the review and update process demonstrates that it is important to anticipate and plan for the education and training needs of code officials, builders, contractors, and other affected parties. Each participant requires time to understand new requirements. Code changes also affect product manufacturers and suppliers, who need lead-time to clear current inventories and ensure that compliant products are available when the revised code takes effect.

Best Practices for Developing and Adopting Building Codes

- *Do your homework.* Evaluate current building energy code laws and options for implementation and enforcement. If there is no state energy code, if it is more than 5 years old, or if there is no evidence of consistent enforcement, it may be time to act:
  - Analyze the benefits and costs of code adoption and implementation.
  - Talk with key stakeholders, including local officials and builders, to gauge their perspectives.
  - Assess resources for training and technical support for code officials, builders, designers, and installers.
  - Contact suppliers about availability of products.
- *Get outside help.* Tap building expertise and other resources from organizations such as DOE's Pacific Northwest National Laboratory, BCAP, Regional Energy Efficiency Organizations (REEOs), state energy offices, the National Association of State Energy Officials (NASEO), and the NBI. Resources might include quantitative assessments of potential benefits, baseline building practice studies, legislative and regulatory assessments, training, and technical assistance for builders and code officials.
- *Create a stakeholder process.* Involve key stakeholders early and regularly. Include them in reviews of studies, proposed regulations, and other aspects of the process. This process increases the chances of code adoption and minimizes enforcement problems.

Interaction with Federal Programs

State and local governments are finding that voluntary programs such as ENERGY STAR can advance building performance beyond code minimum requirements and can field test potential design and building practices that can become future energy code requirements. ENERGY STAR-certified new homes are designed and built to standards well above code and market performance levels, and have undergone inspections, testing, and verification to ensure strict requirements are met.

In some states, ENERGY STAR certification may be recognized under certain conditions as “deemed to comply” with energy codes, helping state and local governments address the technical and resource issues they face in code implementation. This can be especially helpful where utilities fund such voluntary programs. Specific state and local conditions should be carefully reviewed when considering options of this type.

Interaction with State Policies

State and local policy-makers are leveraging other state clean energy policies to support building energy codes. For example, some states are using public benefits funds to support code implementation and enforcement. The New York State Energy Research and Development Authority is committed to ensuring that at least 90 percent of residential and commercial buildings comply with the 2010 Energy Conservation Code of New York State by 2017 through its Energy Codes Training and Support Initiative to transition to a more energy-efficient built environment (NYSERDA 2014).

Some state and local governments are investigating the extent to which building codes can be incorporated into their air quality planning processes. Codes improve air quality by reducing energy consumption in buildings, thereby lowering direct fuel use and electricity generation and the resulting pollution from power plants. Some jurisdictions have examined the role of energy codes in State Implementation Plans for regulated air pollutants. S.B.5 in Texas is an example of legislation mandating building energy efficiency for the purpose of improving the state's ozone air quality through the state's Health and Safety Code (SECO 2010). As states explore their options for developing plans under the proposed EPA Clean Power rule, energy codes are garnering focus as part of the rule's allowed use of energy efficiency in compliance.

Program Implementation and Evaluation

Implementation

States and municipalities are finding innovative ways to implement building codes.

These efforts are needed to address the following commonly encountered barriers to implementation:

- *Building industry technology advancement is slow*. While there are fewer than a dozen U.S. manufacturers of automobiles, home appliances, and light bulbs, there are thousands of home building companies in the United States, even with substantial consolidation in the wake of recent construction downturn. In contrast to highly automated sectors of the U.S. economy, the building sector remains largely a local craft industry dependent on onsite crews and subcontractors integrating hundreds of components from various manufacturers. While some advanced building systems, including those used by modular home builders, are beginning to shift the industry, this barrier still requires training and education services to address such issues.
- *Energy codes can be complex and difficult to understand*. Responding to feedback from code officials and industry groups, code-development organizations have worked to simplify new versions

Best Practices for Energy Code Implementation

States and municipalities have identified the following best practices for energy code implementation:

- Educate and train key audiences:
- Build strong working relationships with local building officials, homebuilders, designers, building supply companies, and contractors for insulation, heating, and cooling equipment.
- Hold regular education and training sessions before and after the effective date of the new energy code requirements. Maintain an ongoing relationship with homebuilders and building officials associations, even between code change cycles. This encourages both understanding and trust and is an opportunity to share concerns.
- Provide the right resources, including:
  - An overview of energy code requirements, opportunities, and related costs and benefits.
  - Basic building science concepts. Practical compliance aids can range from laminated information cards for simple prescriptive methods to software packages for performance-based codes.
  - Information on how to inspect plans and site features for compliance.
  - Whom to contact and resources for more information and technical assistance.
- Provide budget and staff for the program. Assign staff personnel with appropriate training and experience to support the code adoption and implementation processes. Give them enough of a budget to do the necessary homework, involve stakeholders, and support implementation.

of the ASHRAE 90.1 and IECC model codes. Some states have had success with simplified prescriptive codes, as in Oregon and Washington, written in plain English with easy-to-read tables and other user-friendly features. Code officials are also pursuing a range of best practices (see text box, "Best Practices for Energy Code Implementation") that minimize the additional education and time requirements imposed on code officials.

- *Many states do not have the resources to monitor, evaluate, and enforce their energy codes*. Many jurisdictions do not have staff dedicated to training, technical assistance, or enforcement, and thus do not pursue monitoring and evaluation. As a result, self-enforcement of building energy code provisions is the norm in many states. New York accomplishes this by requiring a licensed design professional to complete an official form attesting to code compliance. In the face of resource shortages, other states rely on self-enforcement mechanisms such as home energy rating systems and the ENERGY STAR program.

Evaluation

State and municipal experience demonstrates that evaluating energy savings, conducting compliance surveys, and assessing the process by which program information is distributed are key elements of a successful building energy code. Evaluation of energy and peak demand savings data helps ensure that requirements are followed and that stated goals are achieved. Code officials use information about the "co-benefits" of energy savings (e.g., financial savings and reductions in air pollution), implementation levels, and code awareness to evaluate progress, suggest strategies for improvement, and enhance overall program effectiveness. Another major benefit of compliance evaluation is the identification of code provisions that show the greatest energy savings impacts, as well as low compliance, or reveal significant market confusion. Revealing such issues can help code officials develop targeted corrective actions for training and enforcement.

Similarly, states are conducting studies of prospective energy savings from codes prior to adoption and implementation. Measuring the range of potential benefits, energy, economic, and environmental, can build the case for energy codes by assessing both positive and negative costs. If results show promise, studies of prospective benefits can also broaden stakeholder support for energy codes.

Texas Energy Code Evaluation

In Texas, the South-central Partnership for Energy Efficiency as a Resource developed a *2014 Energy Code Adoption Report* (SPEER 2014) that identifies the code adoption status of 217 cities and describes enforcement and adoption activities. Key findings include:

- In 2013, just over half of the jurisdictions required certification of their enforcement staff.
- Conversations with building industry leaders indicated that the industry tends to support the "leveling of the [playing] field" to the extent that codes can help eliminate low-cost, low-efficiency, low-quality construction that undercuts mainstream builders' market prices and reputations. These discussions indicate support for adoption and enforcement of the current (2009) state energy code.
- Through 2013, 20 cities in Texas had adopted the 2012 IECC energy codes or stronger amendments. This number had almost tripled by 2014.

State and local officials are finding value from the following kinds of evaluation tools:

- *Energy savings evaluation*. Even though theoretical energy savings from building codes can be estimated with computer software, it is important to evaluate whether codes are actually saving energy and meeting goals. Information from energy savings evaluations can indicate if certain portions of the code perform better than others or if overall savings are meeting expectations. With this insight, states can focus their implementation and enforcement efforts on addressing priority concerns. For example, a 2002 study in Fort Collins, Colorado, found that measured energy savings from a code change in 1996 were approximately half of pre-implementation estimates. By conducting a code evaluation, the city was able to identify problem areas and focus its resources accordingly (City of Fort Collins 2002). In the context of

EPA's proposed Clean Power Plan, state plans that include codes need to consider best practices for energy savings evaluation.

- *Compliance surveys*. While there are few comprehensive code compliance studies, DOE has created a series of compliance evaluation tools that can be used to determine whether buildings are being built in compliance with code. Another purpose of compliance studies is to assess the overall state of building technology and practice. Results might show, for example, that certain beyond-code energy features are gaining wide acceptance in the market. In states and municipalities where data exist, they frequently indicate compliance rates between 40 and 60 percent, although much lower levels of performance have been documented (NEEP 2009). Because the methodologies used in compliance studies can vary significantly, DOE's evaluation tools can help provide greater consistency in assessing compliance rates. Regardless of which methods are used, the gap between targeted and measured compliance highlights the challenges state and local governments face in reaching compliance goals and puts a premium on innovation and effort aimed at forging new compliance strategies.
- *Process evaluation.* State programs that offer technical assistance and related services benefit from a process evaluation to assess and suggest improvements to these offerings. These evaluations look less at what is being built than at the ways information is delivered to key stakeholders such as builders and code officials. Improving service delivery can help improve code compliance and overall stakeholder acceptance of the code. Process evaluation is also used to determine the effectiveness of a state's enforcement efforts.

State Examples

The following states have implemented successful building code programs using varying approaches.

California

California's Title 24 standards for residential and commercial buildings constitute a mandatory, statewide building energy code that is more efficient than the 2012 IECC and ASHRAE 90.1-2010. California's building energy code differs from other state codes in that it impacts the process of building design and construction verification more thoroughly. For building designs, all building plans must be reviewed for energy code compliance prior to the release of building permits. For construction verification, California requires energy inspections (envelope, infiltration) and has unique inspection certificates that are required for insulation and mechanical equipment and devices that fall under the Building Energy Efficiency Standards.

Website: http://www.energy.ca.gov/title24/

Massachusetts

The first state to adopt an above-code appendix to its state building energy code, Massachusetts implemented a version of the 2009 IECC that was designed to achieve 20 percent greater savings than the base 2009 IECC. By the end of 2012, 122 communities in Massachusetts adopted the voluntary stretch code—an impressive rate of participation for voluntary code. The Massachusetts state government has since adopted the 2012 IECC and ASHRAE 90.1-2010 building energy codes, with an effective date of July 1, 2014. As a result, DOE estimates, the state will save $144 million annually by 2030.

Website: http://www.mass.gov/eea/energy-utilities-clean-tech/energy-efficiency/policies-regs-for-ee/building-energy-codes.html

Texas

Texas, a state with a "home rule" constitution, passed legislation in 2001 requiring local governments to follow a single statewide building energy code.

While Texas has not adopted the 2012 IECC or ASHRAE 90.1-2013, numerous municipalities in the state have moved forward with more progressive building energy codes than are recommended by the state. Notably, the city of Houston has adopted a stretch code for residential buildings equivalent to 10 percent above the 2009 IECC. It is estimated that 2012 IECC and ASHRAE 90.1-2010 adoption in Texas would save close to $1 billion annually by 2030.

Website: http://seco.cpa.state.tx.us/tbec/

Arizona

Arizona is another home rule state, where energy codes are adopted and enforced at the local level. As such, several communities, including Pima County, Peoria, and Phoenix, have emerged as local leaders in building code adoption. These jurisdictions now have codes based on the 2012 IECC. The successful experience of these municipalities has encouraged other local governments in Arizona to consider adopting an energy code. However, despite the continued success, only half of the cities researched by the Phoenix Chapter's Technical Committee have adopted energy codes. It is estimated that adopting the 2012 IECC and ASHRAE 90.1-2010 energy codes statewide could save Arizona about $270 million annually by 2030.

Website: http://www.azenergy.gov/government/state+energy+codes.aspx

Illinois

Illinois is notable as a state that adopted the 2012 IECC on January 1, 2013, and has set up an aggressive system for implementing future updates to energy building codes. A provision in past legislation to adopt 2009 IECC and ASHRAE 90.1-2007 directed the state's Capital Development Board to adopt subsequent versions of the IECC within 9 months of publication. DOE expects Illinois' energy cost savings to reach $270 million annually by 2030.

Website: http://www.illinois.gov/dceo/whyillinois/KeyIndustries/Energy/Pages/IECC.aspx

What States Can Do

States with energy codes can consider updates and improvements to the implementation process to increase energy efficiency. States with no energy code in place can examine the costs and benefits of implementing a code and consider initiating a code adoption process.

Action Steps for States

States that already have an energy code can:

- Implement a rigorous enforcement program that ensures that local building code departments have proper training and resources, including adequate staff coverage.
- Review the version of the document currently in force. If it is more than 5 years old, consider an updated version. The latest available IECC code is the 2015 version, and the most recent ASHRAE Standard 90.1 is the 2013 version.
- Conduct analysis on the effect of potential code updates on energy and cost savings for building owners, on the effect on energy generation and distribution, and on GHG emissions and other criteria air pollutant levels. Balance these benefits against any added construction costs.
- Initiate a stakeholder process to review the data, obtain participant input, and decide whether to adopt a new code.
- If a new version of the energy code is adopted, initiate administrative and educational processes. Implementation tools and other resources are available at no charge from DOE.
- If a state-specific energy code training program exists, review it and consider an update that describes new codes not currently covered.

A state that does not have an energy code can:

- Review available model codes and standards and learn about other states' experiences. Conduct research and analysis to determine which model codes best match the needs of the area under consideration.
- Establish a construction market baseline against which to assess the benefits of an energy code. This may require a field survey of homebuilders, suppliers, and contractors, including onsite inspections and interviews.
- Conduct an analysis of the effect of the new code on energy and cost savings for building owners, power system reliability, and reduced GHG emissions and other criteria air pollutants. Balance these benefits against any added construction codes.
- Initiate a stakeholder process to review the data, obtain stakeholder input, and decide whether to adopt the energy code under consideration.
- After a decision to adopt an energy code, initiate administrative and educational processes, as appropriate.
- Develop a code implementation process that includes training and technical assistance. Reach out to affected industries and audiences across the state. Tap federal, NGO, and industry sources for expertise and resources to support these efforts.

