Energy Efficiency Resource Standards: Experience and Recommendations

Steven Nadel

March 2006

ACEEE Report E063

1001 Connecticut Avenue, NW, Suite 801, Washington, D.C. 20036
Phone: 202-429-8873, Fax: 202-429-2248, Web site: http://aceee.org

Contents

Acknowledgements

Funding for this work comes from grants from the Energy Foundation and the U.S. Environmental Protection Agency. Many people helped with this research, particularly staff at the many programs profiled in the case studies and Bill Prindle and Dan York at ACEEE. I also thank Rich Cowart (RAP), Nikolaas Dietsch (EPA), Neal Elliott (ACEEE), Howard Geller (SWEEP), Joel Gordes (Connecticut ECMB), Blair Hamilton (VEIC), Michael Messenger (CEC), Julie Michaels (NEEP), Stephanie Monjon (ADEME), Dick Munson (Northeast-Midwest Center), Ed Osann (Potomac Associates), Marcela Pavan (AEEG), Steve Schiller (Schiller Associates), and Devra Wang (NRDC) who provided helpful comments on a review draft of this paper.

Executive Summary

An Energy Efficiency Resource Standard (EERS) is a simple, market-based mechanism to encourage more efficient generation, transmission, and use of electricity and natural gas. An EERS consists of electric and/or gas energy savings targets for utilities, often with flexibility to achieve the target through a market-based trading system. All EERS's include end-user energy saving improvements that are aided and documented by utilities or other program operators. Sometimes distribution system efficiency improvements and combined heat and power (CHP) systems and other high-efficiency distributed generation systems are included as well. EERS's are typically implemented at the state level but can also be implemented over smaller or wider areas. With trading, a utility that saves more than its target can sell savings credits to utilities that fall short of their savings targets. Trading would also permit the market to find the lowest-cost savings. However, unlike other resources such as renewable energy and coal, energy-saving opportunities are distributed throughout the 50 states; studies on many states have found cost-effective opportunities to reduce energy use by 20% or more.

EERS-like laws are now in operation in several states and countries. Texas's electricity restructuring law created a requirement for electric utilities to offset 10% of their demand growth through end-use energy efficiency. Utilities in Texas have had no difficultly meeting their targets and are currently exceeding them. Hawaii and Nevada recently expanded their renewable portfolio standards to include energy efficiency. Connecticut and California have both established energy savings targets for utility energy efficiency programs (Connecticut by law and California by regulation) while Vermont has specific savings goals in the performance contract with the nonprofit organization that runs statewide programs under a contract with the Public Service Board. Pennsylvania's new Advanced Energy Portfolio Standard includes end-use efficiency among other clean energy resources. Colorado's largest utility has energy savings goals as part of a settlement agreement approved by the Public Service Commission. And Illinois and New Jersey are planning to begin programs soon. EERS-like programs have been working well in the United Kingdom and the Flemish region of Belgium. Italy has recently started a program, and another is about to start in France. Details on each of these programs are provided in the body of this report.

Based on the experiences summarized above, we recommend that both states and the federal government enact EERS's covering both electric and gas utilities. So far, states have led EERS efforts and more states should consider policies of this type. Eventually, the federal government should follow these leading states and enact a national EERS so as to expand the savings and benefits throughout the country as well as to provide national emissions reduction and price reduction effects that benefit all states, including those with state EERS's.

We recommend that EERS targets generally start at modest levels (e.g., savings of 0.25% of sales annually) and ramp-up over several years to savings levels currently achieved by the most successful states (e.g., 0.75% to 1.25% of sales annually). However, states with substantial current programs can ramp-up much more quickly. Peak demand savings should also be included. To ensure that costs will be moderate, we recommend that trading of savings

credits be permitted. If there are concerns about the cost of efficiency programs, a "safety valve" could be created and electric and gas utilities could be permitted to buy credits from the implementing agency for about half of the current retail costs of these energy sources with the monies used to fund government-operated energy efficiency programs. Additional important implementation details are discussed in the body of this report including such issues as measurement and evaluation and complementary supportive policies.

Because EERS annual requirements are cumulative, savings would steadily mount. If an EERS calls for 0.75% savings per year, after a two-year ramp-in period, by 2020 annual electricity and natural gas use in the covered region would be reduced by nearly 10%. At the national level, EERS savings would amount to about one-quarter of the currently projected *growth* in electric sales over the 2007–2020 period and about one-half of projected growth in natural gas sales over this same period. A national EERS at this level would reduce U.S. energy use in 2020 by about 5.6 quadrillion Btu ("quads"), which represent about 4.6% of projected U.S. energy use for that year. These savings are significantly greater than the projected savings from the combined efficiency provisions in the federal Energy Policy Act of 2005. Overall, an EERS at this level would provide net benefits to consumers and businesses of about $170 billion (i.e., discounted benefits minus discounted costs). These savings are summarized in Table ES-1.

Table ES-1. Summary of Savings from a National EERS

	2010	2020	Cumulative
Savings from an EERS			
Annual elec. savings (TWh)	87	386	
Estimated peak demand savings (MW)	28,100	124,200	
Annual direct gas savings (TBtu)	355	1,570	
Total savings, all fuels (quads)	1.29	5.59	
Cumulative net benefits (billions)	-$13.7	$64.0	
Benefit/cost ratio			2.6
CO_2 emissions savings from an EERS (MMT)	76	320	

Note: 2010 and 2020 savings include savings from measures installed in prior years.

With savings of this magnitude, EERS's represent one of the largest opportunities for capturing cost-effective energy savings, savings that will save consumers money, promote economic development, and reduce emissions of air pollutants and greenhouse gas that contribute to global warming.

Introduction

An Energy Efficiency Resource Standard (EERS) is a simple, market-based mechanism to encourage more efficient generation, transmission, and use of electricity and natural gas. An EERS consists of electric and gas energy savings targets for utilities, often with flexibility to achieve them through a market-based trading system. All EERS's include end-user energy saving improvements that are aided and documented by utilities or other program operators. Sometimes distribution system efficiency improvements and combined heat and power (CHP) systems and other high-efficiency distributed generation systems are included as well. EERS's are typically implemented at the state level but can also be implemented over smaller or wider areas.

Unlike other resources such as renewable energy and coal, energy-saving opportunities are distributed throughout the 50 states—studies on many states have found cost-effective opportunities to reduce energy use by 20% or more (Nadel, Shipley, and Elliott 2004). EERS's come in a variety of "flavors" ranging from legislated requirements to regulations or contract terms developed by utility regulatory commissions. EERS's are similar to renewable portfolio standards (RPS's), except EERS's pertain to a required level of efficiency savings as opposed to a required level of renewable energy purchases. Due to these similarities, in some states, EERS's and RPS's are combined.

Historically, many utilities began to offer programs to help customers reduce energy use in the 1970s, following the initial 1973 oil embargo. Spending on and savings of utility energy efficiency programs ramped up through the 1980s and early 1990s as more and more utilities began to offer programs and many utilities expanded their initial offerings. In 1994, "restructuring" of the utility industry began in some states, which was designed to allow customers to purchase power and gas from providers besides their local monopoly utility. As a result of restructuring, many utilities cut non-essential costs, including energy efficiency programs, and utility spending on these programs dropped dramatically. However, as part of or following restructuring, many states included small charges for energy efficiency and other "public benefit programs" on customer bills so that these important programs would not be lost. As a result, since the late 1990's spending on utility-sector energy efficiency programs has steadily increased. As of this writing, 18 states plus the District of Columbia have energy efficiency programs of some type funded with public benefit funds (Kushler, York, and Witte 2004; York and Kushler 2005). However, the goal of energy efficiency programs is saving energy, not spending money. Also, many of the states that do not have public benefit funds have been reluctant to set policies in terms of spending. In response to these forces, there has been growing interest in setting energy-saving targets for energy efficiency programs, sometimes in conjunction with public benefit funds and sometimes as a separate policy. This report profiles these activities and develops recommendations based on these profiles.

This report is divided into five sections. First, we provide some background on why policymakers should be interested in encouraging energy efficiency, such as through an EERS. Second, we discuss EERS-like policies in ten states and four European countries. Based on these case studies, we then make recommendations for EERS's in other states and at the federal level. Fourth, we analyze the savings and economic benefits of an EERS at the national level (although the results can be scaled to provide an approximation of state-level savings and benefits). Finally, we draw a few conclusions.

Background

Energy efficiency improvements have contributed a great deal to our nation's economic growth and increased standard of living over the past 30 years. If the U.S. economy had used the same amount of energy per unit of GDP in 2004 as it did in 1973, U.S. energy use in 2004 would have been 90% higher.[1] In other words, efficiency and other energy-intensity improvements saved 90 quadrillion Btu's in 2004, *which is more energy than we now get annually from domestic coal, natural gas, and oil sources combined.* While about one-third of this improvement is due to structural changes in the economy (such as a relative decline in products produced by energy-intensive industries), the remaining two-thirds is improvements in energy efficiency (Geller et al. 2006). Even with this adjustment, energy efficiency can rightfully be called our country's largest energy source.

Efficiency Potential

Although the United States is much more energy efficient today than it was 30 years ago, there is still enormous potential for additional cost-effective energy savings. Some newer energy efficiency measures have barely begun to be adopted. Other efficiency measures could be developed and commercialized in coming years, with proper support.

- The U.S. Department of Energy's (DOE) national laboratories estimate that increasing energy efficiency throughout the economy could cut national energy use by about 20% in 2020, with net economic benefits for consumers and businesses (Interlaboratory Working Group 2000). A just-published report for the Western Governor' Association reaches the same conclusion (WGA 2006). These savings work out to be more than 1% each year.

- ACEEE, in a report on *Smart Energy Policies*, estimated that adopting a comprehensive set of policies for advancing energy efficiency could lower national energy use from Energy Information Administration (EIA[2]) projections by as much as 26% in 2020 (Nadel and Geller 2001).

- The opportunity for saving energy is also illustrated by experience in California in 2001. Prior to 2001, California was already one of the most efficient states in terms of energy use per unit gross state product (ranking 5th in 1997 out of 50 states—Geller and Kubo 2000). But in response to pressing electricity problems, California

[1] Calculated using EIA data (EIA 2005a).
[2] EIA is the statistical and forecasting branch of the U.S. Department of Energy.

homeowners and businesses reduced energy use by 6.7% in the summer of 2001 relative to the year before (after adjusting for economic growth and weather—CEC 2001), with savings costing an average of 3 cents per kWh (Global Energy Partners 2003), far less than the typical retail or even wholesale price of electricity.

- A 2004 study conducted for the New York State Energy Research and Development Authority (NYSERDA) found that electricity use in New York State could be reduced cost-effectively by 27% over the next 20 years (Optimal Energy 2003). This is exactly the same level of savings found in a 1989 study for NYSERDA (Miller, Eto, and Geller 1989). In the intervening 15 years many efficiency measures were implemented, but new efficiency opportunities were developed to take their place.

Market Barriers

Unfortunately, a variety of market barriers keep these savings from being implemented. These barriers are many-fold and include such factors as “split incentives” (landlords and builders often do not make efficiency investments because the benefits of lower energy bills are received by tenants and homebuyers); panic purchases (when a product such as a refrigerator needs replacement, there often isn’t time to research energy-saving options); and bundling of energy-saving features with high-cost extra “bells and whistles.” These barriers are discussed extensively elsewhere (see, for example, Golove and Eto 1996; WGA 2006).

Recent Developments

Recent developments indicate that the U.S. needs to *accelerate* efforts to implement energy efficiency improvements.

- Oil, gasoline and natural gas prices have risen substantially in the past couple of years. For example, residential natural gas prices in the first ten months of 2005 averaged $13.30 per million Btu, up 53% from the average price three years earlier (prices averaged $8.71 per million Btu in the first ten months of 2002) (EIA 2006a). Energy efficiency can reduce demand for these fuels, reducing upward price pressure and also reducing fuel-price volatility, making it easier for businesses to plan their investments. Prices are determined by the interaction of supply and demand—if we seek to address supply and not demand, it’s like entering a boxing match with one hand tied behind our back.

- A recent ACEEE analysis found that gas markets are so tight that if we could reduce gas demand by as little as 4% over the next five years, we could reduce wholesale natural gas prices by more than 20% (Elliott and Shipley 2005). This analysis was conducted by Energy and Environmental Analysis, Inc. using their North American Gas Market Model, the same analysis firm and computer model that was employed by DOE and the National Petroleum Council for their 2003 study on U.S. natural gas markets (NPC 2003). These savings would put over $100 billion back into the U.S.

economy. Moreover, this investment would help bring back U.S. manufacturing jobs that have been lost to high gas prices and also help relieve the crushing burden of natural gas costs experienced by many households, including low-income households. Importantly, much of the gas savings in this analysis comes from electricity efficiency measures, because much of the marginal electric load is met by natural-gas fired power plants.

- The U.S. economy has had mediocre performance for several years. While the economy has picked up substantially, additional boosts would help. Energy efficiency investments often have financial returns of 30% or more, helping to reduce operating costs and improve profitability. In addition, by reducing operating costs, efficiency investments free up funds to spend on other goods and services, creating what economists call the "multiplier effect" and helping the economy broadly. A 1997 study found that due to this effect, an aggressive set of efficiency policies could add about 770,000 jobs to the U.S. economy by 2010 (Alliance to Save Energy et al. 1997).

- Overall, the U.S. has ample supplies of electricity at present, but demand is growing and several regions (such as southwest Connecticut, Texas, New York, and California) are projecting a need for new capacity in the next few years in order to keep reserve margins adequate (NERC 2005; NYISO 2005). Energy efficiency can slow growth rates, postponing the date additional capacity will be needed.

- Emissions of gases contributing to global climate change continue to increase. Early signs of the impact of these changes are becoming apparent in Alaska and other Artic regions (Hassol 2004). And several recent papers have identified a link between warmer ocean temperatures and hurricane intensity (Webster et al. 2005; Emanuel 2005). Energy efficiency is the most cost-effective way to reduce these emissions, as efficiency investments generally pay for themselves with energy savings, providing no-cost emissions reductions (see, for example, Prindle, Shipley, and Elliott 2006).

Energy efficiency also draws broad popular support. For example, in a March 2005 Gallop Poll, 61% of respondents said the U.S. should emphasize "more conservation" versus only 28% who said we should emphasize production (an additional 6.5% volunteered "both") (Gallop 2005). In an earlier May 2001 Gallop poll, when read a list of 11 actions to deal with the energy situation, the top four actions (supported by 85–91% of respondents) were "invest in new sources of energy," "mandate more energy-efficient appliances," "mandate more energy-efficient new buildings," and "mandate more energy-efficient cars." Options for increasing energy supply and delivery generally received significantly less support (Moore 2001).

Furthermore, increasing energy efficiency does not present a trade-off between enhancing national security and energy reliability on the one hand and protecting the environment on the other, as do a number of energy supply options. Increasing energy efficiency is a "win-win" strategy from the perspective of economic growth, national security, reliability, and environmental protection.

However, energy efficiency alone will not solve our energy problems. Even with aggressive actions to promote energy efficiency, U.S. energy consumption is likely to rise for more than a decade, and this growth, combined with retirements of some aging facilities, will mean that some new energy supplies and energy infrastructure will be needed. But aggressive steps to promote energy efficiency will substantially cut our energy supply and energy infrastructure problems, reducing the economic cost, political controversy, and environmental impact of energy supply enhancements.

2005 Federal Energy Legislation

In August 2005, the Energy Policy Act of 2005 (EPAct) was enacted into law. Notable efficiency provisions in this Act include:

1. Enactment of consensus equipment efficiency standards on 16 products plus DOE rulemakings to set efficiency standards on five more products.
2. Tax incentives for advanced energy-saving products and buildings.
3. Enhancements to the appliance labeling program, Federal Energy Management Program, and a variety of studies that will hopefully lead to policy changes in the future.
4. Updated authorizations for advanced energy research including energy efficiency.

Taken together, we estimate that these provisions will reduce U.S. energy use by about 2% in 2020 and will also displace the need for about 210 new power plants of 300 MW each by 2020. These are substantial positive impacts. Nadel (2005) described EPAct's efficiency provisions and savings in more detail.

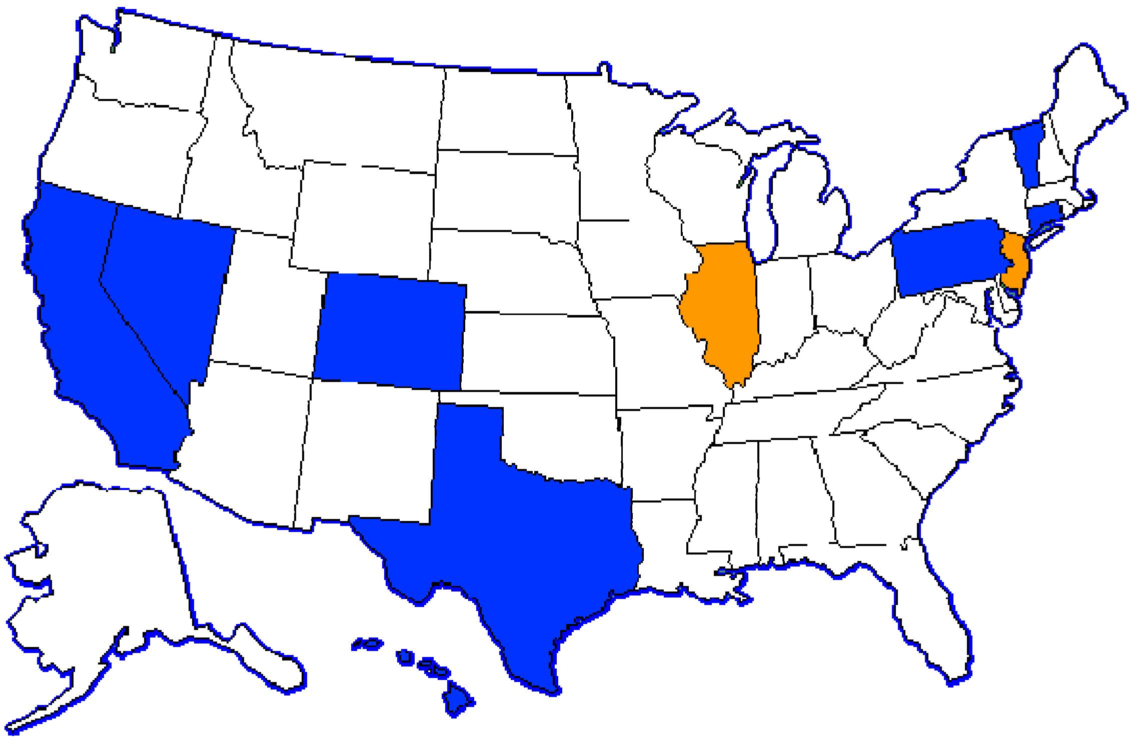
However, while the provisions discussed above are a reasonable start, much more can and should be done to improve U.S. energy efficiency. A spring 2005 ACEEE report recommended a variety of energy efficiency provisions for federal legislation (Nadel, Elliott, and Langer 2005). The report estimated that the complete package of measures would reduce U.S. energy use by about 8% in 2020. The single biggest item was an Energy Efficiency Resource Standard.

EERS Provisions Now in Place and Experience to Date

EERS-like laws and regulations are now in operation in eight states—Texas, Hawaii, Nevada, Connecticut, California, Vermont, Colorado and Pennsylvania. In addition, an EERS is likely to be implemented in Illinois soon, and New Jersey is also planning to implement energy-saving targets. States that have or are actively considering an EERS are shown in Figure 1. Internationally, EERS-like programs have also been established in the United

Kingdom, Italy, France, and the Flemish region of Belgium. In the following sections we discuss each of these efforts and experience to date under them.

Figure 1. States That Have or Are Actively Considering Energy Efficiency Resource Standard Policies



Note: Dark states currently have EERS. Lighter states have pending EERS.

Some of these state and national policies are EERS's in a pure form—legally mandated targets with implementation rules including implications for non-compliance (in Texas and the European countries; also under consideration in New Jersey). On the other hand, some of the state policies are variations on a pure EERS, including combined efficiency/renewable/"advanced" energy portfolio standards (in Hawaii, Nevada, and Pennsylvania), energy targets incorporated into contracts for statewide efficiency program providers (in Vermont and New Jersey), targets incorporated into utility commission decisions (in California and Colorado), and non-binding targets (in Illinois and to some extent Colorado). These variations are elaborated upon in the sections below.

In addition to the descriptions provided below, some additional information on EERS programs can be found in a recent guide for state policymakers published by the U.S. Environmental Protection Agency (EPA 2006).

Texas

Texas was the first state to establish an EERS. Texas's electricity restructuring law (SB-7-1999, signed into law by then-Governor Bush) established a requirement for electric utilities to offset a portion of their demand growth through end-use energy efficiency programs. The Public Utility Commission of Texas (PUCT) developed implementing regulations. Under these regulations, pilot programs were operated in 2001, programs targeted savings of 5% of demand growth in 2002, and ramped up to 10% of demand growth starting in 2003 (PUCT 2005a).

Under the law and regulations, programs fall into two main classes—standard offer and market transformation. Standard offer programs are offered by private energy efficiency service providers selected by customers. The utilities provide specified payments per unit of energy and demand savings to the service provider. Market transformation programs seek to overcome market barriers and promote long-term changes in markets for efficiency measures such as efficient new homes and efficient new air conditioners. Specific programs are developed by utilities and other stakeholders in a collaborative process and approved by the PUCT.

Energy efficiency programs are funded through utility transmission and distribution rates, and in 2004, totaled about $85 million, statewide. Energy savings goals are specified in peak kW and are based on average load growth in the previous five years (rolling baseline). Energy and demand savings are determined through a mixture of deemed savings estimates previously approved by the PUCT and in-field measurements in accordance with the International Performance Measurement and Verification Protocol (see http://www.ipmvp.org/). The PUCT is hiring an independent measurement and verification expert to review utility estimates of energy savings (Gross 2005).

Currently eight programs are in operation:

1. Commercial and Industrial Standard Offer
2. Residential and Small Commercial Standard Offer
3. ENERGY STAR® Homes Market Transformation
4. Residential ENERGY STAR Windows Market Transformation
5. Load Management Standard Offer
6. Hard-to-Reach Customer Standard Offer (has higher incentives than the other programs)
7. Air-Conditioner Distributor Market Transformation
8. Air-Conditioner Installation Information and Training Market Transformation

Through these programs, utilities are generally exceeding their goals. As noted above, the Texas goal is for programs to meet 10% of load growth. In 2003, the specific goal was 135 MW, but utility energy efficiency programs reduced demand by 151 MW, exceeding the goal by 11%. These programs also reduced electricity use by 370 million kWh (PUCT 2005b). In

2004, the respective numbers were a goal of 147 MW and achieved savings of 192 MW, exceeding the goal by more than 30%. The 2004 programs also reduced annual nitrogen oxide (NOx) emissions by about 623 tons and saved consumers about $25 million in 2004 (Gross 2005).

Over the next five years, electricity demand in Texas is projected to grow by an average of 1.8% per year (Shirey 2005). Thus, a savings target of 10% of load growth means an average target of 0.18% of prior-year load.

Given the relative ease Texas utilities have had in meeting their goals and given projections for large amounts of new capacity needed in the future, key parties in Texas are discussing possible changes to the Texas goals. Specifically, there is an emerging consensus among many key parties to increase the goal to 50% of load growth, to propose this change legislatively in 2007, and to include as part of the package mechanisms or incentives so that utility profits do not suffer as a result of the increase in the goal (Smith 2006).

Hawaii

Hawaii established a binding RPS via statute in 2001, with the requirements beginning in 2003. In 2004, this was modified by Act 95 to include energy efficiency. As amended, the law sets a renewable resource requirement of 8% of kWh sales in 2005, rising to 20% in 2020. Efficiency qualifies as a resource under these requirements with no cap on energy efficiency savings or set-aside for renewable energy savings. CHP plants and use of rejected heat (also referred to as "recycled" energy) are also included. For both renewables and efficiency, resources developed before the program began count towards the targets as long as they are providing energy or savings. Hawaiian utilities have been offering energy efficiency programs for many years and advocated for a combined program. Utility support for energy efficiency is aided by generous lost revenue recovery provisions in utility commission regulations.

The two major utilities (Hawaiian Electric Company, Inc. and Kauai Island Utility Cooperative) evaluate savings from their programs annually and submit a report to the Hawaii Public Utilities Commission for review. In 2004, according to reports filed by Hawaii's utilities, renewable energy and energy efficiency resources accounted for about 11.2% of electricity sales, with renewables accounting for 68% of these resources and efficiency 32%. These same reports noted that while the 2005 targets are being met, given projected load growth, some problems with existing renewable generation systems, and delays in developing new projects, the 2020 targets will be hard to meet without increasing energy efficiency and renewable energy efforts (Hawaiian Electric Company, Inc. 2005; Kauai Island Utility Cooperative 2004).

Nevada

In 2001, the Nevada legislature enacted RPS legislation requiring that 15% of the state's electricity come from renewable sources by 2013 (with incremental targets for earlier years).

In 2005, this law was amended by Assembly Bill 3 to increase the portfolio requirement to 20% of 2015 electricity sales, but also to allow the utilities to use energy efficiency programs to meet up to 25% of the requirements. The law requires at least half of the energy efficiency savings to come from the residential sector, unless the Nevada Public Utility Commission (NPUC) approves a different percentage. These amendments were agreed to after the utilities had difficulty meeting the renewables-only requirements during the first two years of implementation.

In November 2005, the NPUC issued implementing regulations for the combined renewable and efficiency portfolio standard (NPUC 2005). Under these regulations, utilities may operate energy efficiency programs themselves and/or purchase credits from third parties under contract. The utilities propose procedures for measurement and verification of energy efficiency savings based on prior NPUC directives. The NPUC reviews and approves renewable energy and energy efficiency credit verification submissions. The utilities report quarterly to the NPUC on portfolio goals and credits earned, including a more detailed annual report that is used to determine compliance with the portfolio standard for the prior accounting year. Extra credits may be rolled over to future years. If a utility does not meet its portfolio goals, it is subject to fines and administrative sanctions, although the NPUC can waive these fines and sanctions if it determines that there was not a sufficient supply of renewable energy or energy efficiency resources available for purchase.

In addition to the portfolio standard, in 2004 the NPUC approved a provision in its Integrated Resource Planning (IRP) and Demand-Side Management (DSM) rules to allow utilities to earn an extra 5% return on equity on a fraction of capitalized DSM expenses. The fraction is determined in each rate case (NPUC 2004). The first rate case with the incentive is now pending. In this case, Sierra Pacific Power proposes to receive an incentive of just under $100,000 for DSM expenditures of about $3 million (Sierra Pacific Power Company 2005).

Nevada's two major utilities (Nevada Power Co. and Sierra Pacific Power Co.) have been operating some efficiency programs for a number of years, but, with passage of this new law, plan to increase their efforts—for example, increasing spending on efficiency programs from about $16 million in 2005 to $30 million in 2006 (Geller 2005). These funds are included in electric rates. Energy efficiency savings will begin counting toward portfolio credits in 2006. The utilities are on record as saying they want to maximize energy efficiency savings allowed under the law (i.e., to use efficiency to achieve 25% of the combined renewable energy and energy efficiency portfolio standard). In order to reach this goal, they are now considering a significant increase in energy efficiency funding for 2007–2009, perhaps to as much as double 2006 funding. Proposed funding levels are still being analyzed and then must be formally filed with and approved by the NPUC (Balzar 2006).