Information Resources

Resources for Building Code Information

Title/Description	URL Address
ASHRAE. ASHRAE provides technical standards, publications, education, and hosting for industry events.	http://www.ashrae.org
BCAP. A nonprofit organization, BCAP is dedicated to helping states adopt and implement up-to-date building energy codes.	http://energycodesocean.org
DOE Building Energy Codes Program. Program provides compliance tools, technical assistance, and other code information and support.	http://www.energycodes.gov
DOE. Building energy code determinations issues by the U.S. Department of Energy.	http://www.energycodes.gov/determinations
ICC. The ICC provides code documents, technical assistance, training, and other services, including the IECC residential code.	http://www.iccsafe.org
ICC Code Library. Online library for each of the ICC model codes.	http://publicecodes.cyberregs.com/icod/
ICC State Codes. Online library of code language for various states that have IECC-based building code language.	http://publicecodes.cyberregs.com/st/
Midwest Energy Efficiency Alliance (MEEA). MEEA works on code development and adoption in the Midwest states.	http://www.mwalliance.org/policy/building-energy-codes
NASEO. The association of state energy offices.	http://www.naseo.org/building-energy-codes
NBI. A nonprofit organization, NBI develops leading-edge commercial building standards and related research and technical information.	http://www.newbuildings.org
Northeast Energy Efficiency Partnerships (NEEP). NEEP works on code development and adoption in the Northeast states.	http://www.neep.org/initiatives/energy-efficient-buildings/building-energy-codes
Northwest Energy Efficiency Alliance (NEEA). NEEA works on code development and adoption in the Pacific Northwest states.	http://neea.org/initiatives/codes-standards/codes
RESNET. RESNET accredits home energy rating organizations and provides a variety of technical information on home energy ratings and home energy performance.	http://www.resnet.us
Southwest Energy Efficiency Project (SWEEP). SWEEP works on code development and adoption in the Southwest region and Rocky Mountain states.	http://www.swenergy.org/programs/buildings/codes/index.html
South-central Partnership for Energy Efficiency as a Resource (SPEER). SPEER works to accelerate the adoption of energy codes in Texas and Oklahoma.	http://eepartnership.org/energy-codes-2/

Compliance and Analytical Tools

Title/Description	URL Address
DOE Building Energy Software Tools Directory. This is the DOE directory of building energy analysis tools available from numerous organizations.	http://www.eere.energy.gov/buildings/tools_directory/
DOE COMcheck and REScheck. DOE-developed tools that offer an easy way to check whether building designs meet energy code requirements.	https://www.energycodes.gov/compliance/tools
DOE Compliance Evaluation Tools. DOE-developed tools to help states and jurisdictions measure and report their rate of compliance.	https://www.energycodes.gov/compliance/evaluation
DOE EnergyPlus. This public-domain software is a whole-building energy simulation program that engineers, architects, and researchers use to model energy and water use in buildings.	http://www.eere.energy.gov/buildings/energyplus/
ENERGY STAR Portfolio Manager. This tool allows users to track energy use of a portfolio of existing buildings online. It includes functions for benchmarking, managing a single building or group of buildings, assessing investment priorities, and verifying building performance.	https://portfoliomanager.energystar.gov/
ENERGY STAR Target Finder. This tool rates the energy performance of a new building design using information about energy use per square foot derived from building design simulation tools. EPA's energy performance rating system uses a 1 to 100 scale, where an ENERGY STAR target rating is 75 or higher.	http://www.energystar.gov/buildings/tools-and-resources/target-finder https://portfoliomanager.energystar.gov/pm/targetFinder
NEEA Energy Code Compliance Studies. These studies document energy code compliance results in the Pacific Northwest states.	http://neea.org/initiatives/codes-standards/codes

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4.4 State Appliance Efficiency Standards

Policy Description and Objective

Summary

Appliance standards save energy and generate net benefits for homes, businesses, and industry by reducing the cost of operating equipment and appliances.

State appliance efficiency standards establish minimum energy efficiency levels for appliances and other energy-consuming products. These standards typically prohibit the sale of less efficient models within a state. Many states are implementing appliance and equipment efficiency standards, where cost-effective, for products that are not already covered by federal government standards.[36] States are finding that appliance standards offer a cost-effective strategy for improving energy efficiency and lowering energy costs for businesses and consumers.

As of February 2014, 12 states (Arizona, California, Connecticut, Georgia, Maryland, Nevada, New Hampshire, New York, Oregon, Rhode Island, Texas, Washington, and the District of Columbia) have adopted one or more appliance efficiency standards for products not covered by federal standards (ASAP 2014).

Appliance efficiency standards have been an effective tool for improving energy efficiency. At the federal level, the U.S. Department of Energy (DOE) has been responsible for setting minimum appliance standards and test procedures for an array of residential and commercial appliances and equipment since 1987. As of 2000, federal appliance efficiency standards had reduced U.S. electricity use by 2.5 percent and carbon emissions by nearly 2 percent (ACEEE 2001). Due to new standards contained in the Energy Policy Act of 2005 (or EPAct 2005), the Energy Independence and Security Act of 2007 (or EISA 2007), and additional DOE rules, total electricity savings from already adopted federal standards are projected to increase 682 billion kilowatt-hours (kWh) per year or 14 percent of the projected total U.S. electricity use in 2025 (ASAP 2012).

Efficiency standards can play a significant role in helping states meet energy savings goals. California's standards program has saved consumers over $75 billion on electricity bills since its inception (CEC 2013).

Objective

The key objectives of appliance efficiency standards are to:

- Raise the efficiency of a range of residential and commercial energy-consuming products, where cost-effective.
- Overcome market barriers, such as split incentives between homebuilders and homebuyers and between landlords and tenants, and panic-purchase situations in which appliances break and must be replaced on an emergency basis. In a panic purchase, customers usually do not have the time to consider a range of models, features, and efficiency levels, and the full range may not be available from all suppliers.
- Reduce energy use to lower criteria air pollution and greenhouse emissions, improve electric system reliability, and cut consumer energy bills.

[36] Under certain conditions, a state may exceed a federal standard for a federally covered product; overall, however, federal law is preemptive. For example, in the case of building codes, a state can create a building code compliance path in which a furnace is at a higher efficiency than the federal standard. However, the state must also provide a compliance path under which the higher efficiency furnace is not required. Thus, the option to exceed federal standards is indirect and is typically only possible in the case of building codes. In addition, states may not ban lower efficiency products.

Benefits

In addition to saving energy, appliance and equipment standards help reduce greenhouse gas (GHG) emissions and other air pollution, improve electric system reliability, and save consumers and businesses significant amounts of money over the life of the equipment. Federal standards completed through 2014 are expected to have reduced U.S. energy use by a cumulative 70 quadrillion British thermal units (quads) by 2020 and result in energy bill savings of $960 billion (DOE 2015a). In 2012, an analysis showing 34 new or updated standards that could be pursued in the near future had potential annual savings of 212 terawatt-hours (TWh)[37] of electricity, 126 trillion British thermal units (Tbtu) of natural gas, and 42,000 megawatts (MW) of peak demand savings in 2025 if implemented nationally. These standards are also cost-effective, with purchases of these appliances through 2035 expecting to result in net present value savings of over $167 billion if the standards are implemented (ASAP 2012).

In addition to appliance standards that set minimum energy efficiency performance levels that all equipment must meet, states can go further by adopting ENERGY STAR specifications that set higher efficiency levels. ENERGY STAR identifies the top performers in the marketplace, and supports even greater levels of energy savings.

The direct economic and environmental benefits of state standards are also substantial. California draft regulations for 15 new appliance standards are expected to save 50 billion gallons of water, 1,400 MW of peak electricity, 9,800 gigawatt-hours (GWh) of electricity, and 162 million therms of natural gas per year. This is expected to result in annual savings of $2 billion (CEC 2014).

While federal appliance standards have been expanding in recent years, there is still great potential for states to move into product areas not yet covered by federal standards. Table 4.4.1 looks at energy savings from some of the products with the largest potential for savings in each sector, then gives a total for each sector for all 34 products considered by an Appliance Standards Awareness Project (ASAP) study into future appliance standards.

[37] One TWh is a billion kWh.

Table 4.4.1: Estimated Energy Savings of Appliance Standards Not Covered by Federal Law

Products	Annual Savings in 2025			Annual Savings in 2035		
	Electricity Savings (TWh)	Peak Demand (GW)	Natural Gas (Tbtu)	Electricity Savings (TWh)	Peak Demand (GW)	Natural Gas (Tbtu)
Residential Standards						
Water heaters	18.2	2.5	—	43.0	5.9	—
Set top boxes and digital communication equipment	14.7	2.0	—	14.7	2.0	—
Air handlers	13.7	5.6	—	29.1	11.9	—
Total (14 products)	**98.5**	**16.8**	**51.6**	**142.3**	**27.0**	**51.6**
Commercial And Industrial Standards						
Walk-in coolers and freezers	14.7	3.4	—	14.7	3.4	—
Distribution transformers	10.9	1.5	—	22.4	3.1	—
Electric motors	9.0	1.4	—	18.6	2.9	—
Total (13 products)	**62.4**	**15.5**	**74.2**	**98.5**	**24.5**	**139.9**
Lighting Standards						
Incandescent reflector lamps	20.2	5.0	—	20.2	5.0	—
Outdoor lighting fixtures	10.3	0.7	—	26.1	1.8	—
General service fluorescent lamps	6.9	1.7	—	6.9	1.7	—
Total (7 products)	**50.8**	**9.3**	—	**65.6**	**15.6**	—
ALL PRODUCTS	**212**	**42**	**126**	**306**	**67**	**235**

Source: ASAP 2012

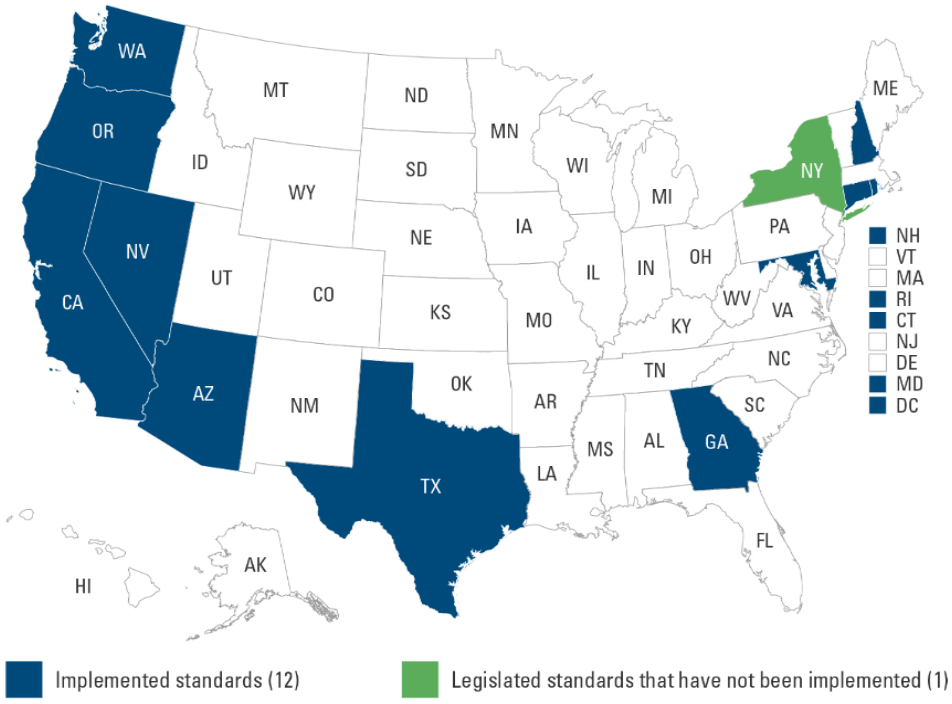
States with Appliance Efficiency Standards

Many states either have implemented appliance standards or are considering implementing them, as shown in Figure 4.4.1. California's appliance standards program dates to the 1970s, when the state began to pursue standards before the enactment of federal legislation. When the federal government opted not to issue standards under its legislative mandate in 1982, other states joined California and developed state standards. These state initiatives helped create the consensus for new federal legislation in 1987 (the National Appliance Energy Conservation Act or NAECA), the EPActs of 1992 and 2005, and EISA 2007. While the NAECA preempted state action on federally covered consumer products (with limited exceptions as discussed later), California has continued to develop efficiency standards for other products and technologies. California's standards program has contributed to substantial improvements in energy efficiency. Since its inception, the program has saved consumers over $75 billion on electricity bills alone (CEC 2013).

Additional states have recently enacted legislation supporting efficiency standards. These include Arizona, Connecticut, Georgia, Maryland, Nevada, New Hampshire, New York, Oregon, Rhode Island, Texas, Washington, and the District of Columbia. Table 4.4.2 lists adopted and pending efficiency standards by state.

In 2013, Oregon passed Senate Bill 692, which added standards for televisions and battery chargers effective in 2014 as well as double-ended quartz halogen lamps effective in 2016 (ODOE 2014). These new standards are expected to save 244 GWh and $22 million annually in utilities by 2020 (OSL 2013).

Figure 4.4.1: States with or Considering Appliance Standards



Source: Compiled by ICF International based on ASAP 2014.

Table 4.4.2: States with Adopted or Pending Appliance Efficiency Standards

Product	AZ	CA	CT	DC	GA	MD	NH	NV	NY	OR	RI	TX	WA
Battery chargers		X								X			
Bottle-type water dispensers		X	X	X		X	X		O	X	X		X
Commercial hot-food holding cabinets		X	X	X		X	X		O	X	X		X
Consumer audio and video products			X						O	X			
Digital television adapters									O				
Double-ended quartz halogen lamps										X			
External power supplies										Y			
Faucets		X			X								
General service incandescent lamps		Y						X					
Metal halide lamp fixtures		Y											
Pool pumps	X	X	X						O				X
Portable electric spas	X	X	X						O	X			X
Portable light fixtures		X							O				
Televisions		X	X						O	X			
Toilets		X			X							X	
Urinals		X			X							X	

Key: X = adopted, Y = state is implementing until national standards take effect, O = standard has been legislated but has not yet been implemented.

Source: Compiled from ASAP 2014.