Connecticut

Connecticut is another state that established a RPS a few years ago and in 2005 expanded it to include efficiency (including CHP). Specifically, in 1998 (as amended in 1999 and 2003), Connecticut adopted a law requiring that Class I renewable resources (e.g., solar, wind, fuel cells, low impact hydro, and low emissions biomass) provide at least 7% of the state's electricity in 2010, while Class I or Class II renewable resources (Class II includes other hydro, municipal solid waste, and higher emissions biomass) provide at least an additional 3% of the state's electricity starting in 2004 (UCS 2005). In June 2005, the Connecticut legislature adopted Public Act 05-1 (the so-called Energy Independence Act) that, among other provisions, complements the existing RPS by adding new "Class III" requirements covering commercial and industrial energy efficiency and CHP plants (residential efficiency is not included). Under the new class III requirements, electricity suppliers must demonstrate they have procured 1% of electricity supply from efficiency and CHP by Jan. 1, 2007, 2% by Jan. 1, 2008, 3% by Jan. 1, 2009, and 4% by Jan. 1, 2010. Only resources developed on or after Jan. 1, 2006 are eligible (Connecticut Legislature 2005).

Connecticut has had a public benefit fund since 2000 that finances energy efficiency and public interest research and development programs but the programs did not have specific legislated savings targets. In addition, for several years Connecticut utilities have been able to earn performance incentives (called a *management fee*) for energy efficiency programs, based on meeting milestones established by the state Energy Conservation Management Board (ECMB), a body established by the legislature that reports to the utility commission. The performance incentives can be up to 5% of program budgets and are before taxes, making their value equivalent to up to 8% of program expenditures (Harrington and Murray 2003; Gordes 2006).

The new 2005 law goes a step farther and establishes legislated savings targets. Under the new law, savings from commercial and industrial programs covered by the public benefit fund will generally count, but utilities will need to seek additional savings by buying from third parties such as energy service companies (the state utility commission plans to host quarterly auctions), increasing efforts under their present programs, or buying certificates from the state (at a default price, initially set at 3.1 cents/kWh of savings[3]) (Koontz 2006).

Two other provisions of the 2005 law also merit mention. First, the law increases requirements for gas utilities to plan and operate gas conservation programs. Program plans must now be submitted annually and reviewed by the utility commission. Second, the law establishes a fund for municipal utility conservation and load management programs and sets minimum contributions to this fund. These contributions start at 1.0 mill/kWh in 2006 (a mill is a tenth of a cent) and gradually increase to 2.5 mills in 2011. The fund is to be used for programs operated by the Connecticut Municipal Electric Energy Cooperative, an organization set up by municipal utilities in the state.

Energy efficiency programs are operated by the state's utilities, with input and review by the ECMB. Program plans and estimates of achieved energy savings are submitted by the utilities

[3] The law calls for a charge of "up to" 5.5 cents/kWh for shortfalls relative to the targets, but due to recent rate increases and a desire to keep rates down, the Commission chose a 3.1 cent/kWh charge for now.

to the Department of Public Utility Control for review and approval. According to the ECMB, programs operated by investor-owned electric utilities in 2004 saved an estimated 291 million kWh. These savings were achieved with expenditures in 2004 of $67.4 million. The ECMB estimated that the 2004 programs will result in lifetime energy cost savings of $440 million. Even after customer contributions to measure costs are included, The ECMB estimated that benefits are approximately three times greater than costs (ECMB 2005).

Energy savings in 2004 represent about 1% of electricity sales that year by covered utilities (municipal utilities are not included in the savings target portion of the program). Of these savings, 64% are from the commercial and industrial sectors (ECMB 2005) and thus the new class III requirements will increase total savings by almost 0.4% of sales annually relative to current efforts.

California

Following California's 2001 electricity crisis, the state put the utilities back in charge of assembling a portfolio of resources to meet their customers' energy service needs, including both demand- and supply-side resources. In overseeing this function, the main state resource agencies (California Energy Commission [CEC] and California Public Utilities Commission [CPUC]) made cost-effective energy efficiency the state's top priority procurement resource. This "loading order" policy was established in the joint agencies' *Energy Action Plan* (CPA et al. 2003) and endorsed by Governor Schwarzenegger (2004). This policy was recently reaffirmed by the agencies in *Energy Action Plan II* (CEC and CPUC 2005) and codified in state law.[4]

As part of this process, CEC developed statewide energy savings goals. These goals were based on detailed studies of cost-effective energy-saving opportunities in each sector of the state's economy and recent experience in the state with energy efficiency programs. These goals call for electricity use reductions of 30,000 million kWh in 2013 from programs operated over the 2004–2013 period, ramping up from lower goals in earlier years. For 2013, they also target about 7,760 MW of peak power savings (CEC 2003). These ten-year targets represent about 10% of predicted statewide 2013 electricity use and about 12% of predicted peak demand (using forecast in CEC 2005).

Once these goals were established, the CPUC adopted electricity and natural gas saving targets for each investor-owned utility (IOU), after receiving input through a public process. The goals for the IOU's, which provide 68% of the state's power and 80% of the state's natural gas, total 23,183 GWh of electricity and 444 million therms (44.4 trillion Btu) of natural gas by 2013 (CPUC 2004). CPUC then asked the state's utilities to submit plans on how they would meet their goals for the first three years, including proposed budgets. After receiving significant stakeholder input through advisory groups, the utilities submitted plans for dozens of programs, with more than half funded through the utilities' resource procurement budgets

[4] California Public Utilities Code sections 454.5(b)(9)(C), 454.56(b), and 9615(a).

with money that would otherwise have been directed to power plant investments. The rest of the budgets are covered by the state's Public Goods Charge (a small charge per kWh established as part of electricity restructuring legislation). The CPUC held hearings on the utility plans and in September 2005 approved them. The utilities were given a fair amount of discretion to modify program plans and budgets over the three-year period without CPUC approval, in order to respond to new information and experiences in the field, but are being held strictly accountable for their savings targets. Evaluation of the utility programs will be done by independent consultants hired by the CPUC, according to measurement and verification protocols that the CPUC is in the process of updating (CPUC 2005a, 2005b).

In order to meet these goals, California's utilities will have to significantly expand their programs. For example, in 2002, IOU programs saved 1,104 GWh per year (CEC 2003), so ramping up to the 2,318 additional GWh savings needed each year to reach the target (ten-year target of 23,183 divided by 10 years) requires more than doubling annual savings. By 2004, this ramp-up had begun, with California utility energy efficiency programs saving about 1,869 million kWh and 384 MW (Wang 2005). Thus, to meet their annual goals, the electric utilities will need to increase annual savings by about one-third relative to their 2004 efforts, with bigger increases needed for peak savings and smaller increases for electricity use (to increase peak savings, California is planning a major demand response effort). Natural gas savings programs will need to increase even more rapidly, with annual savings needing to double by 2008 and more than triple by 2013 (Bachrach and Carter 2004). Savings will be achieved by a mixture of utility programs and programs operated by third parties and selected through a request for proposals process.

Two other aspects of California's utility regulations are important to understand. First, California has an annual adjustment of electric rates to respond to differences between sales forecasts used to set rates, and actual sales (commonly referred to as *decoupling*). Thus, if sales are less than forecast (due to successful energy efficiency programs, for example), rates are modestly increased so utility recovery of fixed costs are unaffected by changes in sales; conversely, if sales are higher than forecast, rates are modestly decreased to return the over-collected revenue to customers (Bachrach, Carter, and Jaffe 2004). Second, as part of the goal-setting and program approval process, the CPUC is also establishing penalties and rewards for the utilities relative to their performance at reaching the Commission's energy savings goals. While details are still to be determined, if they achieve their goals, utility companies will receive a share of the net benefits (program-discounted lifetime benefits minus program-discounted costs) of the energy efficiency programs they oversee (CPUC 2005a). Given these provisions, utility managements have embraced the energy savings goals.

Vermont

Vermont has had extensive energy efficiency programs since 1990, as part of regulated utility's least-cost planning obligations, under the jurisdiction of the Vermont Public Service Board (PSB). Originally, programs were run by the state's utilities, but in 1999 the PSB transferred operations to a single, statewide "energy efficiency utility" operating under the name Efficiency Vermont. It is financed by a public benefit fund established by the legislature and administered by the PSB. Efficiency Vermont in turn is run by a competitively selected contractor, currently the nonprofit Vermont Energy Investment Corporation, under a performance-based contract with PSB. Part of this contract includes the mechanism for how savings will be counted. The Efficiency Vermont contractor submits an annual report to the state providing details on the savings claimed for installed measures that have been tracked and documented in its data tracking system. A savings claim review and adjustment process is carried out by state officials and PSB consultants before the PSB rules on the amount of savings achieved. The contract with the PSB includes specific energy (kWh) and peak demand (kW) savings targets. There is a significant holdback in the compensation received by the contractor, pending confirmation that contractual goals for savings and other performance indicators have been achieved (Hamilton and Dworkin 2004; Hamilton 2005).

Efficiency Vermont began operations in 2000 and in 2004 achieved 205 million kWh of annual savings and 26 MW of summer peak demand reduction (these figures include savings in 2004 from measures installed in earlier years). Savings started modestly at first, but cumulatively met over 3% of Vermont's electricity requirements by the end of 2004. A new contract was recently awarded for the 2006–2008 period, with an annual savings goal of over 1% of electricity sales each year. To date, verified savings have exceeded the goals specified in the Efficiency Vermont contract with the PSB (Efficiency Vermont 2005; Hamilton 2005).

One other recent development is also worth noting. In 2005, the Vermont legislature passed a law (Act 61) that establishes the Sustainably Priced Energy Enterprise Development (SPEED) Program. SPEED essentially establishes a RPS at the level of 100% of net load growth (i.e., after taking efficiency into account). Thus, efficiency and renewable energy are together required to meet 100% of load growth. Since efficiency is generally less expensive, there is now strong support among the utilities for efficiency programs and the utilities supported successful legislation to remove a prior cap on efficiency spending. As a result, the PSB now has a docket underway to consider significant increases to efficiency spending (Cowart 2006).

Technically, the Vermont program might not be classified as an EERS because the goals are established by contract and not directly by legislation or regulations. However, the program otherwise functions the same as an EERS and thus we believe is a useful example to include here. Also, with the new SPEED program, the line between contractual versus legislative direction is becoming blurred.

Pennsylvania

In late 2004, the Pennsylvania legislature adopted the Alternative Energy Portfolio Standards (AEPS) Act. Under the law, renewable energy must account for 8% of the power sold in the state after 15 years of implementation, with lower thresholds for earlier years. In addition, "tier 2" "advanced energy resources" must account for an *additional* 4.2% of power sold starting in 2006, 6.2% in 2011, 8.2% in 2016, and 10% in 2021. "Tier 2" resources include energy efficiency, hydropower, waste coal generation, and municipal solid waste.

The Pennsylvania Public Utilities Commission (PPUC) has developed implementing regulations. These regulations divide energy efficiency measures into two categories—those that are relatively easy to characterize and require few inputs for calculating savings for which a "deemed savings" approach can be used, and more complex measures that require either metering (such as for distributed generation) or custom calculations using a combination of metering and/or documented assumptions. For the deemed savings approach, the PPUC, working with interested parties, developed a Technical Reference Manual (TRM) that includes algorithms for calculating savings from residential, HVAC, lighting, and appliance measures and commercial and industrial HVAC, motor, and lighting measures. The PPUC also noted that "other technologies may be added to the TRM over time to provide a common reference for claiming electricity savings" (PPUC 2005).

However, there are many existing hydroelectric, waste coal and municipal solid waste generating plants in operation that in 2003 accounted for about 8% of statewide electricity use.[5] Thus, absent retirements, new tier 2 resources will only be needed to meet post-2016 targets. When the legislation was passed, numbers were changing quickly and no one really knew how the tier 2 targets related to existing resources (Tuffey 2006).

In light of this information on current use of tier 2 resources, Pennsylvania policymakers will need to consider increasing the tier 2 targets if they want to achieve their goal of encouraging increased use of tier 2 resources.

Illinois

The governor of Illinois presented the *Illinois Sustainable Energy Plan* in February 2005. Among other components, this plan asked the Illinois Commerce Commission (ICC—their utility regulatory commission) to establish an energy efficiency portfolio standard (EEPS) that will meet 25% of projected load growth by 2017. The proposal also included gradually increasing targets for earlier years (i.e., 10% of load growth for 2006–2008, 15% of growth for 2009–2011, and 20% of growth for 2012–2014). A complementary companion proposal would establish RPS requirements (Blagojevich 2005). The proposal has the support of the state's utilities, consumer and environmental groups, and many other stakeholders. ICC staff reviewed the proposal and recommended that it be approved with a few modifications: (1) delay the start date to 2007; (2) place a 0.5% per year cap on rate increases needed to meet the EEPS plus an additional 0.5% per year for the RPS; and (3) implement the plan on a voluntary basis given utility support for the plan and questions about the ICC's legal authority to make compliance mandatory (ICC 2005a). The ICC then passed a resolution accepting the staff recommendations (ICC 2005b).

Since then, some questions about pricing for power purchase contracts arose, which extended well beyond the RPS and EEPS. Utilities were waiting to have these issues resolved before proceeding with implementation of the RPS and EEPS (Clark 2005). In January 2006, the

[5] ACEEE calculations based on Sherrick (2006).

power purchase contract issue was resolved and work on implementing the EEPS and RPS is scheduled to begin soon. Decoupling and/or incentives for utilities are likely to be discussed as part of this process (Baker 2006). However, the delays in EEPS implementation due to other issues indicate that the voluntary nature of the Illinois EEPS could make it difficult to achieve EEPS goals. Working out further implementation details will be critical if goals are to be achieved.

New Jersey

New Jersey is working on two EERS-like policies, one similar to the Vermont system and a second more formal set of EERS requirements for each electrical energy supplier.

New Jersey passed electric industry restructuring legislation in 1999. This legislation included a public benefit fund to pay for energy efficiency and renewable energy programs. The original program established a four-year funding level and specific annual program budgets, but did not establish overall energy savings goals. Programs were administered by the state's seven electric and natural gas utilities. Within the annual program budgets, as approved by the N.J. Board of Public Utilities (BPU), the utilities established participation goals for equipment installed and market share but did not establish an overall energy savings goal.

In 2003, the BPU decided to transfer program administration of the public benefit programs from the utilities to the Board directly and to manage the program through independent contractors and not the utilities, just as Vermont had done. In addition, the BPU established specific electric and natural gas energy savings goals. A Request for Proposals (RFP) for contractors to run the program has been issued and bids are now being reviewed. As part of the RFP process to select program contractors, the winning bidders must agree to energy savings targets. Ultimately, as part of the contracting process, specific performance goals will be set, somewhat similar to the Vermont program (EPA 2006; Winka 2006).

In addition, as per instructions developed through Governor Corzine’s Energy Transition Policy Group (ETPG 2006), the BPU is pursuing development of a more formal EERS that would require each electricity supplier/provider that sells electricity to retail customers in the state to meet energy efficiency goals. The goals themselves are being set through two processes—a state energy master plan process and also a Portfolio Management Workgroup that is focusing specifically on electric distribution service. A straw proposal for the EERS is going through a stakeholder review process led by the BPU and the Rutgers’ Center for Economics, Energy and Environmental Policy (CEEEP). This straw proposal calls for achieving 1% energy efficiency savings in the first year, 2% in the second, etc. (i.e., 1% additional energy efficiency savings each year). "Efficiency" is defined to include clean distributed generation and load management. The draft also includes specific minimums for classes of resources such as residential efficiency and commercial and industrial. The draft envisions a system in which each energy supplier submits an annual report detailing compliance with the requirements. Suppliers may achieve the savings with their own programs, purchase an Energy Efficiency Certificate (EEC) from third parties, or make Energy

Efficiency Alternative Compliance Payments (EEACP) to the BPU. The Board will issue EEC's to third parties based on applications submitted to the BPU and supported by documentation supporting the savings or generation claimed. Presumably the operator of the public benefit program will be a major player in the EEC market. EEACP prices will be set by the BPU with assistance from an advisory committee and under the conceptual proposal will be higher than the estimated competitive market cost of EEC's. Any revenues collected from EEACP's will be put back into the public benefit fund (NJBPU 2005). The objective of the program would be to replace the public benefits funds with revenues from the market-based EEC. Further discussions on the proposal are planned for 2006. The BPU will be reporting to the governor by June 1, 2006 with initial goals and recommendations as well as a timeline for further development (Winka 2006).

Colorado

An EERS-like policy is also in place for Colorado’s largest utility, Public Service of Colorado (also known as Xcel Colorado as they are a subsidiary of Xcel). Colorado has a Least Cost Planning process that requires utilities to submit resource plans every four years. The last Xcel case, in addition to the Least Cost Plan, included a proposal to build a large new coal-fired power plant (Comanche Unit 3). This case was settled by the parties in December 2004, and the settlement was approved by the Colorado Public Service Commission in December 2004.

Under the settlement, Xcel agreed to “use its best efforts to acquire, on average, 40 MW of demand reduction and 100 GWh of energy savings per year from cost-effective Demand-Side Management (“DSM”) programs over the period beginning Jan. 1, 2006 and ending Dec. 31, 2013, so that by Jan. 1, 2014 the Company will have achieved a cumulative level of 320 MW of total demand reduction and 800 GWh of annual savings.” The company agreed to expend up to $196 million (2005 dollars) to meet these commitments. It agreed to include programs for all classes of customers and to conduct appropriate evaluations on its programs. The agreement calls for recovering program costs through rates and for Xcel to amortize DSM investments over eight years. In addition, Xcel agreed to conduct a study on energy efficiency opportunities in its service territory and to petition the Public Service Commission to open a docket to review the results of the study and consider whether future DSM programs beyond the levels in the settlement make sense. Incentives for Xcel will be considered as part of future cases (PSC of Colorado et al. 2004).

Based on Xcel Colorado’s 2004 sales, the annual savings goals amount to about 0.38% of sales. Implementation began Jan. 1, 2006 so it is too early for results to be available.

United Kingdom

In 2001, the United Kingdom (UK—made up of England, Scotland and Wales) established an “Energy Efficiency Commitment” that requires electricity and gas suppliers to achieve targets for energy efficiency in the residential sector. The program was developed by the UK government, was passed by Parliament, and is administered by the Office of Gas and Electric

Markets (OFGEM) working from policy decisions made by the Department for Environment, Food and Rural Affairs (DEFRA). Under the rules developed by DEFRA, specific deemed savings values are recognized for many specific energy-saving measures, based on the results of previous measurements, calculations, and evaluation studies. Half of the savings need to come from homes inhabited by low- and moderate-income families. Electricity and gas suppliers (primarily deregulated entities that compete against each other to provide services to end-use customers) operate different energy-saving programs (both directly and by contracting with third parties) and track measures installed and savings achieved. Savings can be achieved in homes served by other suppliers and thus many suppliers have contracted with housing agencies, appliance stores, boiler manufacturers, and other third parties to deliver energy savings. Electricity and gas suppliers report energy savings results to OFGEM on a quarterly basis using a standardized spreadsheet that OFGEM developed. OFGEM also periodically audits supplier processes and hires firms to inspect a sample of homes to make sure measures are installed as claimed (OFGEM 2005).

The first commitment period covered spring 2002—spring 2005 and required savings of 62 billion kWh (or the equivalent amount of natural gas, oil, or coal). These figures are for lifetime energy savings for measures installed over the 3-year commitment period. Over the commitment period, 87 billion kWh of savings were actually achieved, exceeding the goal by 40%. In part the large savings in the first commitment period were due to a new higher goal for the second commitment period (discussed below) as many suppliers ramped up efforts in 2004–2005 since extra savings from the first period can be used to meet obligations in the second commitment period. Of the savings achieved, 29% came from cavity wall insulation, 26% from ceiling/attic insulation, 24% from compact fluorescent lamps, 11% from efficient appliances, 9% from condensing boilers and other heating system improvements, and 2% from various other measures (OFGEM 2005). Savings were achieved at an average cost of about 0.7 pence per electrical kWh saved (Hargreaves 2005a), which is less than 1.5 U.S. cent/kWh.

For the second commitment period, covering the 2005–2008 period, a goal of 130 billion kWh was set. This second period also includes updated lists of measures and deemed savings values. The 2005–2008 goal amounts to about a 2% reduction in annual UK residential energy use (i.e., savings of nearly 0.7%/year). Due to carryover savings from the first commitment period, about 20% of the 2005–2008 target was achieved before the new commitment period began. Due to changes in UK building codes, sales of efficient appliances, and operating experience with CFLs, adjustments in the calculation procedures likely mean that insulation measures will be even more important in the second commitment period, while efficient boilers, appliances, and CFLs will account for a smaller portion of total savings (DEFRA 2004).

Work is just beginning to consider an appropriate goal for the 2008–2011 period. As part of this work, there is also some discussion of expanding the program to include small commercial customers. Large commercial and industrial customers are covered by other programs related to the UK's commitments to reduce greenhouse gas emissions under the Kyoto Protocol.

Italy

In 2001, the Italian Ministry of Industry established an obligation for gas and electric distribution companies to achieve specific energy savings targets. Implementing details were worked out by the Regulatory Authority for Electricity and Gas (called AEEG in Italian) and the program began in January 2005. Under the program, electric and gas distribution companies must meet steadily increasing savings targets over the 2005–2009 period. The program applies to electricity and gas distribution companies with more than 100,000 customers. The program allows energy service companies to also earn credits and sell these to distribution companies. In addition, the program includes a cost-recovery mechanism so costs can be included in electric and gas rates, although subject to regulatory approval.

The 2009 targets are 1.6 million metric tonnes of oil equivalent for electric distributors and an additional 1.3 million metric tonnes of oil equivalent for gas distributors. The 2009 targets amount to about 2% each of covered electricity use and covered gas use and include savings from measures installed in 2005–2009 that are still in operation. At least half the savings must be achieved in electricity and gas end-uses, but the other half can be achieved in any sector. Savings targets start at modest levels, but in the final year, the targets envision nearly a 1% reduction in electric and gas energy use over and above savings achieved from measures installed in earlier years. Unlike in the UK program, the Italian targets are just for savings achieved each year and do not include expected savings in the future. The Italian targets assume that measures will be in place for five years and thus there appears to be an obligation to maintain measures for at least five years. Distribution companies can operate programs themselves, jointly operate programs with third parties, or buy credits from third parties. If they fall short of targets, they pay a penalty for non-compliance and must make up the shortfall in subsequent years (i.e., the penalty only avoids one year of non-compliance, not the full five years for which measures must be maintained).

There is a list of eligible measures developed by regulators, including some for which deemed savings values have been set. Deemed savings measures are being steadily added to the program. In other cases, savings can be estimated using engineering approaches developed by regulators. New project ideas can also be developed and submitted to regulators for a pre-implementation "qualitative check," but with final savings estimates submitted and approved following implementation.

The program is just beginning so only very preliminary results are available. Many third parties are earning savings credits while some distribution companies appear to be short of the number of credits they need. Popular measures in the first year include cogeneration, district heating improvements, and public lighting projects. Weekly trading markets for the first year will begin in February 2006 and run through May 2006; AEEG is expecting a lot of trading. They are also expecting that more certificates will be issued than are needed to meet 2005 obligations and that the average price of exchanged certificates will be about 100 Euros per tonne of oil equivalent. This works out to about 2.2 Euro cents per kWh (2.6 U.S. cents per kWh) (Pavan 2002, 2005, 2006; Pagliano, Alari, and Ruggieri 2003; Pagliano 2005; Labanca 2006; Voogt and Luttmer 2006).

France

The French legislature in July 2005 passed a new energy law that includes energy saving targets somewhat similar to the programs in the United Kingdom and Italy. In the French law, a target of 54 billion kWh (or the equivalent for other fuels) is established for discounted lifetime savings for measures implemented in 2006–2008 (discounting means that expected savings in out-years are discounted back to the date of installation at the rate of 4% per year). There are no annual targets, just a single three-year target. The 2006–2008 target is on the order of 1% of covered French energy use. The obligation applies to suppliers of electricity, natural gas, domestic fuel (but not for transport), and heating and cooling for stationary applications. Small suppliers (less than 400 GWh of annual energy sales) are exempted.

Suppliers can either implement energy efficiency actions themselves, motivate customers to take energy efficiency actions, or buy "white certificates" for the amount of savings needed. White certificates are tradable certificates, specified in terms of cumulative kWh achieved. Certificates can be earned by suppliers from their own programs, or by third parties who seek to sell them to suppliers. There is a focus on standardized actions, but custom measures can also be implemented. A list of standardized actions is now being prepared for use in the second commitment period (after 2008) and will include about 30 residential/commercial measures, 10 industrial measures, and about 5 transport measures (while transport fuel suppliers do not have obligations, transport energy savings will earn certificates). French regulators plan to encourage a market in certificates by publishing a list of the prices of certificate sales and possibly publishing a list of certificate sellers. If an obligated supplier cannot submit a sufficient number of certificates to meet its obligations, it must pay a penalty price of 2 Euro cents per kWh of shortfall (about 2.4 U.S. cents per kWh) (Monjon 2005a, 2005b).

Flemish Region of Belgium

In 2003, the Flemish regional government established energy savings obligations on electricity distributors. There are 16 distributors covered. The program requires that annual savings targets be met and covers energy savings from residential, commercial, and non-energy-intensive industrial customers. Savings can be in any fuel. For the high-voltage user class (service at 1000 volts or more), the program requires savings of 1% per year over the 2003–2008 period, for a total 6-year savings of 6%. For lower-voltage customers, the program requires savings of 10.5% over this same period as there are some complementary programs established by the Flemish Parliament that are counted toward the goal.

Under the program, each grid operator submits a plan by June 1 to a government department for actions planned in the following year. Plans describe measures included, proposed financial incentives and awareness/information campaigns, and a proposed methodology for calculating energy savings. Plans can include savings in any type of fuel. For electricity, savings are based on primary energy savings, so end-use kWh savings are multiplied by 2.5 to account for energy losses at the power plant and in transmission and distribution. The government then reviews the proposed methodologies for estimating energy savings and approves them or recommends modifications. Program costs are incorporated into electric tariffs. Each grid operator must report by May 1 on actions taken and savings achieved in the prior year. The Flemish Regulator reviews these reports and can impose fines if targets are not achieved. There is a penalty of 10 Euro cents per kWh of shortfall (about 12 U.S. cents). The penalty cannot be passed along in tariffs.

In 2003, the savings target was 381 GWh of primary energy and 763 GWh were achieved, exceeding the target by more than a factor of two. Expenditures totaled 11.8 million Euros (about $14 million), which was less than had been budgeted. Programs cost an average of 3.7 Euro cents (4.4 U.S. cents) per kWh saved for residential customers and 1.03 Euro cents (1.2 U.S. cents) per kWh saved for commercial and industrial customers. The largest energy savings in the residential sector were achieved with energy-saving showerheads, light bulbs, boilers, windows, and roof insulation. The largest energy savings for business customers were achieved with variable speed drives, relighting, condensing boilers, and roof insulation, and thorough energy audits. In 2004 and 2005, plans called for saving 551 GWh and 579 respectively, with budgets of 30.2 and 25.8 million Euros respectively (about U.S. $36 and $31 million). Targets were reached in 2004 but details are not yet available. In general, the targets for low-voltage customers have been easier to meet than the targets for high-voltage customers (Collys 2005).

Discussion

Summary information on each of the programs discussed above is provided in Tables 1 and 2.

The EERS policies described above illustrate that many approaches are possible and that different approaches will likely make sense in different jurisdictions based on the different situations and organizations involved. In the four jurisdictions that have been implementing EERS policies for several years (Texas, Vermont, the United Kingdom, and the Flemish region of Belgium), the programs are widely perceived to be working well. The other jurisdictions are just beginning their EERS's and do not have significant results yet.

Table 1. Summary of Current and Pending EERS Policies in the U.S.