Designing an Effective Appliance Standards Policy

States have substantial experience with appliance efficiency standards. Key issues they have addressed include identifying participants, design issues, and linkages with federal and state policies.

Participants

- *State legislatures.* Establishing efficiency standards in a state typically requires enabling legislation. However, once legislation is enacted, it may allow an executive agency to set further standards administratively. Because several states have established standards for administration procedures, these implementation processes can also be largely replicated from other states' experiences.
- *State energy offices.* State energy offices, which typically administer the federal state energy program funds, have generally acted as the administrative lead for standards implementation.
- *Customers.* It is important to consider the people who use the affected products during the standards development and implementation processes. Consideration includes assessing benefits and costs to consumers and impacts on product features or market choices.
- *Product manufacturers.* Companies that make affected products clearly have a stake in standards development. Proactive consultations with manufacturers can increase the speed and effectiveness of the development and implementation process. Their expertise can help refine efficiency levels and labeling and certification procedures.
- *Product distributors, installers, and retailers.* Wholesale distributors, installation contractors, and retail vendors are key players since they must know the technical requirements and labeling and certification rules to be able to participate effectively in standards implementation and enforcement.
- *Utilities.* Utilities may provide technical assistance for developing standards and support for implementation. Their relationships with customers and trade allies can also be helpful in educating markets about the effects of new standards. Utilities that operate voluntary efficiency programs may want to coordinate their incentive and education programs, gearing voluntary incentive targets to the standards.
- *Public interest organizations*. Groups representing consumers, environmental interests, and other public interests can offer technical expertise and important public perspectives in developing and implementing standards as baselines.

Key Design Issues

- *Defining the covered products and their energy efficiency, applicability, and cost-effectiveness*. States have adopted appliance standards not currently preempted by federal standards covering from one to 12 products. Some products may not be appropriate candidates for standards if, for example, they have recently been covered by federal law, or they are not appropriate for the state's climate or markets. States target certain products for standards based on their total energy savings potential, technical feasibility, and economic attractiveness. Because technologies suitable for appliance standards are typically already being used in well-known, consistent applications, estimating their energy savings has been relatively straightforward.
- *Assessing overall benefits and costs.* In addition to the economic assessment of individual technologies, states have conducted overall assessments of benefits and costs. Benefits can include energy savings, energy bill reductions, electric reliability benefits, reduction in future energy market prices, and criteria air

pollutant reductions and GHG emission prevention. Costs can include product buyer costs, product manufacturer costs, and program administration costs.

- *Availability of test methods.* Test methods are necessary to set efficiency levels for the state appliance standards. Test methods may have been established by federal agencies such as DOE and the U.S. Environmental Protection Agency (EPA), by other states that have already set standards, or by industry associations representing companies that make the products of interest.
- *Defining certification and labeling requirements*. Like test methods, product certification and labeling procedures may have already been established by federal or state agencies or by industry associations. In some cases, it may be necessary for appliance standards regulations to define a labeling or certification method beyond those already established. On the other hand, and in rare instances, technical or market issues may warrant certification or labeling exemptions for certain products. For example, if a standard calls for a simple, prescriptive design change, that feature may be so visible on the product that certification and labeling may not be needed.
- *Establishing inspection and enforcement procedures*. Inspection and enforcement of state appliance standards regulations has typically involved self-policing. Industry competition is usually such that competitive manufacturers report violations. Federal standards and voluntary programs are starting to move toward more stringent inspection and enforcement schemes, with the voluntary ENERGY STAR program and some federal lighting and motor standards requiring third-party certification. Making product performance data publically available (e.g., by listing compliant products on the state website) could encourage fair participation and reporting, as well as invite self-policing by industry stakeholders. While states may want to reserve the legal right to inspect individual products or installations, it is rare that state agencies have had to institute regular inspection or sustained enforcement actions.

Interaction with Federal Policies

Federal laws such as NAECA, EPAct 1992, EPAct 2005, and EISA 2007 have established appliance efficiency standards for more than 50 products (see Table 4.4.3), representing about 90 percent of home energy use, 60 percent of commercial building energy use, and about 30 percent of industrial energy use (DOE 2015a). States can actively promote efficient models of these products by increasing consumer awareness and developing other programs.

States are preempted from setting their own standards for the products covered by federal standards. State efficiency standards that were established before a product was covered under NAECA are pre-empted as of the effective date of the federal standard (i.e., the date that manufacturers must comply with that standard). Nevertheless, some states are enacting standards for products that are not yet covered by federal law, for which DOE rulemakings will take place (as directed by EPAct or EISA), and/or that are being considered for coverage under NAECA, expecting to gain several years of savings in the interim. States can apply for waivers of preemption for products that are covered by federal law. If they face special conditions, for example, states can cite those circumstances as the basis for a waiver. California for instance was granted a waiver for metal halide lamp fixtures; this means its two tier standards, the second of which will take effect in 2015, will not be preempted by federal standards (ASAP 2014). Meanwhile, Oregon's standards for external power supplies will be allowed to remain in effect until 2016, when the federal standards broaden their scope to catch up with Oregon (ASAP 2014).

Table 4.4.3: Products with Existing Federal Appliance Efficiency Standards or Active Rulemakings

Consumer Products	
o Battery chargers	o Furnace fans
o Ceiling fans	o Furnaces and boilers
o Central air conditioners and heat pumps	o Hearth products
o Clothes dryers	o Ranges and ovens
o Clothes washers	o Microwave ovens
o Computer/battery backup	o Pool heaters
o External power supplies	o Portable air conditioners
o Dehumidifiers	o Refrigerators and freezers
o Direct heating equipment	o Room air conditioners
o Dishwashers	o Water heaters
Commercial and Industrial Products	
o Commercial ice makers	o Pumps
o Clothes washers	o Refrigerated beverage vending machines
o Commercial package air conditioners and heat pumps	o Refrigeration equipment
o Commercial packaged boilers	o Single package vertical air conditioners and heat pumps
o Compressors	o Small electric motors
o Computer room air conditioners	o Unit heaters
o Distribution transformers	o Walk-in coolers and freezers
o Electric motors	o Warm air furnaces
o Fans and blowers	o Water heating equipment
o Packaged terminal air conditioners and heat pumps	
Lighting Products	
o Ceiling fan light kits	o Incandescent reflector lamps
o Fluorescent lamp ballasts	o Light-emitting diode lamps
o General service fluorescent lamps	o Luminaires
o General service incandescent lamps	o Medium-base compact fluorescent lamps
o General service lamps	o Metal halide lamp fixtures
o High-intensity discharge lamps	o Torchieres
o Illuminated exit signs	o Traffic signal modules and pedestrian modules
Plumbing Products	
o Commercial spray valves	o Urinals
o Faucets	o Water closets (flush toilets)
o Showerheads	

Source: DOE 2015b

Interaction with State Policies

It is important for states to recognize that their appliance efficiency standards are different from ENERGY STAR efficiency specifications. The former set minimum energy efficiency performance levels that all appliances must meet; the latter are set at higher energy efficiency levels to help identify the top performers in the marketplace (typically the top 25 percent). As the market share of these products grows over time, EPA revisits ENERGY STAR specifications to ensure continued relevance in the marketplace and savings for the consumer above and beyond standard appliance offerings. It is also important to note that the scope of products covered by ENERGY STAR may be narrower and application-specific, and performance requirements may be climate-dependent. Because of these differences, ENERGY STAR specifications may not be an appropriate basis for market-wide appliance efficiency standards.

Program Implementation and Evaluation

Many states have learned that they do not need to start from scratch when developing and implementing appliance efficiency standards; in many cases, they can refer to the work already conducted by states with established appliance efficiency standards. States have made minor adaptations to existing legislation based on the product lists and analyses conducted by other states. States have also consulted national and regional organizations with expertise and technical support capability. (For more information about states' activities, see "State Examples" later in this section.)

While a state agency can initiate an inquiry into efficiency standards, legislation is typically needed to enable executive agencies to regulate in this area. Once legislatively authorized, states have followed these steps toward successful implementation of appliance efficiency standards:

- *Establish a stakeholder process*. Notify affected manufacturers, consumers, utilities, state agencies, and public interest organizations about the initiative. Develop information materials and hold workshops to inform stakeholders and solicit feedback.
- *Define covered products.* Develop a specific list of product and equipment types to be covered by the program. States have obtained lists of eligible products from other states that have recently enacted standards and from national organizations.
- *Conduct benefit-cost analysis and related studies*. (See "Key Design Issues" described earlier in this section.)

Best Practices for Standards Design and Implementation

- *Learn from others.* There are many lessons to be learned from states that have adopted appliance standards.
- *Consult with stakeholders*. Identify key groups early, including product manufacturers, affected retailers and customer groups, advocates, and utilities. Keep stakeholders informed and seek their input regularly.
- *Conduct a benefit-cost analysis* of the proposed standards.
- *Address key issues,* such as covered products, efficiency levels, effective dates, test methods, product certification, labeling requirements, and enforcement.
- *Review and adjust covered product lists* to be sure they are technically and legally up to date.

- *Conduct rulemaking*. The rule typically defines covered products, effective dates, efficiency standards, test methods, certification and labeling procedures, inspection and enforcement procedures, penalties for noncompliance, procedures for appeals, waivers and other exceptions, and contact information for the agencies involved. A rulemaking also provides formal notice, review, and comment procedures. When enabling legislation authorizes the executive branch to add new products or update standards on covered products, the regulatory process may be reopened after a few years.
- *Monitor, review, and modify the program as needed*. Based on stakeholder response and market trends, some states have made specific program modifications, including revisions to covered products, efficiency levels, and effective dates, as well as process improvements such as more frequent stakeholder input cycles and more transparent public information processes.

Typical implementation considerations include:

- *Effective dates*. A single date is typically established after which noncomplying products may not be sold or installed in the state. In some cases, where warranted by product-specific considerations, extra time is allowed for manufacturers or retailers to prepare for the new standards.
- *Test methods.* A specific method must be defined for testing the efficiency of a given product type. DOE, ENERGY STAR, industry associations, and/or technical societies such as ASTM International (formerly the

American Society for Testing and Materials), the American Society of Mechanical Engineers, the Illuminating Engineering Society of North America, and ASHRAE (formerly the American Society of Heating, Refrigerating, and Air Conditioning Engineers) are typical sources of appliance test methods.

- *Product certification.* The federal standards program is essentially self-certifying; that is, manufacturers use DOE-approved test procedures and submit certification reports to attest that affected products comply with standards. Some states, notably California, maintain databases of covered products to identify which models are in compliance with their state standards.
- *Labeling requirements*. To date, state standards programs have relied primarily on national labeling and other information programs to address the need to label covered products. For example, federal law requires the Federal Trade Commission to operate an appliance labeling program for defined product types, and the EPA ENERGY STAR program includes certain labeling guidelines. In some cases, industry associations that maintain their own certification programs set labeling guidelines for certain products. Labeling issues vary by product type and are resolved on a case-by-case basis.
- *Enforcement*. The California program is largely self-policing. Manufacturers are expected to provide complying products and competitive forces are expected to prevent violations. Enforcement actions typically depend on market participants to bring violation claims.

Historically, the federal standards and ENERGY STAR programs were largely self-policing. In 2011, EPA launched new ENERGY STAR third-party certification and verification program requirements; more recently, DOE has ramped up verification and enforcement efforts. Under ENERGY STAR, products are chosen and tested on an annual basis, and both DOE and EPA continue to provide a vehicle for product complaints and challenges.

Evaluation

Appliance efficiency standards programs have achieved defined results with minimal expenditure of public funds. Evaluating the benefits and costs of the standards is important during the standards setting process. Once enacted, little field evaluation is typically performed.

Depending on the state enabling law, the implementing agency may be authorized to increase standards for affected products and/or to set standards for other product types. These actions are likely to involve detailed technical and economic evaluation. Improvements in the standards setting process itself can also be considered at such times.

Best Practices for Standards Evaluation

- Conduct technical and economic evaluation of opportunities to increase appliance standards and/or set standards for new products.
- Review markets and product applications periodically (e.g., every 3 to 5 years) to determine whether new or adjusted regulations are needed to avoid degradation of savings.

Once a state has operated a standards program for several years, it is helpful to conduct a program review to improve procedures and implement other enhancements.

A key consideration for assessment is degradation of savings. Standards are established for a typical assumed application; over time the use of the product or device may change so that the original intent of the standard is not being served, or technology may change to the point that the device is used differently. Consequently, it can be valuable to review the markets and applications in which standards-covered devices are used, to ensure that the standards are having the intended effect. If the market or application context changes sufficiently for a product, the applicable standard may need to be reevaluated.

Other opportunities for evaluation include assessments of energy, demand, emissions, and other impacts over time, both for evaluating effectiveness and for quantifying emissions impacts for air quality or climate policy purposes. A periodic process evaluation of the standards program can also be helpful to ensure that stakeholder participation is appropriate, technical methods are up-to-date and effective, and rulemaking procedures are as transparent and streamlined as possible.

State Examples

California

California was the first state to initiate an appliance efficiency standards program (in 1977) and maintains the most active and well-funded standards program of any state. California law now covers over 50 products, 17 of which have not been replaced by federal standards (ASAP 2014). Most recently, in 2010 California approved efficiency standards for televisions, and in 2012 California created standards for battery chargers and external power supplies (ACEEE 2013). Most state standards programs in recent years have used California's covered products (or a subset of these products) and technical procedures as the basis for their efforts.

The California Energy Commission operates the standards programs for the state. It develops technical and economic assessments of products recommended for rulemakings, develops draft regulations, holds public participation processes, issues final rules, monitors compliance, and maintains a database of covered products. Recently, California's investor-owned utilities have increased their role in the program, providing technical advice and recommending and advocating for new appliances to be covered. Since the 2006–2008 program cycle, these utilities have also been able to claim credit for program savings in their energy efficiency targets through the California Public Utilities Commission (Cadmus 2012).

California's standards program has contributed to substantial improvements in energy efficiency. Since California's appliance standards program was first established, it has saved consumers over $75 billion on electricity bills alone (CEC 2013). The building code and appliance standards currently in place contribute a combined gross energy savings of 3,229 GWh and electricity demand savings by 446,000 kW annually (CPUC 2013).