State	EERS Description	Applies to	Savings Target	Timeframe
California	Sets specific energy and demand savings goals.	Investor-owned utilities	Savings goals set for each program year from 2004 to 2013. The savings target for program year 2013 is: • 23,183 GWh, 4,885 MW peak • 444 MMtherms	2004–2013 Annual MWh, MW, and therm savings adopted for each of these years.
Colorado	Settlement agreement approved by PUC includes specific targets utility will make "best efforts" to achieve.	Public Service of Colorado (the major utility in the state)	320 MW and 800 GWh (40 MW and 100 GWh each year)	2006–2013
Connecticut	Includes energy efficiency at commercial and financial facilities as one eligible source under its Distributed Resources Portfolio Standard (also includes combined heat and power and load management programs).	Investor-owned utilities	Savings goals set for each program year:	
			1%	2007
			2%	2008
			3%	2009
			4%	2010 and thereafter
Hawaii	Allows efficiency to qualify as a resource under RPS requirements.	Investor-owned utilities	20% of kWh sales (overall RPS target, EE portion not specified)	2020
Illinois	Setting goals as percentage of forecast load growth.	Investor-owned utilities	10%	2006–2008
			15%	2009–2011
			20%	2012–2014
			25%	2015–2017
New Jersey	Two initiatives: 1. Setting energy and demand goals for overall PBF program. 2. Setting goals for savings as a percent of sales.	1. PBF program administrators (which is based on competitive solicitation) 2. Investor-owned utilities	1. 1,814 GWH (four-year total)	1. 2005–2008
			2. Conceptual draft calls for 1% per year for a total of 12% in 2016	2. 2005–2016 in conceptual draft
Nevada	Redefines portfolio standard to include energy efficiency as well as renewable energy.	Investor-owned utilities	Energy efficiency can meet up to 25% of the energy provider's portfolio standard. Combined EE/RE standard is:	
			6%	2005–2006
			9%	2007–2008
			12%	2009–2010
			15%	2011–2012
			18%	2013–2014
			20%	2015 and thereafter
Pennsylvania	Includes energy efficiency as part of a two-tier alternative energy portfolio standard	Investor-owned utilities	Tier 2 goals (including EE):	
			4.2%	Years 1-4
			6.2%	Years 5–9
			8.2%	Years 10–14
			10.0%	Years 15 and thereafter
Texas	Sets goals as percentage of forecast load growth	Investor-owned utilities	10%	2004 and thereafter
Vermont	Sets energy and demand goals for overall PBF program	Program administrator	83,766 MWh	2000-2002
			119,490 MWh	2003-2005
			204,000 MWh	2006-2008

Table 2. Summary of Current EERS Policies in Europe

State	EERS Description	Applies to	Savings Target		Timeframe
Flanders Region of Belgium	Sets energy-saving goals as a percent of electricity sales.	Electricity distributors	High voltage customers: 1% in new savings each year. Low-voltage customers: 1%, 2%, 2.1%, 2.2%, 2.2%, 1% in new savings for 2003–2008 respectively		2003–2008
France	Sets specific energy savings goal that must be achieved over a 3-year period.	Retail suppliers of electricity, natural gas, and domestic fuel	54 billion kWh (or equivalent) discounted lifetime savings		2006–2008
Italy	Sets specific energy saving goals that must be achieved each year.	Electric and gas distribution companies	Targets in million tones of oil equivalent:		
			Electric	Gas	
			0.1	0.1	2005
			0.2	0.2	2006
			0.4	0.4	2007
			0.8	0.7	2008
			1.6	1.3	2009
United Kingdom	Sets specific energy saving goals for each 3-year period.	Retail suppliers of electricity and gas	62 billion kWh lifetime savings		2002–2005
			130 billion kWh lifetime savings		2005–2008

Source: Documents on policies in each country (listed in References).

Furthermore, in a number of cases it is clear that the EERS's are having significant impacts. For example, savings in Texas, Vermont, and the United Kingdom are significantly greater than savings before the EERS's began. In the case of Texas, energy efficiency savings in 2003 totaled more than 5 *billion* kWh (York and Kushler 2005), which is more than an order of magnitude greater than the 0.3 billion saved in 1998 before the EERS policy began (Nadel, Kubo, and Geller 2000). In Vermont, savings were 255 million kWh in 2003, nearly a 50-fold increase relative to 1998 when just over 5 million kWh were saved (York and Kushler 2005; Nadel, Kubo, and Geller 2000). In the U.K., about 4 TWh were saved by programs in the year before the Energy Efficiency Commitment began (DEFRA 2004). In the final year of the first commitment period, 39.5 TWh of savings were achieved, an order of magnitude increase (DEFRA 2005). Regulators in Italy also report substantially increased activity (Pavan 2006) and the utility in Nevada reports large increases in its energy efficiency budgets so it can achieve the maximum amount of savings permitted under its combined renewable and energy efficiency portfolio standard (Balzar 2006). Large budget increases have also been approved in California. For the other states profiled above, data are not available as their EERS's have all gone into effect after 2003, the last year for which complete state data are available. In all of these states and countries, the EERS is the primary change in policy that could have driven these increased savings and investments.

However, not all of these benefits can be attributed to the EERS in each jurisdiction. Substantial savings in Vermont, California, Connecticut, and New Jersey are financed by their public benefit funds, although many of these states are supplementing public benefit financing with funds collected in rates. In addition, program implementers in Vermont, Nevada, California, and Connecticut receive financial incentives for achieving goals. California also has decoupling (discussed further below). And Hawaiian utilities receive a generous allowance for lost revenues.

In the following section, we draw from the experiences described above to make recommendations for new EERS's at both the state and federal level.

EERS Recommendations for States and the Federal Government

We recommend that both individual states and the federal government consider enacting EERS policies. So far, states have led EERS efforts and more states should consider policies of this type. Eventually, the federal government should follow these leading states and enact a national EERS so as to expand the savings and benefits throughout the country as well as provide national emissions reduction and price reduction effects that benefit all states, including those with state EERS. In the following sections, we describe a variety of issues that apply to such programs for consideration by both state and federal officials. At times, we differentiate between state and federal programs in our discussion.

Specific questions addressed are as follows:

- How should an EERS work?
- How should an EERS be administered?
- Which electric and gas providers should be covered?
- Which energy-saving measures should be eligible?
- What are appropriate savings goals?
- How many years should an EERS extend for?
- Should trading and cost caps be included?
- Should an EERS be separate from a RPS or combined with a RPS?
- What steps should be taken to monitor and verify savings?
- How does an EERS relate to other energy efficiency policies such as public benefit funds and decoupling?

At the end of this section, we provide an illustrative example of how such a program might work for a typical utility.

How Should an EERS Work?

We recommend that an EERS should require retail electricity and natural gas suppliers to secure annual savings of 0.75–1.25% of their most recent year's sales to retail customers as reported to the state utility commission (for a state program) or EIA (for a federal program). In the initial years, savings targets could be lower. These savings could be achieved flexibly through end-use efficiency improvements at customer facilities. As discussed below, some jurisdictions may also wish to make distribution system efficiency improvements and CHP systems at customer facilities also eligible. A credit and trading system should be established as should a cash buyout option to give retailers and other market-players added flexibility to buy and sell energy-saving credits to meet their targets. All of these issues are discussed further in the sections below.

How Should an EERS Be Administered?

At the state level, an EERS will generally be administered by the state utility commission, as it generally has jurisdiction over all investor-owned utilities in its state and in some states (albeit a minority of states) it also has jurisdiction over public utilities such as municipal power systems and rural cooperatives. The utility commission generally has most of the information it needs to administer an EERS program such as annual electricity sales and utility efficiency program energy savings. The utility commission should conduct a rulemaking to work out the details of administering a program, just as Texas, Nevada, Pennsylvania, and California have recently done (PUCT 2005b; NPUC 2005; PPUC 2005; CPUC 2004, 2005a, 2005b).

For a federal EERS, we recommend that the DOE administer the EERS, although states should have the option to act as sub-administrators if they so choose. Another option would be to have the Federal Energy Regulatory Commission (FERC) administer the program. DOE already collects much of the data needed to administer an EERS program through the Energy Information Administration. DOE or FERC should be directed to conduct a rulemaking to work out the details of an EERS including eligible measures, how savings will be measured, how the credit and trading system will work, and reporting requirements.

Which Electric and Gas Providers Should Be Covered?

We recommend that an EERS apply to retail power and gas providers, including both private and public utilities. A size-cap could be established to exempt very small utilities from these requirements if administrative burdens are substantial. In the sections below, we discuss each of these choices.

Retail Providers

Most of the opportunity for energy savings is at the end-user level, so it is the distribution utilities and other power providers that sell to and work with end-use customers that are best positioned to promote energy efficiency projects. These are the retail providers. They have information on end-use customers, regularly send bills and other information to end-use customers, and periodically visit customer sites to read meters and sometimes perform other services. This information and contact makes it much easier for retail providers to achieve energy savings than wholesale providers. Generally the retail provider is a utility company, either a distribution utility or an integrated utility. But in some cases the retail provider is an independent company that sells power to customers in states that permit retail competition. These independent providers should have the same energy savings obligations as utilities that serve the same retail function.

Electric and Gas

All of the EERS's discussed above apply to electric service and thus there should be little question about whether to include electric service in programs. In addition, most of the European programs profiled also apply to natural gas service, as does the California program, and to a much more limited extent, the Connecticut legislation. We recommend that U.S. states and the federal government include gas utilities in an EERS because: (a) there are substantial opportunities to save natural gas cost-effectively; and (b) natural gas energy savings can play a major role in addressing gas supply-demand imbalances that have caused natural gas prices to skyrocket in the past few years.

Regarding natural gas savings opportunities, a study by Nadel, Shipley, and Elliott (2004) examined five studies on the economic potential for natural gas savings. They found estimated cost-effective gas savings ranging from 13–35%, with a median finding of 22% savings available.

As for the natural gas crisis, in recent years demand for gas has grown substantially while supplies have grown more slowly. This has caused gas prices to be bid up. For example, U.S. residential natural gas prices in the first ten months of 2005 averaged $13.30 per million Btu, up 53% from the average price three years earlier (prices averaged $8.71 per million Btu in the first ten months of 2002) (EIA 2006a). EIA predicts that residential natural gas prices will remain above $10 per million Btu throughout the 2006–2030 period (EIA 2006a). Fortunately, energy efficiency can reduce the imbalance between demand and supply. As noted earlier, a study of U.S. markets estimated that a reduction in natural gas and electricity demand of 4–5% over the next five years could reduce natural gas prices by an average of more than 20% (Elliott and Shipley 2005). Savings to U.S. consumers from reduced energy bills (due to both lower gas prices and direct efficiency savings) would total about $165 billion over this five-year period (Elliott and Shipley 2005). Even programs operated at the regional level could have a significant impact on natural gas prices. For example, studies on the impact of a similar level of energy savings in just the Midwest and just the Pacific Coast states found average reductions in natural gas prices of 6% and 15%, respectively, over the next five years (impacts are larger on the West Coast due to much greater reliance on natural gas for electricity generation) (Elliot and Shipley 2005; Prindle, Elliott, and Shipley 2006).

If gas is included, the program should probably be limited to firm gas service. Interruptible service would probably be too complicated to include since these customers regularly switch back-and-forth between natural gas and other fuels. Also, avoided costs are very different for interruptible customers than for firm customers. Likewise, customers who buy gas directly on the wholesale market and only receive transportation service from the local distribution company should not be included as these customers make their own resource procurement decisions.

Since there is a lot more experience in the U.S. with EERS policies for electric utilities, one option for states or the federal government might be to start with an electric program and then add a gas program later.

Private and Public Utilities

In the U.S., about 75% of electricity is sold by private utilities and about 25% by public utilities (municipal utilities, power authorities, and rural electric cooperatives). For natural gas, a somewhat smaller portion comes from public utilities. Ideally, both private and public utilities would be covered, as there are cost-effective savings opportunities in all service territories and both types of utilities often offer energy efficiency programs. For example, when the Connecticut legislature established energy savings targets, it also began to require that public power providers offer energy efficiency programs (Connecticut Legislature 2005). Likewise, all but one municipal utility in Vermont subscribes to the Efficiency Vermont effort (the largest municipal utility operates its own programs, cooperating closely with Efficiency Vermont). The one utility that is not directly part of Efficiency Vermont had been running successful programs for many years and was excluded due to this successful track record. If its own programs falter, the Vermont Public Service Board has the authority to include it under Efficiency Vermont (Cowart 2006).

However, in many states the utility commission does not have authority over public utilities. In these states, either legislative action will be needed or programs will need to be limited to utilities under utility commission jurisdiction.

At the federal level, ideally public utilities should be included in any EERS or RPS requirement. To the extent there is a concern about the administrative burden on small municipal utilities, this can be addressed through a size cap (see next section). However, there is also a long-standing debate on jurisdiction over public utilities and any attempt to include public utilities in a federal EERS or RPS will enter this larger debate and meet with opposition from public utilities and their supporters.

Size Cap

Many small utilities operate energy efficiency programs. For example, two efficiency leaders among municipal utilities are the cities of Waverly, Iowa (4,300 customers, annual electric sales of 0.12 billion kWh) and Burlington, Vermont (20,000 customers, annual electricity sales of 0.35 billion kWh). From our review of state EERS laws and regulations, it appears that most states do not have a size-cap on their programs. In addition, small utilities can work together to administer programs, such as through state-level organizations of municipal utilities as exist in Connecticut, Massachusetts, and quite a few other states. However, for very small utilities and other power providers, state officials may decide that the administrative burdens of certifying compliance are too great. In these cases, states could allow small providers to opt out of their programs. If a size cap is set, based on the Waverly, Iowa and Burlington cases, a reasonable definition of “small” might be annual electricity sales of less than 100–300 million kWh or less than 4,000–15,000 customers.