In order to go beyond federal standards, California must obtain a federal waiver. The state requested and was allowed to implement national standards for general service incandescent bulbs earlier than mandated. California has also been granted a waiver to avoid federal preemption of its metal halide lamp fixture standards.

Over the course of 2014 and 2015, California is releasing draft regulations on a variety of new standards for appliances including faucets, toilets, urinals, air filters, dimming ballasts, LED lamps, MR lamps, pool pump motors, portable electric spas, computers, monitors, displays, network equipment, game consoles, and commercial clothes dryers. These proposals have the potential to bring annual savings of 50 billion gallons of water, 1,400 MW of peak electricity, 9,800 GWh of electricity, and 162 million therms of natural gas. The standards are expected to result in natural resource savings of $2 billion annually (CEC 2014).

Websites: http://www.energy.ca.gov/appliances/
http://www.energy.ca.gov/appliances/database/historical_excel_files/
(contains California appliance data)

Connecticut

Connecticut enacted efficiency standards legislation in 2004, 2007, and most recently in 2014 through Senate Bill 1243. Through this legislation, Connecticut has drawn or is drawing up plans to implement nine appliance standards that are not currently covered by federal standards. These appliances include bottle-type water dispensers, commercial hot food holding cabinets, hot tubs, swimming pool pumps, compact audio equipment, DVD players and recorders, and televisions (DSIRE 2014).

Website: http://www.ct.gov/deep/cwp/view.asp?a=4120&Q=481608

Oregon

In 2005 and 2008, Oregon passed legislation setting minimum energy efficiency standards for appliances. The standards that have not been preempted by federal standards cover bottle-type water dispensers, hot food holding cabinets, compact audio devices, DVD players and recorders, and portable electric spas. In addition, Oregon's standards for external power supplies will be allowed to remain in effect until 2016, when the federal standards broaden their scope to catch up with Oregon (ASAP 2014).

In 2013, Oregon passed Senate Bill 692. This bill added standards for televisions and battery chargers effective in 2014, as well as standards for double-ended quartz halogen lamps effective in 2016 (ODOE 2014). These new standards are expected to save 244 GWh and $22 million annually in utilities by 2020 (OSL 2013).

Website: http://www.oregon.gov/ENERGY/CONS/Pages/StateRegulatedApplianceStandards.aspx

What States Can Do

Depending on whether authority for efficiency standards already exists, states interested in exploring appliance efficiency standards can begin a new standards initiative, upgrade standards for products currently covered by state law, or expand coverage to new products.

Action Steps for States

States that have adopted appliance efficiency standards can conduct the following action steps:

- Assess whether the state has authority to upgrade current standards or set standards for other products. If it has authority, determine appropriate increases in efficiency levels for current standards or appropriate new products and efficiency levels. If it does not have authority, work with policy-makers to assess the benefits of allowing the implementing agency to upgrade standards and set standards for other products.
- Develop a list of products for which standards could be established and conduct an initial assessment of efficiency levels and potential savings. Conduct a rulemaking process to determine the final products to cover and the associated efficiency levels. Encourage active stakeholder participation and use transparent analysis and decision-making procedures.
- Periodically report on program impacts and operations.
- Assess stakeholder communication and participation and revise these processes, if needed.
- Actively promote consumer awareness of appliances for which EISA 2007 directs DOE to set standards.

States that are considering adopting appliance efficiency standards can:

- Review sample legislation, product lists, and analyses available from other states.
- Consult with stakeholders, national and regional associations, and other key parties to conduct preliminary cost/benefit and feasibility analyses.
- Work with policy-makers to determine whether appliance efficiency standards are an appropriate option.
- Actively promote consumer awareness about the energy cost savings and environmental benefits of appliance standards.

Information Resources

Information about States

Title/Description	URL Address
Appliance Efficiency Program. This website provides information and resources on California's appliance efficiency programs, including current regulations, rulemakings, a database of energy efficiency appliances, and background information.	http://www.energy.ca.gov/appliances/
2014 Appliance Efficiency Regulations. This document provides California's appliance efficiency regulations, and related public comments, hearing transcripts, and other information.	http://www.energy.ca.gov/2014publications/CEC-400-2014-009/CEC-400-2014-009-CMF.pdf
California's Appliance Standards: A Historical Review, Analysis and Recommendations, Staff Report. This 1983 report by the California Energy Commission reviews the history of California's appliance standards.	URL not available.
Energy Efficiency Standards: A Low-Cost, High-Leverage Policy for Northeast States. The analysis conducted for this project showed that efficiency standards have very large and highly cost-effective economic, energy, and environmental benefits for states in the Northeast.	http://www.eswaterheater.org/sites/default/files/library/1147/313.pdf
State-Regulated Appliance and Equipment Standards. Overview of the current and federally preempted appliance standards in Oregon.	http://www.oregon.gov/ENERGY/CONS/Pages/StateRegulatedApplianceStandards.aspx
Product Efficiency Standards. Overview of standards from the Connecticut Department of Energy and Environmental Protection.	http://www.ct.gov/deep/cwp/view.asp?a=4405&Q=481608&deepNav_GID=2121#ProductEfficiency
Multi-State Appliance Collaborative. This website has information by state on each state's appliance standards program and information by appliance on relevant state standards.	http://appliancestandards.org/

General Information about Appliance Efficiency Standards

Title/Description	URL Address
The American Council for an Energy-Efficient Economy (ACEEE). The ACEEE website contains many publications and resources on all aspects of energy efficiency, economic development, and environmental concerns.	http://www.aceee.org
ASAP. This group provides information and resources on federal and states appliance standards.	http://www.standardsasap.org

Title/Description	URL Address
Codes and Standards White Paper on Methods for Estimating Savings. This 2005 paper addresses California building and appliance energy efficiency standards, and the role of codes and standards programs as part of utility portfolios of energy efficiency programs.	http://www.cpuc.ca.gov/NR/rdonlyres/6E783BC7-3467-484E-AD2A-29EF4A50432B/0/Mahone_2005_CS_White_Paper_SavingsEstimatingSavings.pdf
Collaborative Labeling and Appliance Standards Program. This program's website provides information and resources on developing countries that are pursuing energy efficiency and labeling programs.	http://www.clasponline.org/
Appliance and Commercial Equipment Standards. This DOE website provides information on state and federal appliance standards.	http://energy.gov/eere/buildings/appliance-and-equipment-standards-program
Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards. This 2006 report describes opportunities for state governments to set minimum-efficiency standards for 18 appliances and other types of equipment currently not covered by federal standards.	http://www.aceee.org/sites/default/files/publications/researchreports/a062.pdf
Northeast Energy Efficiency Partnerships (NEEP). NEEP's website provides information on promoting energy efficiency in the Northeastern United States.	http://www.neep.org
Energy Efficiency Standards: A Low-Cost, High-Leverage Policy for Northeast States. This report provides information about energy efficiency standards in the Northeastern states.	http://www.eswaterheater.org/sites/default/files/library/1147/313.pdf
Realized and Prospective Impacts of U.S. Energy Efficiency Standards for Residential Appliances. 2002 report on a Lawrence Berkeley National Laboratory project that involved developing an analytical framework to estimate energy, environmental, and consumer economic impacts of federal residential energy efficiency standards.	http://eetd.lbl.gov/sites/all/files/realized_and_prospective_impacts_of_us_energy_efficiency_standards_for_residential_appliances_lbnl-49504.pdf
Smart Energy Policies: Saving Money and Reducing Pollutant Emissions Through Greater Energy Efficiency. The report details nine specific policy recommendations that could have a substantial impact on the demand for energy in the United States while also providing positive economic returns to American consumers and businesses.	http://www.aceee.org/sites/default/files/publications/researchreports/E012.pdf
DOE State Energy Program This DOE website provides information and resources on state energy programs.	http://energy.gov/eere/wipo/state-energy-program
Rules, Regulations & Policies for Energy Efficiency. This table, part of the Database of State Incentives for Renewables and Efficiency (DSIRE), summarizes details on federal and individual state appliance standard programs.	http://programs.dsireusa.org/system/program?type=62&

Examples of Legislation

State	Title/Description	URL Address
Arizona	House Bill 2332. This bill sets minimum efficiency standards for 15 products.	http://www.azleg.gov/legtext/49leg/1r/bills/hb2332s.pdf
California	2014 Appliance Efficiency Regulations. This document provides California's appliance efficiency regulations, and related public comments, hearing transcripts, and other information.	http://www.energy.ca.gov/2014publications/CEC-400-2014-009/CEC-400-2014-009-CMF.pdf
Colorado	A Bill for an Act Concerning Energy Efficiency Standards for Specified Devices (House Bill 04-1183). This bill sets minimum energy efficiency standards for 14 products.	http://www.swenergy.org/policy/legislation/2004/colorado/HB-1183.pdf http://www.swenergy.org/policy/legislation/2004/colorado/HB-1183_FactSheet.pdf
Connecticut	An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future (Senate Bill 1243). Establishes the Department of Energy and Environmental Protection and sets minimum performance standards for appliances.	http://www.cga.ct.gov/2011/ACT/PA/2011PA-00080-R00SB-01243-PA.htm
Maryland	State Government—Energy Efficiency Standards (House Bill 1030). This bill, which was enacted in January 2004, provides legislative language for Energy Efficiency Standards for 10 products.	http://mlis.state.md.us/2005rs/billfile/HB1030.htm
Massachusetts	An Act Establishing Minimum Energy-Efficiency Standards for Certain Products (Chapter 139 of the Acts of 2005). This act requires establishment of minimum efficiency standards for five products.	http://www.mass.gov/legis/laws/seslaw05/sl050139.htm
Oregon	An Act Relating to Minimum Energy Efficiency Standards; Creating New Provisions; and Amending ORS 469.229, 469.223, 469.238 and 469.239 (Senate Bill 692). Establishes minimum energy efficiency standards for certain products. Prohibits sale or installation of products that do not meet standards.	https://olis.leg.state.or.us/LIZ/2013R1/Measures/Text/SB0692/Enrolled
Pennsylvania	An Act Providing for Minimum Energy Efficiency Standards for Certain Appliances and Equipment; and Providing for the Powers and Duties of the Pennsylvania Public Utility Commission and of the Attorney General (House Bill 2035). Pennsylvania bill introduced in 2003.	http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=PDF&sessYr=2003&sessInd=0&billBody=H&billTyp=B&billNbr=2035&pn=4640
Rhode Island	Energy and Consumer Savings Act of 2005 (S 0540). Rhode Island's appliance standards legislation, signed July 1, 2005.	http://webserver.rilin.state.ri.us/BillText05/SenateText05/S0540.htm
Vermont	Senate Bill 52. An Act Relating to Renewable Energy Portfolio Standards, Appliance Efficiency Standards, and Distributed Electricity (Senate Bill 52). Vermont bill introduced in 2005.	http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2006/bills/house/S-052.HTM
Washington	An Act Relating to Energy Efficiency (Senate Bill 5098). Washington bill establishing minimum standards and testing procedures for 13 electrical products that are not covered by federal law.	http://apps.leg.wa.gov/documents/billdocs/2005-06/Pdf/Bill%20Reports/Senate/5098.SBR.pdf
United States	Energy Policy Act of 2005.	http://energy.gov/sites/prod/files/2013/10/f3/epact_2005.pdf

State	Title/Description	URL Address
United States	Energy Independence and Security Act of 2007.	http://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf

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4.5 Lead by Example

Policy Description and Objective

Summary

State and local governments are implementing a range of policies and programs that advance clean energy within their own facilities, fleets, and operations. These "lead by example" initiatives help state and local governments achieve substantial energy cost savings and greenhouse gas (GHG) reductions while promoting adoption of clean energy technologies by the public and private sectors.

"Lead by example" programs offer states opportunities to achieve substantial energy cost savings within their own operations, demonstrate environmental leadership, and raise public awareness of the benefits of clean energy technologies.

States are leveraging their purchasing power, their control of significant energy-using resources, and the high visibility of their public facilities to demonstrate clean energy technologies and approaches that lower their energy costs and reduce emissions. They also work closely with local governments, schools, colleges and universities, parks and recreation facilities, and other public sector organizations to promote clean energy within their operations. Lead by example programs take many forms, including:

- Incorporating clean energy principles into statewide energy policies.
- Adopting energy efficiency savings goals for existing public buildings.
  - Benchmarking building energy performance using ENERGY STAR Portfolio Manager and identifying under-performing buildings to target for energy efficiency improvements.
  - Assessing the energy efficiency of a building in terms of its design, construction, and energy systems by using the U.S. Department of Energy's (DOE) Asset Scoring Tool.[38]
- Establishing above-code energy efficiency performance standards for new and renovated public buildings.
- Developing and adopting green building standards with minimum energy efficiency requirements for public housing.
- Procuring energy-efficient equipment for public facilities, including implementing "green fleets" programs, using electric vehicles, and establishing electric vehicle charging infrastructure.
- Purchasing and using renewable energy in public facilities.
  - Increasing use of green power through programs such as the Green Power Partnership.
- Developing innovative financing mechanisms, including:
  - Approving legislation enabling state agencies (and local governments) to enter into energy savings performance contracts (ESPCs), which require that the energy savings cover the cost of financing the improvements out of current and future operating budgets.
  - Establishing energy efficiency revolving loan funds to finance improvements in state and local facilities.
  - Establishing commercial property assessed clean energy (PACE) legislation or ordinances that enable repayment of clean energy measures through property assessments.

[38] DOE's: http://energy.gov/eere/buildings/building-energy-asset-score.

  - Creating a statewide master financing program, such as a lease-purchase agreement, that enables government agencies to own the equipment at the end of the lease term.
  - Directing public pension fund trustees and managers to establish energy-efficient investment strategies for real estate and securities portfolios and/or allocate investment funds for energy-efficient and renewable energy technology development.
- Providing technical assistance and training to state and local facility managers and their staff, including:
  - Developing advanced building design and commissioning guidelines.
  - Assisting with energy audits and implementation of verified savings using ESPCs.
  - Building operator certification training.

Substantial energy and cost savings can be achieved through energy-efficient improvements in public facilities. DOE's State Energy Program has implemented energy-efficient retrofits in more than 150 million square feet of state and local buildings, resulting in annual cost savings of more than $250 million (DOE 2014b).

Objective

The objectives of state lead by example programs vary from state to state. They include:

- Serving as a leading component of comprehensive statewide clean energy programs and initiatives, and encouraging action by a broad range of public and private sector organizations.
- Accelerating adoption of clean energy in the marketplace by setting an example and demonstrating cost-effectiveness.
- Sponsoring research, development, and demonstration projects to promote commercialization of early-stage clean energy technologies and practices.
- Educating and informing policy-makers and stakeholders and raising public awareness about the multiple environmental, economic, and energy benefits that clean energy offers.
- Demonstrating cost-effective ways to reduce GHGs and address climate change.
- Achieving cost savings through adoption of energy-efficient technologies and clean generation.

Benefits

Lead by example programs provide direct operational benefits to state and local governments, including:

- Reducing facility operation costs and increasing funding available for non-energy-related expenditures.
- Encouraging clean energy development in the state and region and demonstrating environmental leadership.
- Achieving substantial cost savings through aggregated purchasing of energy-efficient products and green power.

New York's Energy-Efficient State Buildings

New York's Executive Order 88, issued by the governor's office in 2012, establishes a target to reduce energy consumption in state buildings by 20 percent in 2020 relative to 2010–2011 levels.

The order includes requirements such as developing a comprehensive operations and maintenance plan for the state's building portfolio, and performing an energy efficiency analysis in the design phase of all capital project plans. Onsite renewable energy generation may be used as a credit toward meeting the target (New York State Governor's Office 2012).

- Supporting the development of in-state markets for clean energy products, manufacturers, and services (e.g., ESPCs, renewable energy systems manufacturers, installers, energy-efficient product retailers).
- Attracting businesses that commercialize clean energy technologies to their state.
- Understanding how they use energy and where best to focus energy savings efforts.

Many state lead by example programs focus on improving the energy efficiency of equipment and building systems. Programs can achieve additional benefits, however, by purchasing or generating clean power for public facilities. A number of options are available to state and local governments:

- Purchasing green power for public facility consumption.
- Using combined heat and power (CHP) technologies to reduce energy use through higher efficiency.
- Developing onsite clean energy facilities, such as solar photovoltaic (PV), wind, and CHP.
- Using existing government resources for clean power production (e.g., electricity generation from landfill gas, methane recovery at sewage treatment plants, and biomass resulting from tree and garden trimming).

Types of State Lead by Example Programs

While the possibilities for state lead by example initiatives are broad, state lead by example initiatives typically fall into one of the following categories:

- *State clean energy plans.* Several states are incorporating specific clean energy goals and objectives for state facilities in their state energy plans. States that show leadership in this area include California, New Hampshire, and Texas. (See the *State and Local Examples* later in this section.)
- *Energy savings targets.* States also set energy savings goals for existing facilities, typically expressed as percentage targets with calendar milestones (e.g., reducing energy use per square foot by 20 percent by 2010). Several states have enacted legislation to set these targets. For example, in 2012, the governor of Oregon released a 10-Year Energy Action Plan, which set a statewide goal to reduce energy consumption in all state-owned buildings by 20 percent by 2023 (OR 2012). Connecticut, California, Minnesota, New Hampshire, New York, Vermont, and others have also adopted energy savings targets.
- *Energy efficiency performance standards.* A growing number of states and localities are establishing sustainable design principles that incorporate energy efficiency criteria in performance standards for new and renovated buildings and facilities. As of 2013, 16 states have set energy efficiency targets for public facilities (NCSL 2013).
- *Energy-efficient purchasing.* States are setting minimum energy efficiency specifications for a range of products (e.g., appliances, office equipment, green fleets of vehicles that use alternative fuels). In some cases, states establish procurement policies that require vendors to provide them with products that have earned ENERGY STAR certification. Where mandatory low-bid requirements are in place, legislative authority might be required to modify procurement regulations. States that have issued executive orders and/or legislation to require procuring energy-efficient products include Alabama, Arizona, California, Colorado, Connecticut, Delaware, D.C., Hawaii, Illinois, Kentucky, Louisiana,

Iowa's Executive Order 41

Iowa's Executive Order 41 was adopted on April 22, 2005; it directs state agencies to obtain at least 10 percent of their electricity from renewable energy sources by 2010. To satisfy this requirement, agencies may generate their own renewable energy or participate in their utility's green power programs (Iowa DNR 2005).

Maryland, Massachusetts, Michigan, Nevada, New Hampshire, New Jersey, New York, North Carolina, Texas, Vermont, and Virginia.

- *Energy-efficient public housing*. State housing authority programs can promote clean energy in public housing and other residential buildings through measures such as establishing minimum energy performance criteria. For example, the Michigan State Housing Development Authority requires windows, patio doors, and appliances (refrigerators, dishwashers, washers, and room air conditioners) in public housing to be ENERGY STAR qualified (MSHDA 2009).

In Maryland, the State Agency Loan Program provides 0 percent loans to state agencies for cost-effective, energy-efficient improvements in state facilities. This self-sustaining fund is capitalized with national oil overcharge funds. Since 2007, Maryland's program has provided more than $10.5 million to upgrade lighting, controls, boilers, chillers, and other energy equipment, with projected energy cost savings of more than $32 million (DSIRE 2014).

- *Clean energy generation and procurement.* Purchasing and using renewable energy and clean energy generation for state and local facilities is another way states are leading by example. State and local agencies have established clean energy supply targets that are met through onsite generation or by purchasing green power electricity or renewable energy certificates. An increasing number of state and local governments, including New Jersey, New York, and Iowa, are aggregating electricity demand to purchase green power. States are also identifying opportunities to generate clean onsite power, such as CHP systems, and to use clean onsite generation technologies for backup or emergency power.
- *Innovative financing.* States are developing a wide range of innovative financing mechanisms, including revolving loan funds, commercial PACE financing, tax-exempt master lease-purchase agreements, lease revenue bonds, pension funds, and performance contracting. These mechanisms, used to finance programs to implement energy efficiency improvements in existing buildings, renovation projects, and new state facilities, are usually administered by the state energy office or other lead agency, which coordinates the program across multiple state agencies.
- *Technical support.* Many states lead by example by providing technical assistance, training, and evaluation support to state and local agencies and facility operators. State examples include California's new building design and commissioning guidelines and Oregon's Building Commissioning Program. California's Energy Partnership Program provides a variety of services including conducting energy audits, preparing feasibility studies, and reviewing existing proposals and designs. In Washington, school districts are advised to seek the assistance of the General Administration's ESPC program for energy performance contracts and for project oversight. Missouri has trained more than 100 building operators to Building Operator Certification Level I/II so that they have the requisite knowledge to operate building systems at peak efficiency.

Examples of State and Local Green Power Purchasing Contracting

- In 2010, Delaware entered a cooperative electricity purchase of renewable energy for service to schools, offices, state parks, clinics, emergency responders, and prisons. As of 2013, state and local partners procured more than 80 million kilowatt-hours (kWh) of renewable energy and saved more than $1 million annually (Delaware DFM 2014).
- In 2013, Houston, Texas, signed a 2-year agreement to purchase more than 620 million kWh of Green-e certified renewable energy credits for wind projects annually. This purchase accounts for half of the city's municipal power needs (EPA 2014a).
- Peterborough, New Hampshire, uses 100 percent green power for all of its public facilities through Green-e certified renewable energy credits. Peterborough also plans to increase its use of onsite renewable energy and is currently constructing a solar array to power its new wastewater treatment facility. Once completed, it is expected to be the largest solar array in the state at one megawatt; it will save the town between $400,000 and $800,000 in electricity costs over a 20-year period (EPA 2014a).
- The Cape Light Compact in Massachusetts negotiates lower cost electricity and other benefits for all members, which includes all 21 towns in Cape Cod and Martha's Vineyard. It offers customers green power products with up to 100 percent renewable energy (Cape Light Compact 2014; Connecticut 2009; DSIRE 2012).
- In 2014, Oak Ridge, Tennessee, launched a community challenge to encourage greater participation in the region's renewable energy program, resulting in 5.5 percent community-wide green power use and a participation rate nearly three times the rate at the start of the challenge. Residents, businesses, and the local government used more than 73 million kWh of renewable energy annually, including more than 126,000 kWh of onsite solar power at the Oak Ridge National Laboratory (EPA 2014a).

Designing an Effective Lead by Example Program

Although specific program designs vary from state to state, a number of common elements have helped states develop effective lead by example programs. These include involving multiple agencies and levels of government, identifying funding sources, and leveraging federal and state programs.

Participants

- *Executive branch.* The executive branch plays a key role in lead by example initiatives. Many state governors have issued executive orders that set energy savings targets for existing buildings, define energy and environmental performance standards for new buildings, set fuel economy targets for state-owned or -leased vehicle fleets, create green power purchasing policies, and create efficiency guidelines for purchasing energy-using equipment. Since most lead by example initiatives involve state-owned or -leased property, the executive branch typically has broad powers to change policies and practices involving state facilities, fleets, purchasing operations, and other aspects of state government. New York's Executive Order 88, for example, sets a goal of reducing energy consumption by 20 percent in state-owned and -managed buildings by 2020, relative to a 2010/2011 baseline.
- *State legislature.* In many cases, legislative authority is not needed to launch lead by example initiatives. However, legislative authority may be required when modifying procurement regulations (e.g., to release state agencies from mandatory low-bid requirements when purchasing green power or to enable agencies to enter into

New Hampshire has a master lease program for state facilities that leverages energy savings from current and future operating budgets to cover the financing cost of new equipment. California offers a revenue bond program to provide low-cost financing of alternative energy equipment and for energy and water conservation measures by state and K–12 facilities. While performance contracts are not financing agreements, per se, they can assist with project funding and implementation. In Louisiana, state agencies will be able to issue requests for proposals that essentially follow the performance contract model developed by the state Energy Fund. Colorado passed enabling legislation authorizing performance contracting in the early 1990s, and is now ranked fourth in the United States for energy performance contracts completed by state. As of 2013, Colorado's program had completed $330 million in projects and had $82 million in current performance contracts (Colorado Energy Office 2014).

long-term energy service agreements for performance contracting). For example, Connecticut has used a series of legislative actions to incorporate lead by example principles in its General Statutes, beginning with Public Act 06-187 in 2006, which directed the Connecticut Office of Policy and Management to adopt building construction standards for state facilities that meet or exceed the U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED) Silver rating. This was followed by Public Act No. 07-242 in 2007, which established mandatory efficiency requirements for certain equipment purchased by the state, and Public Act No.11-80 of 2011 established goals for reducing state energy consumption. Most recently, Public Act No. 13-298 was adopted in 2013, allowing the Department of Energy and Environmental Protection to benchmark energy and water consumption of all state-owned buildings larger than 10,000 square feet (DSIRE 2013).

- *State energy offices.* In many states, the energy office develops and administers a range of clean energy programs and provides technical assistance and training to state and local agency staff and facility managers. State energy offices are deeply involved in energy efficiency programs and allocate or oversee more than $7 billion of energy efficiency funds derived from ratepayers and state appropriations each year (NASEO 2015). They often direct efforts to implement state lead by example efforts. State energy offices also work with other state agencies, local governments, school districts, and other public organizations to identify clean energy opportunities statewide.
- *State department of general services and department of the treasury.* One of these agencies typically serves as the custodian of state facilities. It administers state capital construction programs and establishes guidelines for construction, operation, and purchasing practices. For example, the Maryland Department of General Services (DGS) helps Maryland state agencies track energy use and costs, reduce energy consumption, and procure renewable energy and deregulated energy for state facilities. DGS has installed solar panels on four of its own buildings and works with state agencies to develop renewable energy projects (Maryland DGS 2015).
- *State housing and economic development offices.* These agencies may operate a variety of programs, including low- and moderate-income housing and development programs, state mortgage financing programs, and enterprise zone and brownfield redevelopment initiatives. For example, the Iowa Economic Development Authority supports a variety of clean energy programs, including the Economic Development by Gaining Efficiency initiative (a statewide recognition program that engages industrial stakeholders in energy efficiency projects to reduce energy costs), as well as a collaborative effort with the Iowa Department of Natural Resources to streamline the CHP permitting process (Iowa Economic Development Authority 2015).
- *Local governments.* Many local governments have initiated and adopted their own lead by example programs. For example, in Maryland, Montgomery County has developed a green power purchasing program to leverage the buying power of multiple local jurisdictions. Some states work with local governments to educate local officials about these opportunities and to coordinate, pool, and set common criteria for such initiatives. States can also provide financial assistance, education, training, and technical assistance to local governments. For example, the California Energy Commission's (CEC) Energy Partnership Program offers technical assistance to cities, counties, hospitals, and colleges and universities. The program helps these local groups identify energy efficiency improvements in existing buildings and energy-efficient options in new construction. The CEC also helps these groups identify state loans and other financing sources for project installation (CEC 2013).
- *School districts, colleges, and universities.* There are many opportunities to improve energy efficiency and purchase or generate clean onsite power at K–12 schools, colleges, and universities. One option is to use efficiency savings in operating budgets to finance new energy projects, thereby freeing up capital budget

dollars for other uses. In fact, some colleges and universities have found that investing in energy efficiency projects provides better yields than conventional investments such as the stock market. For example, Duke University has used endowment funds to finance energy efficiency and renewable energy projects.

- *Utility energy programs.* Utilities are often responsible for achieving energy efficiency or renewable energy targets established by state legislatures. Utilities that have energy efficiency and onsite generation programs can support a state's lead by example efforts by providing technical assistance to state facility managers and new facility design teams. In some cases, utilities provide funding and incentives to state agencies for clean energy projects. Utilities that administer public benefit funds or that have regulated efficiency acquisition or renewable energy mandates are typically best positioned to provide this kind of assistance.
- *Nonprofit organizations.* Some states designate and work with third-party nonprofit organizations to develop and administer lead by example programs. For example, Iowa established the State of Iowa Facilities Improvement Corporation, a nonprofit corporation that helps agencies implement energy efficiency measures (EPA 2009).
- *State treasurers and public pension fund managers.* The role of pension fund trustees and state treasurers is to provide policy direction for fund managers, who are increasingly looking for opportunities to improve the value of their portfolios. Some state treasurers and public pension fund managers invest in clean energy programs and energy audit investments to identify cost savings. For example, New York State's comptroller established the Green Strategic Investment Program, which commits $500 million over three years to invest in renewable energy and clean technology under the $154.5 billion New York State Common Retirement Fund (New York Office of the State Comptroller 2013).