At the federal level, legislation passed by the U.S. Senate that would establish a national renewable portfolio standard exempts utilities with annual sales of less than 4 billion kWh, which is a fairly high threshold that exempts large numbers of utilities (U.S. Senate 2005). For an EERS, we would recommend reducing this threshold significantly (e.g., to no more than 1 billion kWh per year).

Which Energy-Saving Measures Should Be Eligible?

All of the programs discussed above include end-use efficiency measures. In addition, some of the programs include other energy saving measures, such as distribution system efficiency improvements and CHP plants at customer facilities. Including these other measures increases opportunities for savings and also broadens political support. On the other hand, including these other measures makes an EERS more complicated as special rules will be needed for each of these resources. We think the decision on which measures to include should be made by each jurisdiction based on its evaluation of the pros and cons of including each option. If transmission and distribution improvements and distributed generation are included, EERS targets should be higher than if the EERS were limited to just end-use efficiency.

In the following paragraphs we discuss these three classes of measures in more detail:

- End-use efficiency measures at customer facilities.
- Transmission and distribution improvements that improve efficiency, such as superconducting transmission technology and high-efficiency transformers.
- Distributed generation efficiency measures at end-user sites such as fuel cells, CHP, and recycled energy technologies, with credit for electricity efficiency savings relative to the regional or national average generation-plant efficiency.

End-use efficiency measures range from efficient residential appliances to efficient commercial lighting systems to more efficient industrial processes. Hundreds of utilities are currently offering programs to encourage end-use efficiency. Measurement and verification rules for estimating energy savings are discussed further below. End-use efficiency is the core of all the EERS programs discussed above and should be included in all future programs.

Quite a few utilities have implemented measures to reduce transmission and distribution losses such as improved transformers, conductors, and power lines. The majority of EERS programs discussed above are limited to end-use savings at customer facilities. However, a bill introduced at the federal level by Senator Jeffords (I-VT) includes distribution systems (Jeffords 2003). Likewise, some state programs include combined heat and power systems at customer facilities including Hawaii (DBEDT 2005) and Connecticut (Connecticut Legislature 2005). Connecticut also includes fuel cells in its renewable portfolio standard.

Adding these additional efficiency measures expands the number of efficiency opportunities that can be tapped for meeting the targets and can also broaden political support by appealing to distribution utilities and large commercial and industrial customers who are potential hosts of CHP plants. However, distribution utilities already have an incentive to improve distribution system efficiency, as efficiency improvements reduce their direct costs. If distribution improvements are included and savings targets are not raised, many utilities might emphasize distribution improvements in their compliance strategies.

In the case of CHP and other distributed generation technologies, these have substantial differences from end-use efficiency and require special rules. For example, not all CHP and distributed generation improvements should be included but only improvements above a defined basecase. We recommend the basecase be based on the average heat rate in a state or region and credit only given for savings relative to this basecase. Some efficiency supporters are concerned that if CHP and distributed generation are included in an EERS, these systems could dominate as they are the type of large and easily monitored systems favored by many energy service companies and other third-party investors. If they are included, targets need to be increased in order to ensure that significant end-use efficiency improvements are realized.

Another question policymakers face is how and whether to limit the geographic location of savings. For state programs, we recommend that savings be limited to sites within the state, so that benefits are obtained locally. This means that a utility or other power provider cannot obtain credit for efficiency improvements out of state, such as from out-of-state customers they serve. While a case can be made that some out-of-state savings be allowed, it is difficult to draw lines to limit the amount of out-of-state savings allowed. If more than one utility or power provider serves a state, policymakers will need to decide whether one provider can get credit for assisting another provider’s customers. Most U.S. programs limit savings to a provider’s own customers, but the United Kingdom, for example, has had good experience permitting providers to save energy in other service areas (Hargreaves 2005b).

There may also be opportunities for including other energy sources, such as renewable energy, in a combined “clean energy performance standard.” This option is discussed later in this paper.

What Are Appropriate Savings Goals?

Savings Metrics

In the U.S., the most common way to express EERS goals is as a percentage of energy sales (expressed in kWh). This is the approach used in Connecticut, Hawaii, Nevada, and Pennsylvania and the approach planned in New Jersey. However, two states (Texas and Illinois) are expressing goals as a percent of load growth, and two other states (California and

Vermont) are expressing goals in terms of absolute kWh. In Europe, a mixture of absolute targets and percent of sales are used.

With absolute kWh goals, savings needed are known as soon as the targets are set. However, policymakers need to periodically set these goals. With savings as a percent of kWh sales, there is a small amount of uncertainty as to the exact goal, although this uncertainly is small since base sales are generally stable from year to year and the only uncertainty is growth in sales from year to year. On the other hand, these goals can be used for many years without resetting, since, unlike fixed goals, they automatically adjust to changes in energy sales. Targets based on growth in sales are the most uncertain, as growth rates can vary substantially from year to year depending on economic factors and weather. In general, all three approaches are workable, although we prefer percent of total sales since it provides only small amounts of uncertainty as to the exact target but also adjusts for changes in sales over time and therefore needs to be reset less often.

Target Size

In terms of the size of the target, as shown in the earlier discussion on specific EERS policies, many of the leading programs are targeting and achieving savings of 1% of covered electricity and natural gas use each year from end-use energy efficiency programs. This includes programs in California, Connecticut, New Jersey, Vermont, the U.K., Italy, and the Flemish region of Belgium. For states already operating substantial energy efficiency programs, this is a reasonable level to target, although a few years may be needed to ramp-up from current annual savings levels to 1% per year. A target of 1% of total sales is equivalent to 50% of load growth, assuming annual load growth of 2% per year, a common figure for much of the U.S.

If distribution efficiency improvements and/or CHP and other distributed energy resources are included in the EERS, then even higher savings targets are probably possible than 1% per year. For example, Connecticut is now targeting about 1.3% savings per year when residential programs are added to the 1% EERS target that covers only commercial and industrial customers.

For states not currently offering programs, a more modest target may be appropriate at first. For example, the Texas target averages 0.18% savings per year, although given pending resource needs and the ease with which Texas utilities have met their target, higher targets are now being considered (i.e., the new target may be five times the current requirement). The Illinois program will ramp up to a level of about double the current Texas goal.[6]

Many states have conducted studies to estimate the amount of cost-effective savings that are available. These studies have typically found opportunities for cost-effective savings of 10% or more over a ten-year period and 20% or more over a twenty-year period (i.e., incremental

[6] Illinois' target is 2.5 times the Texas target, but both states link their target to load growth and load growth in Illinois is lower than in Texas.

savings of at least 1% annually) (Nadel, Shipley, and Elliott 2004). These studies provide strong support for targets that increase savings goals by 1% of sales each year. Savings opportunities vary over time because of both technology development and the fact that the longer the time period, the more existing equipment and buildings that will need replacement. Some states may wish to conduct their own studies to verify that they have savings opportunities of at least this magnitude. However, enough studies have been conducted in a variety of states, including states that have aggressively pursued efficiency savings for many years (e.g., California, Massachusetts, and Oregon) that there is little doubt that there are cost-effective savings opportunities of 1% per year in all states.

At the federal level, given the mix of experience in individual states, we recommend that the EERS targets start at moderate levels (e.g., 0.25% of sales annually) and ramp-up over several years to 0.75% of sales annually, a level a little short of the savings currently achieved by the most successful states. If this program is successful, savings targets can be increased later.

For both state and federal programs, we recommend that peak electric demand savings should also be included. While most of the current EERS programs target just energy use, Texas targets peak demand, and California is trying to achieve both energy and peak demand objectives. At the federal level, peak demand targets would build on a proposal in H.R. 3406 (section 103) introduced by Rep. Barton in the 107th Congress that called for power providers to reduce peak demand by 5% over a three-year period from demand-response programs (Barton 2001). Peak demand savings can be achieved by energy efficiency programs as well as load management programs (shifting load from one period to another such as through load control and hourly pricing programs). Since there are more ways to achieve demand savings than energy savings, demand-savings targets (expressed as a percent of peak demand) can be equivalent to or higher than energy savings targets. For example, in 2004, according to data compiled by the EIA (2005b), demand-side management programs reduced U.S. electric sales by 1.4% but reduced peak demand by 3.3%.[7]

U.S. experience with energy saving targets has so far been with electricity and not natural gas. However, experience by two leading utilities (Vermont Gas and Xcel Minnesota) show that incremental savings of 0.5% of sales are possible annually. Likewise, cost-effective savings in five natural gas technical efficiency potential studies averaged 0.5% per year (Nadel, Shipley, and Elliott 2004). Based on these findings, natural gas targets of 0.5% of sales appear to be a good starting point until additional experience can be gained. On the other hand, the U.K. and Italy are both asking natural gas utilities to achieve savings of about 1% per year after initial ramp-up periods.

One other issue related to target size is whether energy suppliers can meet the targets in whichever sectors they choose, or whether there should be requirements to meet at least some portion of targets in particular sectors. For example, Nevada requires half the efficiency

[7] The figures for kWh savings provided here are lower than those estimated by York and Kushler (2005) because EIA only includes utility-run DSM programs while York and Kushler also include programs run by states. Also, York and Kushler fill in a few other gaps in the EIA data.

savings to come from the residential sector. New Jersey is considering a requirement that at least 25% of savings come from end-use efficiency in the residential sector. And in the U.K., at least half of the savings have to be in homes inhabited by low and moderate income households. Residential and low-income set-asides will generally raise the cost of a program as these savings are on average more expensive than savings in the commercial and industrial facilities (Kushler, York, and Witte 2004). On the other hand, without set-asides for residential and/or low-income customers, they may be underserved by programs as program implementers seek to minimize the expense of meeting targets. We recommend that sub-targets be set for residential and/or low income customers, so all customers have the opportunity to benefit from these programs. The size of the sub-target will depend on residential and/or low-income sales in a state.

Length of Target Period

Some states call for covered energy providers to meet targets annually, filing information each year to report on savings achieved. Many of the European programs and some states call for settling up every two to three years. For example, California utilities and U.K. energy providers have three-year goals, so if they are ahead or behind in the first year they can adjust efforts in years two and three to correctly hit their target. We prefer filings every two or three years, as these provide extra flexibility for meeting targets and reduce the administrative burden on power providers and regulators relative to annual filings. On the other hand, when programs are first beginning, more frequent filings (e.g., annually) can be useful so that problems can be identified early and adjustments made. If annual filings are required for the first few years, energy providers can still be given some flexibility to make up shortfalls in one year by "catching up" the next year.

How Many Years Should an EERS Extend For?

The timeframe for EERS policies varies widely. Policies in Hawaii, Illinois, Nevada, and Pennsylvania are linked to renewable portfolio standards and extend for the same timeframe—typically for 10–15 years. In California, targets extend for ten years. In Connecticut, targets extend for four years; in the European countries they typically apply to a three-year period. In these latter cases, regular extensions are anticipated (e.g., the U.K. is in their second commitment period and planning has begun for a third commitment period).

In order to provide more certainty for resource planners and power providers, we recommend that targets extend for at least ten years, with periodic reviews and the option to make refinements. Also, longer-term targets provide greater assurances to energy efficiency service providers that investments to develop their businesses in specific states will be worthwhile. If ending dates are set, policymakers should consider whether an extension is needed and justified several years before the final target date so that momentum generated while the policies are in place will not be lost.

Should Trading and/or Cost Caps Be Included?

Trading

To keep costs to moderate levels, the most cost-effective savings should generally be procured.[8] Trading is one way to allow the least expensive resources to be tapped—if a power provider can buy credits for less money than it would cost to operate their own programs, they will save money by buying credits. Also, permitting trading gives power and gas providers an additional mechanism to meet their obligations. Furthermore, trading allows successful program operators to sell surplus credits, providing a revenue stream to support some program costs.

Trading of credits was pioneered in clean air regulation and is widely perceived to be working well (see, for example, Burtraw 1996). Likewise, trading is commonly included in renewable portfolio standards although we are not aware of any studies on how these provisions have worked in practice.

In a related vein, it would be useful to permit independent efficiency providers to procure savings so that the market is not limited to just established utilities, maximizing the opportunity for obtaining the lowest-cost savings. For example, the Nevada program makes explicit provisions for energy service companies and other independent efficiency providers (NPUC 2005). Likewise, the New Jersey conceptual draft includes extensive provisions for third parties and trading (NJBPU 2005). In Europe, the U.K. and Italian programs include specific provisions to allow trading and include third-party providers. Under the U.K. program to date there has been extensive use of third-party providers but very little trading (Hargreaves 2005b). The U.K. has retail competition under which customers can choose from many providers and as a result energy providers are primarily large sophisticated companies with extensive marketing expertise who have chosen to implement programs themselves. In Italy, on the other hand, third-party providers have developed many projects and the implementing agency is expecting a robust trading market. The Nevada program is just getting started and the New Jersey program has yet to begin. Based on the many advantages of trading and third-party providers and positive experiences to date, we recommend that provisions for trading and third-party providers be included in both state and federal programs.

To implement trading, a system of tradable credits should be developed by program administrators, permitting credits to be awarded, bought, sold, and traded. For example, the New Jersey conceptual proposal includes a process by which credits can be issued by the BPU to energy suppliers and third parties for achieving documented savings, and then power providers must turn in the required number of credits each year (NJBPU 2005). Such systems are now being implemented in Italy and are under study in many other European countries. In

[8] Although perhaps subject to provisions that all consumers have a chance to participate and low-income households are well-served.

Europe, the credits are called *white certificates* in order to differentiate them from *green certificates* used in renewable energy programs.

Under a white certificate program, a credit amount is determined (e.g., 1 million kWh of savings) and credits awarded by the program administrator once savings are verified. State utility commissions (or for a federal program, DOE or FERC) would develop rules and guidelines for trading that could include bilateral contracts, or in the case of the federal program, a trading market. Under the credit trading system, suppliers could buy and sell credits for efficiency savings. In addition, other entities could sell credits that they control, including end-users and efficiency aggregators, states, utilities, and private energy service companies. A good starting point for such a system is the New Jersey conceptual proposal.