Funding and Financial Considerations

States sometimes pay for energy efficiency and renewable energy projects with general funds allocated through the budget and appropriations process. Another source of funding is DOE's State Energy Program, which annually allocates Congressional-appropriated funds to 56 states, territories, and the District of Columbia. However, because of fiscal constraints, states are developing new funding approaches for their clean energy investments. One popular strategy involves redirecting the operating budget dollars saved from the utility budget when energy conservation improvements are made and using the savings to pay for the financing of the needed equipment.[39] Several states have adopted innovative funding mechanisms to support lead by example programs, including:

- *Revolving loan funds.* This mechanism involves making loans and re-lending current loan payments to fund new projects. The original capitalization can come from a variety of sources, including system benefits charges and oil overcharge refunds. They are typically low-interest, long-term loans for energy conservation or renewable energy projects. They may cover all capital expenditures or may be on a cost-shared basis. The Texas LoanSTAR (Saving Taxes and Resources) program, described in the *State and Local Examples* later in this section, provides an example of how Texas has structured its loan program. (For more detailed information on revolving loan funds, see Chapter 3, "Funding and Financial Incentive Policies.")
- *Commercial PACE.* PACE is an innovative financing structure that enables commercial and industrial property owners to finance energy efficiency and renewable energy conservation upgrades to buildings.

[39] For example, the South Carolina Energy Office provides a number of resources to help public institutions and local governments use ESPCs. For more information, see http://www.energy.sc.gov/perfcont.

PACE can pay for new heating and cooling systems, lighting improvements, solar panels, water pumps, insulation, and more for almost any property: homes, commercial, industrial, nonprofit, and agricultural. An example is the BetterBuildings Northwest Ohio Challenge. The Toledo-Lucas County Port Authority administers a PACE program that enables virtually every type of building owner to be eligible for fixed rate competitive financing to pay for 100 percent of the high-efficiency improvements to their buildings. The BetterBuildings Challenge has completed 84 projects worth $18 million at an interest rate between 5 and 6 percent (PACE 2015).

- *ESPCs.* The ESPC industry has developed over the past 25 years in response to the need for major new capital investments in energy efficiency, particularly in public and institutional facilities. Energy savings performance contracting is a construction method that allows a facility to complete energy-saving improvements within an existing budget by financing them with money saved through reduced utility expenditures. Facilities make no initial capital investment and instead finance projects through guaranteed annual energy savings. Although only a few states have developed model programs, several states have created enabling legislation helping to develop an industry capable of bringing significant capital investment to state governments. (See Chapter 3, "Funding and Financial Incentive Policies.")
- *Aggregated purchasing contracts for green power.* An increasing number of organizations, including state and local governments, reduce their need for funding by aggregating electricity demand to purchase green power. By combining the electrical needs of a number of agencies, state and local governments can often negotiate lower prices for green power. It is easier to achieve savings from aggregated green power purchases in restructured markets where there are competing energy suppliers.
- *Qualified Energy Conservation Bonds (QECBs) or other public bonds.* Bonds are one of the most common forms of financing used by states because they are a low-cost capital source available to most entities. States may consider using bonds for a variety of clean energy purposes, including financing a specific set of energy upgrades in their own facilities (which can be combined with an ESPC) and/or capitalizing finance programs for public sector energy upgrades (e.g., revolving loan funds; see above). A variety of bonds are available to states for clean energy initiatives. Municipal/public bonds are the most traditional, and there are also federally subsidized-option debt products aimed specifically at supporting clean energy, such as QECBs and Qualified Zone Academy Bonds. States may also wish to partner with state-chartered bond authorities, such as housing finance authorities, which can provide tax-exempt bond financing to nonprofits and industry. A successful example is Massachusetts' "green bond" issuance, the first of its kind, which capitalizes the state's Clean Energy Investment Program.
- *Leasing arrangements*. Leasing energy-related improvements, especially the use of tax-exempt lease-purchase agreements for energy efficiency equipment, allows states to finance retrofits and then use the energy savings to pay for the financing cost. Leases are contracts that allow an entity to obtain (or purchase) equipment or real estate. They are similar to long-term rental agreements where the lessee gets to use the equipment for a period of time in return for regular payments to a third party (lessor). Leases come with a purchase option that can be exercised at the end of the lease period. Leases often have slightly higher rates than bond financing; however, they can be a faster and more flexible tool. States can also establish programs to aggregate lease-purchase financing demand from public entities across the state and issue Certificates of Participation to fund these projects. Participants can then get more attractive rates than they would otherwise have access to and avoid the time and effort required to set up their own individual financing options. Washington's Local Option Capital Asset Lending program is an example.
- *Pension funds.* Some states use pension funds to invest in clean energy projects. Pension fund managers seek a mix of investments that ensure stable returns for their contributors when they retire. Energy cost

savings are captured over a set period to pay off the capital investment, and generate a solid return to the pension fund.

For example, Washington Real Estate Holdings (a real estate manager for the Washington State Investment Board, which manages the state's pensions) completed a $3.5 million energy efficiency upgrade of Union Square that lowered the building energy costs by 40 percent and created 30 jobs for a year (Feldman 2005).

- *Use of life-cycle cost accounting for energy efficiency projects.* Cost-effective energy efficiency investments more than pay for themselves in the form of reduced energy bills over the life of the investment. However, government procurement and capital budgeting practices frequently do not take life-cycle costs into account. Procurement rules (e.g., those applicable to small purchases, such as equipment replacement) often require states to accept the lowest bid, on a first-cost-only basis. Similarly, capital budgeting (e.g., applicable for larger investments such as new buildings or major renovations) often accounts only for the debt service obligations to the government and does not recognize operating budget savings that can more than offset the debt service payments. These practices often result in the rejection of cost-effective energy efficiency investments because the accounting rules do not fully recognize the benefits of these investments.

  To overcome these problems, states have modified procurement rules by 1) specifying minimum efficiency levels for designated types of purchases (such as requiring certain product types to be ENERGY STAR certified) or 2) instituting a life-cycle cost bid procedure, where vendors provide both equipment investment costs and estimated lifetime energy costs for designated equipment types. For capital projects, a similar approach can be used: either requiring projects to meet specified energy performance targets or including life-cycle energy costs in the project accounting analysis.

Interaction with Federal Policies

Several federal programs, described below, provide resources for states as they develop lead by example programs.

DOE Better Buildings Challenge

The Better Buildings Challenge is a voluntary leadership initiative that highlights leaders who have committed to upgrading buildings and plants across their portfolio and providing their energy savings data and strategies as models for others to follow. DOE offers technical assistance and helps Challenge participants create energy efficiency implementation models to support their commitment to measure, track, and improve portfolio-wide energy performance. The Challenge involves, but is not limited to, states, municipalities, commercial businesses, and industrial corporations that make a public commitment to reduce energy consumption in their facilities (DOE 2014a).

ENERGY STAR®

The U.S. Environmental Protection Agency (EPA) offers its ENERGY STAR program to governments, schools, and businesses as a straightforward way to achieve superior energy management and realize the cost savings and environmental benefits that can result. EPA's guidelines for building energy management promote a strategy that starts with the top leadership, engages the appropriate employees throughout the organization, uses standardized measurement tools, and helps an organization prioritize and gets the most from its efficiency investments. The following ENERGY STAR initiatives may offer resources for states as they lead by example.

- *National Building Competition*. This annual "Biggest Energy Loser" competition, first held in 2010, focuses on reducing energy consumption in government buildings, educational and healthcare facilities, and commercial buildings. Between 2013 and 2014, contestants in the 2013 National Building Competition saved more than $20 million and reduced GHG emissions by more than 130,000 metric tons, equivalent to the annual electricity use of nearly 18,000 homes (ENERGY STAR 2014a).
- *Targeted assistance to states.* ENERGY STAR provides targeted information resources, technical assistance, tools, and communications and outreach support to help state and local governments improve energy efficiency within their own operations. ENERGY STAR tools include guidelines for energy management that are helpful to states in improving their energy and financial performance, as well as a Portfolio Manager, which provides tools related to benchmarking, measurement and verification, and investment priorities (ENERGY STAR 2014b).
- *Purchasing and procurement.* As part of its targeted assistance to states, ENERGY STAR provides a comprehensive guide to purchasing energy-efficient products. These purchasing and procurement resources include sample procurement language and energy efficiency specifications for many products. For products not covered under ENERGY STAR, EPA provides links to the DOE's recommended energy-efficient products used by federal government procurement officials (ENERGY STAR 2014c).

EPA Combined Heat and Power Partnership

The CHP Partnership is a voluntary program to reduce the environmental impact of power generation by promoting the use of CHP. The partnership works closely with energy users, the CHP industry, state and local governments, and other stakeholders to support the development of new projects and promote their energy, environmental, and economic benefits (EPA 2014b).

EPA Green Power Partnership

The Green Power Partnership is a voluntary program developed by EPA to boost the market for clean power sources that do not result in the environmental and health risks associated with conventional electricity generation. State and local governments participating in the partnership receive EPA technical assistance and public recognition (EPA 2014d).

DOE State Energy Program

The State Energy Program is a federally funded program administered by DOE that provides funding and technical assistance resources to state energy offices. Many states have used State Energy Program resources to support their lead by example programs and activities (DOE 2005d). It provides funding to states through "formula grants," which are annual grants that states can use for a variety of energy efficiency activities, including lead by example efforts. DOE

CHP Partner: Texas A&M University

EPA's CHP Partnership helped develop a CHP project with Texas A&M University. The system can operate during a power outage to the grid, ensuring that the university can maintain critical operations, such as emergency housing, research facilities, and a veterinary hospital, without grid power. The system produces 45 megawatts of power, while simultaneously providing space cooling, space heating, and hot water to the 5,000-acre campus. Over the last 10 years, the CHP system has reduced the university's energy consumption by 40 percent per square foot and saved $150 million. The system reduces carbon dioxide emissions by 99,600 tons per year, equivalent to the annual emissions of more than 9,000 homes (EPA 2013).

Green Power Partner: Western Pennsylvania Energy Consortium

The Western Pennsylvania Energy Consortium, which won a Green Power Purchasing Award in 2009, seeks to save the city of Pittsburgh and Allegheny County money on their electricity bills. By collectively procuring green power, Consortium members saved nearly 20 percent per unit of green power energy relative to traditional sources. In 2013, the Consortium purchased 42 million kWh of green electricity, 25 percent of its total consumption, in support of Pittsburgh's GHG reduction goals of 20 percent below 2003 levels by 2023. The Consortium also provides guidance for similar organizations across the state of Pennsylvania looking to procure green energy and realize similar cost savings (EPA 2014c).

also awards funding competitively to states to fund innovative projects that are designed to meet DOE's national focus on fundamentally and permanently transforming markets across all sectors of the economy.

DOE Federal Energy Management Program

The Federal Energy Management Program (FEMP) works to reduce the operating costs and environmental impacts associated with federal facilities by advancing energy efficiency and water conservation, promoting the use of onsite generation and renewable energy, and improving utility management decisions at federal facilities. Although the FEMP focuses mainly on federal facilities, it offers online information resources, an annual training conference, and workshops that are available to state and local government energy managers (DOE 2005a). The FEMP website also provides a compendium of energy efficiency purchasing recommendations, interactive energy cost calculators, and other resources to help purchase energy-efficient products (DOE 2003, 2005b).

DOE Building Technologies Office

The Building Technologies Office (BTO) partners with private and public sector organizations to improve building efficiency through the development of innovative, cost-effective energy saving solutions. The BTO conducts work in three key to continually develop these solutions: research and development, market stimulation, and building codes and equipment standards. State and local governments can access and utilize BTO resources, including guidelines, training information, funding opportunities, partnerships, and technical assistance. BTO resources include step-by-step guidance for developing and implementing energy efficiency programs for residential buildings, commercial building design guides and performance data, and case studies (DOE 2015).

Housing and Urban Development Housing and Community Development Programs

The U.S. Department of Housing and Urban Development's (HUD's) Energy-efficient and Green HOME Housing program encourages the use of energy-efficient and environmentally friendly designs and conservation measures. Through the HOME Investment Partnership Program, HUD provides resources to state and localities during the building, buying, and/or rehabilitating of affordable housing. In addition to providing formula grants, HUD also collaborates with EPA and DOE to promote ENERGY STAR qualified housing and provides training and technical assistance on how to conserve energy in HOME-assisted housing (HUD 2015).

Interaction with State Policies

A variety of state programs and policies can be further leveraged by lead by example programs. Key opportunities include:

- *Procurement policies and accounting methods.* Over the last 30 years, some states have modified their public procurement and accounting methods to encourage energy efficiency investments and renewable energy procurements. These innovations include:
  - Permitting long-term contracts, which are often needed for performance contracting agreements.
  - Modifying low-bid requirements, since performance contracts and other energy-saving investments might increase up-front capital costs, but produce lower overall life-cycle costs.
  - Revising leasing regulations, so that private entities can be owners of equipment for tax purposes. This can be key to attracting private investment in public facilities.

  - Modifying budgeting and accounting practices, so that facilities (e.g., schools) are allowed to keep some portion of energy savings from efficiency projects. Otherwise, energy bill savings could simply result in reduced budget outlays in subsequent years and would not encourage facility managers to develop energy efficiency projects.
  - Changing state budget "scoring" rules, so that performance contracting, bond issues, or other debt obligations are treated comprehensively rather than simply as costs. Even though these state obligations are often covered by guaranteed-savings agreements, legislative budget procedures often fail to give them a net savings accounting treatment.
  - Requiring that state facilities procure a percentage of electricity demand from renewable resources.