The size of one credit should be large enough so that only serious market participants are included but small enough that many firms can participate. For example, a large industrial customer should be able to earn a credit from improvements to its facility, but it will be too cumbersome to permit individual homeowners to play in this market. On the other hand, an energy provider, energy service company, or another third party should be able to aggregate hundred of homeowners and be able to earn one or more credits.

Cost Caps

In addition, to ensure that costs will be moderate, a cost-cap could be provided. Such a cap will assure skeptical policymakers that costs will be within acceptable levels. For example, the Connecticut program permits providers who are short of their targets to purchase savings credits for 5.5 cents per kWh of savings (or lower if permitted by the Connecticut utility commission) (Connecticut Legislature 2005). This fee effectively serves as a price cap on the cost of the EERS for individual electricity suppliers. Under the Connecticut law, funds collected from the fee are used to fund energy-saving programs. Pennsylvania has a similar provision with credits available for 4.5 cents per kWh of savings. The size of this “buyout” fee might vary from state to state, depending on local electricity prices. Both the Connecticut and Pennsylvania fees are about half the average retail cost of electricity in the state (EIA 2006b).

If a similar guideline were used for a federal program (half of average retail costs), the buyout fee would be about 4 cents per kWh of savings, roughly $50 per kW of peak demand reduction for one year, and perhaps $5 per million Btu of natural gas. This same fee could be used as a basis for fines for energy suppliers who fall short of their goals. At the federal level, funds collected through these fees should be conveyed to states with “lost savings” through grants to state energy offices to support energy efficiency programs.

Should an EERS Be Separate from a Renewable Portfolio Standard (RPS) or Combined with a RPS?

Most of the states with EERS’s also have RPS’s as well. More commonly the two policies are separate, as is the case in California, Illinois, New Jersey, Texas, and Vermont. However, in a number of cases, the two are combined. For example, Hawaii and Nevada have combined targets, although efficiency is capped at 25% of the target in Nevada. Connecticut and Pennsylvania have combined programs with separate targets for renewable resources and other resources.

Based on experience to date, all three of these approaches appear to be workable and thus the choice of which route to take will depend on state-specific considerations and politics. However, if efficiency and renewable energy both count toward a combined goal, a floor on renewable energy use should probably be established, since efficiency investments are generally less expensive per kWh and could dominate a combined portfolio. For this reason, renewable energy advocates generally prefer separate efficiency and renewable energy targets, although in some cases (e.g., Nevada) they supported combining the programs. On the other hand, efficiency programs reduce energy bills, saving money that can be used to help pay for renewable energy programs. Combining efficiency and renewable energy in some fashion tends to broaden political support for a policy, as combined proposals can draw support from renewable energy and energy efficiency advocates, as well as supporters of other energy sources that are included. In particular, the inclusion of CHP and recycled energy may at least gain the acquiescence if not the support from some industrial energy consumers.

If a portfolio requirement includes both renewable energy and energy efficiency, and if the efficiency portion targets savings of about 1% of sales per year, the renewable portion will typically be about 1% per year as well, as this is the most common level for state RPS requirements (UCS 2005).

At the national level, there is also the option for separate or combined RPS and EERS policies. If the policies are kept separate, it is still likely that both policies would apply to the same group of retail electricity suppliers, and the parallel credit trading systems of both proposals offer opportunities for synergies in administration. The U.S. Senate has passed RPS's several times, but such legislation has yet to be accepted by the House of Representatives. A federal EERS has been proposed by Senator Jeffords (e.g., S. 1754 in the 108th Congress) but has not made much progress.

In order to break the logjam between the House and Senate on a RPS, there is increasing talk of combining a RPS and EERS, and possibly adding other "advanced" energy sources such as "clean" coal or nuclear power. By expanding the requirement to include efficiency (and perhaps other resources), political support would be broadened and it would address concerns by some legislators that there are not enough viable renewable energy projects in their states to make a RPS workable.

If a federal RPS were expanded in this manner, at least 50% of the combined standard could be reserved for renewable sources alone. A combined standard should probably apply to new efficiency and renewable resources built after the date of enactment, in order to avoid the many complexities of trying to decide which current resources should be counted and how best to do so. The Senate-passed bill called for at least 10% of electricity use to come from renewables by 2020, including the approximately 2.5% of U.S. electricity that presently comes from renewable sources covered by the bill. If renewables and efficiency are combined, the 10% target could be maintained and the date of full effectiveness moved up (e.g., to 2015) or a higher 2020 target could be set. Setting a 10% in 2020 target for a combined RPS and EERS would be an overly modest requirement.

What Steps Should Be Taken to Monitor and Verify Energy Savings?

Monitoring and verification is an important part of an EERS program. Monitoring and verification help ensure that savings targets are met and provide information on program accomplishments. They also provide the necessary credibility, transparency, and consistency needed to use energy efficiency as a resource to help meet economic, environmental, and energy system goals.

Monitoring and verification typically means periodically evaluating a sample of installations using established evaluation measures and regularly reporting the results. For large systems that generate power, such as CHP systems, monitoring may mean installing a meter to measure kWh output. For common measures that may be installed in thousands of homes or businesses, such as compact fluorescent lights or efficient electric motors, monitoring may mean statistical studies of electrical bills before and after measure installation across a large sample of households or engineering estimates backed up with data on instantaneous power use reductions and logging of annual operating hours.

Typically, monitoring and evaluation will cost around 2–5% of a program budget (Nadel 1999). Lower budgets generally will not provide enough assurance that savings are real. Higher budgets have been used in some areas to collect additional useful information.

Detailed rules for monitoring and verification of savings should be developed by state utility commissions based on established protocols developed elsewhere. For example, many states have developed such rules including Texas (PUCT 2005b), Pennsylvania (PPUC 2005), and Nevada (NPUC 2005). California also has prepared extensive guidance, such as a 2004 Evaluation Framework report (TekMarket Works et al. 2004) and an entire Web site devoted to evaluation results (see www.calmac.org). For a federal program, DOE would develop the rules, but should allow some flexibility for state public utility commissions to modify these rules for use in individual states.

An important part of the programs in Europe has been the calculation of "deemed savings" values, which are precalculated savings amounts that providers can use for calculating savings for commonly used efficiency measures. For example, a deemed saving value could specify that each compact fluorescent lamp installed is credited with 65 kWh of annual savings for a six-year period and each ENERGY STAR® refrigerator is credited with 75 kWh of annual savings for a 19-year period. Use of deemed savings provides certainty to program operators on the amount of credit they will receive and reduces administrative burden. Deemed savings values are generally based on previous field evaluations of different measures. These values should be periodically reviewed and revised. For example, in the U.K., these values are reviewed and revised every three years. In the U.S., the Pennsylvania program includes deemed savings values for six groupings of measures, with multiple measures included in each grouping. Other utility commissions, such as in Texas, have developed such values for efficiency programs under their jurisdiction. The number of measures covered by deemed savings calculations can gradually be expanded as more field experience is gained with specific measures.

However, deemed savings values are only appropriate for commonly used measures for which savings are well-understood. In other cases, custom calculations will be needed. A good source of procedures for estimating project specific savings is the International Performance Measurement and Verification Protocol (see http://www.ipmvp.org) and also ASHRAE Guideline 14—Measuring Energy and Demand Savings (see www.ashrae.org). Guidance is also provided by Federal Energy Management Program (FEMP) protocols (see http://ateam.lbl.gov/mv/) and some of the state regulations referenced above. The FEMP Web site also contains extensive guidance on deemed savings.

In addition to rules on how to determine initial energy savings, evaluation rules also need to consider how savings may change over time. For example, some states have program operators evaluate savings for several years to monitor for attrition in savings over time. Based on savings trends over the first several years of measure life, an annual savings attribution rate is applied to subsequent years. For example, if second-year savings are determined to be 95% of first-year savings and third-year savings determined to be 90% of first-year savings, then fourth-year savings can be estimated at 85% of first-year savings and the progression continued for subsequent years. Another common approach is to use evaluation studies to determine average measure lives and allow program operators to assume that savings persist for this period.

Other good evaluation references include a study on evaluation practices in the Northeast (NEEP 2006) and a paper by Schiller et al. (2002) on approaches to measurement and verification.

Typically, energy savings are evaluated by program operators, such as utilities and energy service companies, with documentation submitted to the public utility commission for review. Commission staff, often with the aid of experienced evaluation consultants, review the savings calculations for reasonableness and make adjustments if needed. For a federal program, DOE or FERC should delegate review to state commissions that are willing to take on this responsibility. For states who do not want this responsibility, DOE or FERC would conduct the reviews.

For an EERS to work well, there need to be consequences if targets are not met or rules not followed. As discussed above under trading and cost caps, many states have established penalties per kWh for shortfalls relative to targets.

How Does an EERS Relate to Other Energy Efficiency Policies Such as Public Benefit Funds and Decoupling?

Many states have adopted other policies to encourage efficiency investments, such as public benefit funds, decoupling, and state tax credits. These policies can and should be complementary to an EERS, but care should be taken to think through the details.

Public benefit funds (PBF's) are small charges on electric (and sometimes natural gas) bills used to fund energy efficiency programs and other programs deemed in the public interest (e.g., assistance to low-income households). Seventeen states now fund efficiency programs through such funds (ACEEE 2004). PBF's can be used to fund all or part of the programs needed to comply with an EERS. For example, the Vermont Public Service Board is now considering an appropriate PBF funding level to meet its savings targets. In California, on the other hand, the PBF covers only about half of utilities' efficiency program budget, with the other half being directly included in electric rates. Likewise, the Connecticut EERS will need a combination of funding through a PBF and rates. New Jersey is planning a combination approach as well.

In a related vein, at least eight states provide energy efficiency tax incentives (Brown et al. 2002). These tax incentives make it easier for providers to reach energy savings targets, as one program strategy is to market availability of the tax credits and perhaps provide technical assistance so end-users can take advantage of the tax credits. There are also presently federal tax incentives that can be used in a similar fashion (Nadel 2005).

While several states have both EERS's and PBF's, some states have only one or the other. An EERS without a PBF generally means that all program costs are included in rates. A PBF without savings goals generally means that more utility commission oversight is needed to help ensure that PBF funds are spent in ways that maximize benefits. Often the choice of whether to do a PBF, EERS or both depends on political considerations. In the 1990's, many states enacted PBF's as mandating spending is easier to do than having to verify specific levels of savings. In recent years, EERS's have become increasingly popular as these provide more assurance that specific levels of savings will be achieved, and also, it also can be easier politically to mandate savings than to mandate spending. However, situations vary from state to state.

In addition, for programs to succeed, they must fit in with utility objectives, including, for investor-owned utilities, their obligation to shareholders to earn a return on their investments. But even public utilities need to be able to recover their expenses, including previously incurred capital costs. At a minimum, achieving these objectives means recovering reasonable program costs. In addition, it may mean financial incentives to the utility for successfully meeting program objectives. And ideally it also means aligning rate-making so utility profits do not suffer if sales decline due to successful energy efficiency programs. These items are discussed further in the paragraphs below. Much more information is provided elsewhere (see, for example, Moskovitz 2000).

Cost Recovery is a process whereby a utility is able to recover, through rates, the costs of implementing DSM programs. These costs can include staff costs, expenses, consultants, and rebates. Costs can either be "expensed" in the year they were spent or "capitalized" over a period of time. All utilities with DSM programs receive cost-recovery of some type. Typically costs can be recovered as long as they are "just and reasonable."

Shareholder/Contractor Incentives are bottom-line profits for program administrators based on the administrators meeting certain criteria associated with their DSM programs. Goals may include reaching savings targets, meeting market share milestones, and/or completing certain specified actions. In general, the closer the criteria are to the end results desired, the more effective incentives will be at ensuring that these end results are achieved. For investor-owed utilities, the incentives go to shareholders and are generally collected through rates. For third-party administrators working under contract, the incentives are spelled out in the contract. Of the states discussed in this report, California, Connecticut, and Vermont have shareholder or contractor incentives and many of the other states discussed are considering such incentives.

Decoupling is a process whereby rates are periodically adjusted to reflect the difference between actual energy sales and the sales forecast used in the ratesetting process. To simplify a complex process, under utility regulation in the U.S., rates are set by taking reasonable expenses for a recent or prospective "test year" and dividing by actual or forecasted sales for that test year. Once rates are set, increasing sales tends to increase profits and reducing sales tends to decrease profits since the rates include an allowance for fixed costs which by definition do not change as sales vary. Various mechanisms have been developed to break this link and make energy efficiency profitable (or at least not unprofitable) to utilities. These mechanisms generally look at actual sales and adjust rates upwards or downwards to account for over- or under-collection of fixed costs. Of the states discussed in this report, California has decoupling. In addition, Hawaii has a mechanism in which the utility is reimbursed for lost base (fixed cost) revenues associated with DSM program savings.

Illustrative Example

A retail electricity supplier with 1 million customers sells 10 billion kWh in the base year for the program. Under our proposal for a federal EERS, its EERS target would be about 25 million kWh in the first year, 50 million additional kWh in the second year, and 75 million additional kWh in the third year. The supplier assembles a "portfolio" of energy savings credits through:

1. Gaining credit for its current energy efficiency incentive programs, which currently produce 35 million kWh in savings (these savings exceed all of the first-year target and account for the majority of the second- and third-year targets);
2. Securing 25 million kWh from expanding its energy efficiency programs (these savings will allow it to exceed its second-year target);
3. Buying 5 million kWh of credits from a utility with very active efficiency programs;

4. Gaining 5 million kWh of credits through a series of distribution system efficiency improvements; and
5. Gaining 5 million credits by helping a major customer install a very efficient CHP system.

Its sales in the second year grow to 10.2 billion kWh, making its target for the second year 51 million kWh (while maintaining savings from the previous year's investments). By the tenth year, the supplier will likely be saving over half a billion kWh per year. It files annual reports with its state utility commission on its baseline sales, its current year savings target, and verification data for the portfolio of savings it has assembled to meet the target.