- *State bonding authority.* States can use public financing mechanisms, such as educational, health, and environmental bond issuance authorities, to help develop clean energy projects or add clean energy features to planned facility bond issues.
- *Air quality planning.* EPA encourages states to use energy efficiency and renewable energy resources to achieve emissions reductions. Some states have developed specific calculation methods for quantifying the contribution that energy efficiency projects can make to emission reduction targets.

  For example, through the Texas Emissions Reduction Plan (also known as "Senate Bill 898"), Texas works with local governments in "nonattainment counties" (those below air quality standards) to reduce electricity consumption by 5 percent per year, in each year from 2011 to 2021.

Important Considerations for Lead by Example Programs

- *Learn from your peers.* Consult with other states that have implemented lead by example initiatives.
- *Secure support from leaders and stakeholders*. The support of top-level leadership and key stakeholders can be critical to the successful revision of clean energy practices that affect state-owned facilities and fleets. For example, in some cases it may be appropriate for the governor (and legislature, if enabling laws are needed) to establish overall goals and/or to require specific rule changes. Involving stakeholders in planning can ensure their buy-in and support.
- *Follow up with administrative support.* While a law or executive order provides the initial structure for lead by example programs, it is also important to design a strong administrative structure. This entails 1) establishing a lead agency with the authority to implement key targets, 2) setting up a coordinating structure among affected agencies to ensure that the agencies remain involved and that targets are met, 3) developing an approach for evaluation of savings, 4) developing an annual reporting system to track progress against goals, and 5) ensuring that funds are available for programs that exceed current staff and budget capacities.
- *Leverage federal programs.* Review and assess existing federal programs to identify those that provide resources for designing and implementing a lead by example program. For example, the ENERGY STAR program provides energy efficiency specifications for products and building energy performance benchmarking tools.
- *Review and update the program.* Periodically (e.g., every 5 years or less) review and update the state's efforts to bring clean energy investments to its facilities and fleets. Expand efforts that show success and/or potential for success and revise or eliminate unproductive programs.

Program Implementation and Evaluation

Because states can choose from a wide range of lead by example programs, specific design and implementation approaches might differ by program. For example, state policy-makers may identify one state agency or department to administer and implement their energy efficiency programs and a different agency to lead efforts to encourage onsite generation or renewable energy. While multiple agencies may be involved in program design and implementation, the more successful state efforts typically include a multi-agency coordination structure.

Successful program implementation flows from a sound design, which in turn flows from a carefully developed overall strategy or plan. For example, some states have developed clean energy plans that set targets for percentage reductions in state facility energy use by certain dates, followed by an implementation plan that includes the specific measures, budgets, timetables, and other details needed to reach those targets.

Evaluation

Evaluation of lead by example programs is important in determining the effectiveness of an initiative. While procedures for evaluating lead by example initiatives will vary according to specific project features, the following general guidelines are applicable to all programs:

- *Develop baselines.* Baselines will vary depending on the type of initiative. For existing buildings, current energy use or current building practices define baselines for energy performance. For fleets, estimated current fuel economy averages can serve as baseline data. For procurement procedures, baseline information can be based on product data or efficiency standards.
- *Measure and verify savings.* Develop reporting and database systems as needed to document the energy savings and other benefits of program initiatives (e.g., cost savings, job creation, pollutant reductions, health impacts). DOE's Uniform Methods Project is developing a framework and a set of protocols for determining the energy savings from specific energy efficiency measures and programs. The protocols provide a straightforward method for evaluating gross energy savings for common energy efficiency measures (DOE 2014c). For larger and more complex efficiency projects, a project-specific measurement and verification method might be more appropriate (EVO 2014). For example, eProject Builder is a secure, online tool that enables energy savings performance contractors and their customers to upload and track project-level information and benchmark proposed ESPC projects against historical project data. (For more information, see Section 4.1, "Energy Efficiency Resource Standards"; Chapter 3, "Funding and Financial Incentive Policies"; and Section 4.2, "Energy Efficiency Programs.")
- *Communicate results.* Use monitoring and tracking information to document the energy, economic, and environmental benefits derived from the program. By communicating results and benefits to key audiences, states can document progress toward their lead by example goals and promote the benefits of clean energy, describe recommendations for improvement, and obtain continued support for their programs and projects. Reporting results also enhance transparency and comparability of information while encouraging participation from public and external stakeholders. To enhance visibility and accessibility, states can consider reporting results via a dedicated, public website.
- *Review and reinforce effectiveness.* Many worthy initiatives fade into inactivity after initial efforts are complete. Use evaluation efforts to ensure that innovations result in lasting changes in institutional behavior and become part of the organizational culture.

Best Practices: Implementing Lead by Example Programs

- *Coordinate across state agencies.* Involve multiple parties during the design, implementation, and evaluation stages of program development.
- *Assess energy use.* Identify opportunities for energy efficiency improvements or more efficient generation and assess the potential energy savings from these options.
- *Develop an intervention strategy*. A number of incentives, financing mechanisms, and education/outreach opportunities are available to states seeking to implement lead by example initiatives. States can provide education and training to contractors and vendors that provide associated services (which also supports local economic growth and job creation), provide a comprehensive range of cost-effective options for participants, provide a high-quality customer service experience, and accurately track program activities in a way that facilitates savings measurement. When implementing innovative financing approaches, note that states may need to modify their rules to allow agencies to use certain mechanisms (e.g., performance contracting) or accounting methods (e.g., extended payback periods). (See Chapter 3, "Funding and Financial Incentive Policies," for more detailed information on financing options.)

State and Local Examples

California

The CEC administers several lead by example programs. In addition, local governments participate in state programs and have developed their own lead by example programs.

- *Assembly Bill 758 and American Recovery and Reinvestment Act (ARRA) Funds*. Assembly Bill 758, known as the Comprehensive Energy Efficiency in Existing Buildings Law, requires the CEC to develop a comprehensive program to achieve greater energy efficiency in the state's existing residential and nonresidential building stock that falls significantly below the efficiency required by the current version of Title 24 Building Energy Standards. The law also requires the California Public Utilities Commission to investigate each electrical and gas corporation's ability to provide energy efficiency financing options to their customers for implementing the program. The first phase began with the ARRA of 2009's implementation period (2010–2012). The CEC used ARRA funds ($251 million in total) to finance a portfolio of programs that supported energy efficiency efforts through state and local upgrade programs, workforce training, and financing. Through these programs, more than 14,000 homes and 7,700 nonresidential buildings had energy efficiency retrofits. In addition, more than 10,000 individuals participated in workforce education and training. Overall, evaluation results indicate that energy savings exceeded 184 gigawatt-hours (GWh) and 3.8 million therms annually. Furthermore, 4.2 GWh in annual electricity generation has resulted from the implementation of renewable energy generation projects.

  Websites:
  Assembly Bill 758: http://www.energy.ca.gov/ab758/
  CEC ARRA Programs: http://www.energy.ca.gov/ab758/pilot-programs.html
  Evaluation of CEC ARRA Programs: http://www.energy.ca.gov/2014publications/CEC-400-2014-011/CEC-400-2014-011.pdf

- *PACE*. In July 2008, California amended its state law to enable cities and counties to offer PACE financing programs to property owners. PACE allows private property owners to pay for energy efficiency and renewable energy projects through an addition to their property tax bill, overcoming the high upfront costs that prevent most property owners from investing in such retrofits.

  Financing may be used for improvements to developed property only if the property owner agrees to a contractual assessment (that is, agrees to repay the loan) on his/her property tax bill for up to 20 years. In

California, local governments that have implemented programs using this property tax financing mechanism include:

- CaliforniaFIRST
- California Home Energy Renovation Opportunity (HERO) Program
- Green Finance San Francisco
- Los Angeles County Commercial PACE Program
- Clean Energy Chula Vista
- Placer County (mPower Placer)
- City of Folsom (mPower Folsom)
- Berkeley Financing Initiative for Renewable and Solar Technology
- Sonoma County (Energy Independence Program)
- Western Riverside Council of Governments HERO Program
- San Bernardino Associated Governments HERO Program

Website: General information and list of California PACE providers:
http://energycenter.org/policy/property-assessed-clean-energy-pace

- *Senate Bills 77/96 and Assembly Bill 14—California PACE programs.* Senate Bill 77 of 2010 required the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) to develop and administer a PACE Bond Reserve program to help reduce overall program costs. The bill appropriated $50 million to the authority through January 1, 2015. Due to legal issues raised by the Federal Housing Financing Agency in 2010, many jurisdictions in California put a hold on developing PACE programs; CAEATFA therefore appropriated half of its PACE funding to the Clean Energy Upgrade Financing Program through Assembly Bill 14. Under this program, CAEATFA offers financial assistance in the form of a loan loss reserve to participating financial institutions that provide loans to finance the installation of energy efficiency improvements or onsite generation renewable energy sources on residential properties. The goal of the Clean Energy Upgrade Financing Program is to increase access to retrofit financing by reducing its cost and to grow the number of green jobs in the state.

  In 2013, Senate Bill 96 directed CAEATFA to develop the PACE Loss Reserve Program to mitigate the potential risk to mortgage lenders associated with residential PACE financing. The $10 million Loss Reserve Program will protect mortgage holders from losses associated with a PACE lien on the property.

  Websites:
  CAEATFA PACE Loss Reserve Program: http://www.treasurer.ca.gov/caeatfa/pace/index.asp
  CAEATFA Clean Energy Upgrade Financing Program:
  http://www.treasurer.ca.gov/caeatfa/abx1_14/index.asp
  CAEATFA report on Senate Bill 77: http://www.treasurer.ca.gov/caeatfa/pace/2011.pdf
  Senate Bill 96: http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0051-0100/sb_96_bill_20130911_enrolled.pdf
  Assembly Bill 14: http://leginfo.ca.gov/pub/11-12/bill/asm/ab_0001-0050/abx1_14_bill_20110802_chaptered.pdf

- *California Executive Order B-18-12.* Issued in April 2012, this order requires all new state buildings and major renovations beginning design after 2025 to be constructed as zero net energy facilities with interim targets, and directs agencies and departments to reduce their energy consumption by 20 percent from

2003 levels by 2018. The order requires new and renovated state-owned facilities larger than 10,000 square feet to meet USGBC LEED Silver certification,[40] requires existing state buildings over 50,000 square feet to complete LEED-Existing Building (EB) certification by December 31, 2015, requires new and existing buildings to incorporate building commissioning procedures to improve building operations, and sets procurement policies for ENERGY STAR qualified electrical equipment. The order further instructs the CEC to establish energy use intensity threshold targets to set requirements for commissioning of existing buildings.[41]

Websites:
Executive Order B-18-12: http://gov.ca.gov/news.php?id=17508
Green Building Action Plan: http://www.climatechange.ca.gov/climate_action_team/documents/Green_Building_Action_Plan.pdf

- *Energy Efficiency Financing Program.* Through this program, the CEC provides low-interest loans for public schools, public hospitals, and local governments to fund energy audits and install energy efficiency measures. The CEC offers 0 percent and 1 percent interest rates, depending on eligibility, and the maximum loan per application is $3 million. The interest rates are fixed for the entire length of the loan. The repayment schedule is based on the annual projected energy cost savings from the aggregated projects, and loans must be repaid within 20 years.

  Website: http://www.energy.ca.gov/efficiency/financing/

- *Energy Partnership Program.* The CEC offers this program to help cities, counties, hospitals, and other facilities target energy efficiency improvements for existing facilities and energy-efficient options for new construction. The CEC provides a variety of services, including conducting energy audits, preparing feasibility studies, reviewing existing proposals and designs, developing equipment performance specifications, reviewing equipment bid specifications, and assisting with contractor selection and commissioning. The CEC also helps identify state loans and other financing sources for project installation.

  Website: http://www.energy.ca.gov/efficiency/partnership/

- *Assembly Bill 1103*. Passed in 2007, this bill requires electric and gas utilities to record consumption data for all non-residential customers for at least 12 months. These data can be uploaded to ENERGY STAR Portfolio Manager in case a building owner or operator requests the data. Additionally, the bill requires all non-residential building owners to disclose ENERGY STAR Portfolio Manager benchmarking data and ratings to any potential buyer, lender, or lessee.

  Website: http://www.energy.ca.gov/ab1103/documents/ab_1103_bill_20071012_chaptered.pdf

- *Proposition 39*. This proposition changed the corporate income tax code in order to make up to $550 million available annually for eligible energy projects at California local education agencies. The change went into effect for the 2013–2014 fiscal year and is set to last for 5 years. Under the program, these agencies—including public school districts, charter schools, state special schools, and county offices of education—can submit a proposal and receive funding for projects that upgrade energy efficiency or

[40] USGBC certifies new buildings based on a cumulative 69-point system at several possible levels: Certified (26–32 points), Silver (33–38 points), Gold (39–51 points), and Platinum (52–69 points). Points are based on a variety of criteria, including energy efficiency, ozone impacts, site development impacts, materials choices, and indoor air quality.

[41] The commissioning process for existing buildings is defined as adjusting energy systems to operate at their intended efficiency levels. Commonly referred to as re-commissioning, commissioning of buildings is a periodic check on system performance.

promote clean energy generation. These projects may include new or repaired HVAC systems, lighting, windows, thermostats, or onsite energy generation.

Website: http://energy.ca.gov/efficiency/proposition39/

- *Other local programs.* Local governments in California are actively involved in developing or purchasing clean energy supplies. For example, Yolo County developed a 7-megawatt-capacity onsite solar energy project with the capacity to generate almost 14 million kWh of solar energy, equivalent to 152 percent of the county's electricity needs. As of 2013, this project avoided carbon dioxide emissions equivalent to those of 2,000 passenger vehicles per year. Santa Monica became the first city in the United States to convert to 100 percent renewable energy in municipal buildings. Many other California cities have installed renewable energy systems. For example, the municipal facilities in Tulare, San Jose, and Santa Clara have installed solar PV and biogas fuel cell technology to generate onsite renewable energy.

  Websites:
  Onsite renewable energy generation: http://www.epa.gov/greenpower/toplists/top30onsite.htm
  Green power procurement:
  http://epa.gov/statelocalclimate/documents/pdf/greenpowerprocurement508final.pdf

New Hampshire

The state government is the largest energy user in New Hampshire, with heating, cooling, and electricity costs of more than $22 million annually in 2010. New Hampshire has implemented several projects to measure energy efficiency, track energy savings, and fund related projects for public entities.

- *Executive Order 2011-1.* Under a previous executive order issued in 2005, New Hampshire's state government reduced its energy use by 16 percent per square foot over 5 years. Executive Order 2011-1, issued April 15, 2011, sets a new target to reduce statewide fossil fuel use by 25 percent from 2005 levels by 2025, with interim goals for 2015 and 2020. State staff are required to purchase equipment with an ENERGY STAR rating. Every state agency must also implement a "clean fleets" program to reduce transportation fuel use.

  Website: http://sos.nh.gov/ExecOrderLynch.aspx

- *Executive Order 2004-7.* This order requires the New Hampshire Department of Administrative Services to develop an energy information system, which includes an energy efficiency rating system. State staff were required to conduct an inventory of annual energy use by each of the state's 1,200 facilities starting in 2001 and use EPA's Portfolio Manager to assess each facility's energy efficiency. Procedures for tracking and reporting energy use information by each state department are currently being developed.

  The executive order also authorizes a steering committee to develop an energy reduction goal and plan, a procedure for conducting audits of facilities that score between a 40 and a 60 on the rating system, procurement policies that require ENERGY STAR products, new energy efficiency standards for new construction, and a procedure for commissioning new facilities that ensures adoption of energy-efficient design specifications and equipment operations. The executive order also establishes specific policies for the transportation sector. The order stipulates that all new vehicles purchased by the state must achieve a highway fuel economy of 30 miles per gallon or better and an emissions classification for a low-emission vehicle or better. Other efficiency measures affecting transportation include the purchase of low-rolling-resistance tires, an anti-idling initiative, and the promotion of ride-sharing among agencies.

  Website: http://sos.nh.gov/ExecOrderBenson.aspx

- *Senate Bill 409, Building Requirements for State Funded Buildings*. Passed in July 2010, S.B. 409 requires state buildings or structures that are larger than 25,000 square feet and constructed or renovated with state funding to meet specific energy-efficient and sustainable building design standards. This law went into effect on July 1, 2011.

  Website: http://www.gencourt.state.nh.us/legislation/2010/SB0409.html

Texas

Texas' State Energy Conservation Office (SECO) administers and delivers a variety of energy efficiency and renewable programs in all market sectors, including state and local facilities.

- *Alternative Fuels Program.* This program promotes using alternative transportation fuels in Texas by demonstrating their positive environmental impact, technical feasibility, and energy efficiency.

  Website: http://www.seco.cpa.state.tx.us/transport/alt-fuels/

- *LoanSTAR Revolving Loan Program.* The Texas LoanSTAR Program is SECO's most visible program. As of January 2014, the program had provided more than $395 million in over 237 loans for energy efficiency projects, financed for state agencies, institutions of higher education, school districts, and local governments. The program's revolving loan mechanism allows borrowers to repay loans through the stream-of-cost savings generated by the funded projects.

  Website: http://www.seco.cpa.state.tx.us/ls/

- *Senate Bill 898, the Texas Emissions Reduction Plan.* This bill established a goal to reduce electricity consumption by at least 5 percent each year until 2021, beginning in 2011. This policy imposes new energy efficiency requirements on political subdivisions (i.e., cities and counties) in 41 urban and surrounding counties. The affected political subdivisions must implement energy efficiency measures designed to decrease electric consumption while improving air quality. SECO provides assistance and information to the political subdivisions to help them meet their goals.

  Website: http://www.seco.cpa.state.tx.us/energy-reporting/history.php

- Senate Bill 700, Relating to Energy and Water Management Planning and Reporting by State Agencies and Institutions of Higher Education. The Texas legislature passed this bill in June 2014. The bill requires state agencies and institutions of higher education to set percentage goals for reducing their use of water, electricity, gasoline, and natural gas, and to include those goals in their comprehensive energy plans.

  Website: http://legiscan.com/TX/text/SB700/2013

What States Can Do

States have chosen from a wide variety of approaches and goals in developing their lead by example programs. These programs have reduced energy costs for state agencies, increased funding for non-energy-related expenditures, and helped stimulate development of clean energy projects and resources. States have also used lead by example programs to encourage other organizations to take actions that support clean energy.

Action Steps for States

Based on the best practices and examples of effective state programs described above, states can take the following action steps when developing their lead by example programs.

- Look across the entire government to identify opportunities for the state to lead by example on clean energy. Communicate with state agencies, local governments, schools, and other public sector organizations to identify effective ways to incorporate clean energy into their activities. Engage facility managers and agency staff for program planning, implementation, training, tracking, and evaluation.
- Explore requirements to ensure that cost-effective energy efficiency improvements are implemented in both new and existing buildings, since these have provided a major opportunity for energy savings in many states. This includes:
  - *Standards for new buildings.* Most states require that their new facilities meet the most recent version of the ASHRAE 90.1 standard. However, some states have adopted more advanced standards, such as CEC's Title 24 Building Energy Standards (CEC 2005). Voluntary advanced building energy efficiency guidelines are available from ENERGY STAR and the New Buildings Institute (ENERGY STAR 2015; NBI 2004). Some states have adopted green building standards (USGBC is leading this effort through its LEED certification program; see USGBC 2005). (For more information on building codes, see Section 4.3, "Building Codes for Energy Efficiency.")
  - *Performance targets for existing buildings.* Typical targets have been set at 20 percent reduction in current energy use per square foot of floor area, using a recent base year and setting a compliance date of between 5 and 15 years from enactment of the target.
- Consider procurement policies for products, equipment, and green power.
- Investigate targets for using renewable energy to power state and local facilities, allowing flexibility for different agencies to either develop onsite generation or purchase green power, depending on local conditions. States can also explore opportunities to use CHP at state facilities.
- Develop and enable financing mechanisms. States have developed a range of financing methods, including adoption of legislation or rules that ensure that state facilities can use financing strategies such as performance contracting and revolving loans. (See also Chapter 3, "Funding and Financial Incentive Policies.")
- Offer staffing, technical assistance, and training to facility managers and staff on developing energy efficiency programs. Some states have established accountability structures within and between agencies so that procurement, facility management, and accounting departments are all engaged in a common effort to save energy.
- Ensure that agencies are authorized to use and are using ESPCs and performance contracting to implement energy savings projects in their facilities, if internal sources of project financing are lacking. States can adopt legislation authorizing the use of performance contracting in public facilities.

Information Resources

General Information about State and Local Programs

Title/Description	URL Address
American Council for an Energy-Efficiency Economy: State and Local Energy Efficiency Policy Database. Database of energy efficiency policies implemented at the state and local level across multiple sectors.	http://aceee.org/sector/state-policy
CEC: How to Finance Public Sector Energy Efficiency Projects. Describes strategies and funding sources that public sector agencies can use to finance energy efficiency projects.	http://www.energy.ca.gov/reports/efficiency_handbooks/400-00-001A.PDF
CEC: Title 24 Building Energy Standards. Describes the energy standards for residential and nonresidential buildings.	http://www.energy.ca.gov/title24
California Energy Partnership Program. Provides technical assistance to cities, counties, special districts, public or nonprofit hospitals, public or nonprofit public care facilities, and public or nonprofit colleges/universities to improve energy efficiency in new and existing facilities. Helps arrange financing to conduct projects.	http://www.energy.ca.gov/efficiency/partnership/
California Executive Order S-20-04. This order established a goal of reducing energy use in state-owned buildings by 20 percent by 2015 and directs compliance with the Green Building Action Plan, which provides details on how the state can achieve these goals. The commercial sector is also encouraged to comply with these two policies. They require CEC to develop a building efficiency benchmarking system and commissioning and retro-commissioning guidelines for commercial buildings.	Executive Order S-20-04: http://gov.ca.gov/news.php?id=3360 Green Building Action Plan: http://gov.ca.gov/docs/Green_Building_Action_Plan_B.18.12.pdf
California Tier 1 and Tier 2 Energy Efficiency and Sustainable Building Measures Checklists. These checklists ensure that energy efficiency and sustainable building measures are included in new building construction and renovations. Tier 1 checklist items have been evaluated as "cost effective" and must be incorporated into projects when part of the project scope. Tier 2 checklist items may or may not be cost-effective, but should be considered for inclusion. While the checklists include some performance standards, they are primarily prescriptive in nature.	http://www.calrecycle.ca.gov/GreenBuilding/Design/Tiers.pdf
Cape Light Compact. This regional services organization provides energy efficiency programs and aggregated power cost negotiations for its members.	http://www.capelightcompact.org/
Consortium for Energy Efficiency: State and Local Government Purchasing Model Program Plan: A Guide for Energy Efficiency Program Administrators. A step-by-step guide for developing and adopting a successful state and local government procurement program.	http://ncprojectgreen.com/Documents/StateLocalGovModelPP.pdf
Efficiency Vermont. Vermont's statewide energy efficiency utility provides technical assistance and financial incentives to help residents as well as public- and private-sector organizations identify and pay for cost-effective approaches to energy-efficient building design, construction, renovation, equipment, lighting, and appliances.	http://www.efficiencyvermont.com/index.cfm
Energy Efficiency's Next Generation: Innovation at the State Level. A guide for model policy measures for energy efficiency.	http://www.aceee.org/research-report/e031

Title/Description	URL Address
New Jersey Clean Energy Program. The New Jersey Board of Public Utilities administers this program, which provides information and financial incentives to help New Jersey residents, business, and communities reduce their energy use, lower costs, and protect the environment.	http://www.njcleanenergy.com/
New Jersey's Green Power Purchasing Program. This program allows the state to aggregate electricity purchases for 200 facilities and negotiate lower costs.	http://www.state.nj.us/dep/dsr/bscit/GreenPower.pdf
New York Guidelines: Executive Order No. 88 "Build Smart NY" New York State Government Buildings. This document elaborates on the requirements of the Executive Order and provides details on the policies and protocols for implementation.	https://www.nypa.gov/BuildSmartNY/Guidelines.pdf
North Carolina Division of Energy, Mineral, and Land Resources: Energy Section. The Resources for Government Web page describes North Carolina's Utility Savings Initiative, a comprehensive, multi- programmed approach to reducing utility expenditures and resources in state buildings.	http://www.energync.net/home/efficiency/government.html
Commissioning for Better Buildings in Oregon. Provides technical assistance to ensure that building systems are designed, installed, functionally tested, and capable of being operated and maintained according to the owner's operational needs.	http://www.oregon.gov/ENERGY/CONS/BUS/comm/docs/commintr.pdf?ga=t
Oregon SEED. This program provides energy efficiency assistance for new and renovated public buildings.	http://egov.oregon.gov/ENERGY/CONS/SEED/SEEDhome.shtml
Texas A&M Energy Systems Laboratory. This laboratory provides tools, technical assistance, and training to help government and building industry users design and evaluate a wide range of energy savings projects.	http://esl.tamu.edu/

Examples of Legislation and Model Language

State	Title/Description	URL Address
California	Executive Order S-20-04. This executive order establishes energy conservation standards for state-owned buildings and encourages commercial building owners, local governments, and schools to take similar measures.	http://gov.ca.gov/news.php?id=3360
	Energy Efficiency Revenue Bond Program. This website provides official documents from the program.	http://www.energy.ca.gov/efficiency/revenuebonds/
Colorado	Public Energy Performance Contracting. This website provides sample guidance and documents to assist with energy performance contracting.	http://www.colorado.gov/cs/Satellite/GovEnergyOffice/CBON/1251599983018
Connecticut	Chapter 298: Energy Utilization and Conservation. This general statute requires the state Department of Energy and Environmental Protection to establish an energy management plan that maximizes energy efficiency for state-owned and leased buildings.	http://www.cga.ct.gov/2011/pub/chap298.htm
Hawaii	Revised Statutes 196-9. This bill requires newly constructed or substantially renovated state-owned facilities to be built to meet LEED Silver standards.	http://www.capitol.hawaii.gov/hrscurrent/vol03_ch0121-0200d/HRS0196/HRS_0196-0009.htm

State	Title/Description	URL Address
Maryland	Senate Bill 267. This 2006 bill sets energy performance standards in state buildings.	http://mlis.state.md.us/2006rs/bills/sb/sb0267e.pdf
	House Bill 376. This 2008 bill requires new or renovated state and new school buildings to be constructed as high performance buildings.	http://mgaleg.maryland.gov/2008rs/fnotes/bil_0006/hb0376.pdf
New Hampshire	Executive Order 2004-7. Signed in October 2004, the order requires 10 percent efficiency improvement in 1,200 state buildings.	http://sos.nh.gov/ExecOrderBenson.aspx
New York	Executive Order 88. This order directs state agencies and authorities to improve the energy efficiency of state buildings.	http://www.governor.ny.gov/news/no-88-directing-state-agencies-and-authorities-improve-energy-efficiency-state-buildings
Oregon	ORS 276.900-915, State Agency Facility Energy Design. This law established the Oregon SEED program in 1991. SEED helps ensure that state facilities are designed, constructed, renovated, and operated to "minimize the use of nonrenewable energy resources and to serve as models of energy efficiency."	http://www.oregon.gov/energy/CONS/SEED/docs/AppendixA.pdf
	Senate Bill 1149. Adopted in 1999, this bill restructured the electric power industry and created a Public Purpose Fund to finance specified energy-related capital projects, including building commissioning.	http://energytrust.org/About/PDF/sb1149.pdf
All States	Consortium for Energy Efficiency: Model Energy Efficiency Purchasing Policy. This document includes model language to be used by state and local governments interested in directing agencies to purchase energy-efficient products.	http://ncprojectgreen.com/Documents/StateLocalGovModelPP.pdf

References

Title/Description	URL Address
CALMAC. 2005. Welcome to CALifornia Measurement Advisory Council.	http://www.calmac.org
CalRecycle. 2005. Sustainable Building Guidelines. California Department of Resources Recycling and Recovery.	http://www.calrecycle.ca.gov/GreenBuilding/Design/Guidelines.htm
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