Energy Savings from a National EERS

Savings from an EERS will vary depending on the level of target that is set and will also vary by state since states vary widely in their energy sales. In this section, we briefly summarize the savings from a national EERS that requires 0.25% savings the first year, 0.5% in additional savings the second year, and 0.75% in additional savings each subsequent year. Our estimates are based on the latest EIA projections (EIA 2006c). Because EERS annual requirements are cumulative, over a decade annual savings would steadily mount. Under this proposal, if the program began in 2007, by 2020 annual electricity and natural gas use will be reduced by nearly 10%. Our full analysis is included as an appendix to this report. Results are summarized in Table 3.

EERS savings would amount to about one-quarter of the currently projected *growth* in electric sales over the 2007–2020 period and about one-half of projected growth in natural gas sales over this same period. A national EERS at these levels would reduce U.S. energy use in 2020 by about 5.6 quadrillion Btu ("quads"), which represent about 4.6% of projected U.S. energy use for that year. Such a program would reduce peak electric demand by about 124,000 MW in 2020 (equivalent to more than 400 power plants of 300-MW each). If half the electricity savings came from natural gas-fired power plants,[9] total gas savings in 2020 would come to about 3,600 trillion Btu of natural gas, equivalent to the current annual natural gas consumption of California and New York combined (EIA 2004). These savings are significantly greater than the savings from the efficiency provisions in the federal Energy Policy Act of 2005. Overall, an EERS at these levels would provide net benefits to consumers and businesses of about $170 billion (i.e., discounted benefits minus discounted costs), with an average benefit-cost ratio of 2.6 to 1.

[9] EIA (2006c) estimated that about 53% of power plant capacity additions between 2005 and 2020 will be natural gas fired.

Table 3. Summary of Savings and Costs of a Federal EERS

	2010	2020	Cumulative
Savings from an EERS			
Annual electricity savings (TWh)	87	386	
Estimated peak demand savings (MW)	28,018	124,191	
Annual direct gas savings (TBtu)	355	1569	
Total savings, all fuels (quads)	1.29	5.59	
Program costs			
Program costs (billions)			
Electric	2.8	3.1	
Gas	1.2	1.2	
Customer investments	8.0	8.7	
Total costs	12.0	13.0	
Discounted costs (2005$, 4.5% real discount rate)	9.6	6.7	
Program benefits and net benefits			
Program benefits (billions)			
Electric	6.4	28.0	
Gas	2.8	11.9	
Total	9.1	39.9	
Discounted benefits (2005$, 4.5% real disc. rate)	7.3	20.6	
Cumulative net benefits	-13.7	64.0	
Benefit/cost ratio			2.6
Power sector CO_2 emissions (MMT)	2,533	2,835	
Natural gas consumption CO_2 emissions (MMT)	927	1,005	
CO_2 emissions savings from EERS	76	320	

Note: 2010 and 2020 savings include savings from measures installed in prior years.

Conclusion

Energy efficiency should be an important cornerstone for America's energy policy. Energy efficiency has saved consumers and businesses billions of dollars in the past two decades, but these efforts can and should be accelerated. A key policy to accelerate energy efficiency would be an Energy Efficiency Resource Standard. We recommend that both states and the federal government adopt an EERS. Such a policy would:

- save consumers and businesses money;
- change the energy supply and demand balance and put downward pressure on energy prices;
- decrease reliance on energy imports (particularly liquefied natural gas whose use is projected to skyrocket in coming decades);
- help with economic development (since savings from energy efficiency generates jobs); and

- reduce carbon emissions, helping to moderate growth in the gases that contribute to global climate change.

While these benefits accrue from many policies to promote energy efficiency, EERS's are particularly effective because they can save large amounts of energy using a market-based system that helps keep costs down per unit of savings achieved. Experience in Texas, Vermont, and the United Kingdom indicates that goals can be met or exceeded in a very cost-effective manner.

The provisions in the federal Energy Policy Act of 2005 took modest steps to promote energy efficiency. A national EERS would produce significantly more savings and would be one of the most significant actions the U.S. could take to reduce U.S. energy use (e.g., the energy savings modeled here for 2020 are equivalent to raising Corporate Average Fuel Economy standards for passenger vehicles to 40 miles per gallon starting with the 2010 model year). So far, states have led EERS efforts and more states should consider policies of this type. Eventually, the federal government should follow these leading states and enact a national EERS so as to expand the savings and benefits throughout the country as well as provide national emissions reduction and price reduction effects that benefit all states, including those with state EERS's.

References

[ACEEE] American Council for an Energy-Efficient Economy. 2004. “Summary Table of Public Benefit Programs and Electric Utility Restructuring.” http://aceee.org/briefs/mktabl.htm. Washington, D.C.: American Council for an Energy-Efficient Economy.

Alliance to Save Energy, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Tellus Institute, and Union of Concerned Scientists. 1997. *Energy Innovations: A Prosperous Path to a Clean Environment.* Washington, D.C.: American Council for an Energy-Efficient Economy.

Bachrach, D. and S. Carter. 2004. “California Sets Nation’s Most Aggressive Energy-Saving Goals.” October 5 memorandum. San Francisco, Calif.: Natural Resources Defense Council.

Bachrach, D., S. Carter, and S. Jaffe. 2004. “Do Portfolio Managers Have an *Inherent* Conflict of Interest with Energy Efficiency?” *The Electricity Journal*, 17 (8), October, 52–62.

Baker, David (Illinois Department of Commerce and Economic Opportunity). 2006. Personal communication with D. York. February.

Balzar, Bob (Nevada Power). 2006. Personal communication with S. Nadel. January.

Barton, Joseph. 2001. *Sec. 103.: Price-Responsive Demand Programs.* HR3406. Washington, D.C.: U.S. House of Representatives.

Blagojevich, Rod. 2005. “Illinois Sustainable Energy Plan.” http://www.icc.illinois.gov/ec/docs/050217ecGovEnergy2.pdf. Springfield, Ill.: Office of the Governor.

Brown, Elizabeth, Patrick Quinlan, Harvey M. Sachs, and Daniel Williams. 2002. *Tax Credits for Energy Efficiency and Green Buildings: Opportunities for State Action.* Washington, D.C.: American Council for an Energy-Efficient Economy.

Burtraw, Dallas. 1996. *Cost Savings Sans Allowance Trades? Evaluating the SO_2 Emission Trading Program to Date.* Discussion Paper 95-30-REV. Washington, D.C.: Resources for the Future.

[CEC] California Energy Commission. 2001. *Emergency Conservation and Supply Response 2001.* Report P700-01-005F. Sacramento, Calif.: California Energy Commission.

———. 2003. *Proposed Energy Savings Goals for Energy Efficiency Programs in California*. Publication 100-03-021F. Lead author = Michael Messenger. Sacramento, Calif.: California Energy Commission.

———. 2005. *California Energy Demand 2006–2016 Staff Energy Demand Forecast.* CEC-400-2005-034-SF-ED2. Sacramento, Calif.: California Energy Commission.

[CEC and CPUC] California Energy Commission and California Public Utilities Commission. 2005. *Energy Action Plan II.* www.energy.ca.gov.

Clark, Fred. 2005. Letter to Edward C. Hurley, Chairman, Illinois Commerce Commission dated Sept. 6, 2005. http://www.icc.illinois.gov/ec/docs/050914ecEnergyComed.pdf. Chicago, Ill.: Commonwealth Electric.

Collys, Ann. 2005. "The Flanders (Belgium) Regional Utility Obligations." Presentation to the European Parliament, March 3.

Connecticut Legislature. 2005. *An Act Concerning Energy Independence.* House Bill No. 7501. Public Law 05-1. Hartford, Conn.: Connecticut Legislature.

Cowart, Richard. 2006. Email to S. Nadel dated Feb. 10. Burlington, Vt.: Regulatory Assistance Project.

[CPA] California Consumer Power and Conservation Financing Authority (CPA), California Energy Resources Conservation and Development Commission (CEC), and California Public Utilities Commission (CPUC). 2003. *Energy Action Plan.* www.energy.ca.gov/energy_action_plan/2003-05-08_ACTION_PLAN.PDF. Adopted May 8, 2003 by CPUC; April 30, 2003 by CEC; and April 18, 2003 by CPA.

[CPUC] California Public Utility Commission. 2004. "Energy Saving Goals for Program Year 2006 and Beyond." Decision 04-09-060. San Francisco, Calif.: Public Utilities Commission of the State of California.

———. 2005a. Decision 05-09-043. *Interim Opinion: Energy Efficiency Portfolio Plans and Program Funding Levels for 2006–2008—Phase 1 Issues.* San Francisco, Calif.: Public Utilities Commission of the State of California.

———. 2005b. "Administrative Structure for Energy Efficiency: Threshold Issues." Decision 05-01-055. San Francisco, Calif.: Public Utilities Commission of the State of California.

[DBEDT] Department of Business, Economic Development, and Tourism. 2005. *Hawaii's Renewable Portfolio Standard Law.* §269-91. http://www.hawaii.gov/dbedt/

ert/rps.html. Honolulu, Hi.: State of Hawaii, Department of Business, Economic Development, and Tourism.

[DEFRA] Department for Environment, Food and Rural Affairs. 2004. *A Review of the Energy Efficiency Commitment to the End of the Second Year*. London, UK: DEFRA.

———. 2005. *The Energy Efficiency Commitment from April 2005*. London, UK: DEFRA.

[ECMB] Energy Conservation Management Board. 2005. *Energy Efficiency, Investing in Connecticut's Future, Report of the Energy Conservation Management Board, Year 2004 Programs and Operations*. New Britain, Conn.: Department of Public Utility Control.

Efficiency Vermont. 2005. *Working Together for an Energy-Efficient Vermont, 2004 Annual Report*. Burlington, Vt.: Efficiency Vermont.

[EIA] Energy Information Administration. 2004. *State Energy Data Report 2001*. Washington, D.C.: Energy Information Administration.

———. 2005a. *Annual Energy Review 2004*. Report #: DOE/EIA-0384(2004). http://www.eia.doe.gov/emeu/aer/contents.html. Washington, D.C.: Energy Information Administration.

———. 2005b. *Demand Side Management Actual Peak Demand Reductions by Program Category*. http://www.eia.doe.gov/cneaf/electricity/epa/epat9p1.html. Washington, D.C.: Energy Information Administration.

———. 2006a. *Natural Gas Navigator: U.S. Natural Gas Residential Price*. http://tonto.eia.doe.gov/dnav/ng/hist/n3010us3m.htm. Visited Jan. 10. Washington, D.C.: Energy Information Administration.

———. 2006b. *Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State*. http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html. Visited Jan. 13. Washington, D.C.: Energy Information Administration.

———. 2006c. *Annual Energy Outlook 2006 with Projections to 2030*. Report #: DOE/EIA-0383(2006). http://www.eia.doe.gov/oiaf/aeo/index.html. Washington, D.C.: Energy Information Administration.

Elliott, R. Neal and Anna Monis Shipley. 2005. *Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets: Updated and Expanded Analysis*. http://www.aceee.org/pubs/e052full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

Emanuel, Kerry. 2005. "Increasing Destructiveness of Tropical Cyclones over the Past 30 Years." *Nature,* 436, 4 August, 686–688.

[EPA] U.S. Environmental Protection Agency. 2006. *Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action Steps for States*. Prepublication version. Available online at: http://www.epa.gov/cleanenergy/stateandlocal/. Washington, D.C.: U.S. Environmental Protection Agency.

[ETPG] Energy Transition Policy Group. 2006. *Energy Policy Transition Report.* Prepared for Governor-Elect Jon S. Corzine. Newark, N.J.: Energy Transition Policy Group.

Gallop. 2005. "Gallop Poll Social Series—The Environment." Princeton, N.J.: The Gallop Organization.

Geller, Howard. 2005. "Utility Energy Efficiency Program Overview." Presentation at the 2005 Regional Energy Efficiency Program Workshop, Phoenix, Ariz., Nov. 3.

Geller, H., P. Harrington, A. Rosenfeld, S. Tanishima, and F. Unander. 2006. *Policies for Increasing Energy Efficiency: Thirty Years of Experience in OECD Countries.* Forthcoming. Boulder, Colo.: Southwest Energy Efficiency Project.

Geller, Howard and Toru Kubo. 2000. *National and State Energy Use and Carbon Emissions Trends*. Washington, D.C.: American Council for an Energy-Efficient Economy.

Global Energy Partners. 2003. *California Summary Study of 2001 Energy Efficiency Programs, Final Report.* Lafayette, Calif.: Global Energy Partners.

Golove, W.H. and J.H. Eto. 1996. *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency.* LB-38059. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Gordes, Joel (Connecticut Energy Conservation Management Board). 2006. Personal communication with D. York. January.

Gross, Theresa. 2005. "Energy Efficiency Programs." Presentation at the Energy Efficiency as a Resource Conference, Berkeley, Calif., September 26–27.

Hamilton, Blair (Efficiency Vermont). 2005. Personal communication with S. Nadel. December.

Hamilton, Blair and Michael Dworkin. 2004. "Four Years Experience of the Nation's First Energy Efficiency Utility: Balancing Resource Acquisition and Market Transformation Under a Performance Contract." In *Proceedings of the 2004 ACEEE*

Summer Study on Energy Efficiency in Buildings, 5.129–5.140. Washington, D.C.: American Council for an Energy-Efficient Economy.

Hargreaves, Charles. 2005a. "The Energy Efficiency Commitment." Briefing packet provided to S. Nadel. September. London, UK: Office of Gas and Electricity Markets.

———. (Office of Gas and Electricity Markets). 2005b. Personal communication with S. Nadel. September.

Harrington, C. and C. Murray. 2003. *Who Should Deliver Ratepayer Funded Energy Efficiency? A Survey and Discussion Paper*. http://www.raponline.org. Montpelier, Vt.: The Regulatory Assistance Project.

Hassol, Susan Joy. 2004. *Impacts of a Warming Arctic: Arctic Climate Impact Assessment.* http://www.acia.uaf.edu. Cambridge University Press.

Hawaiian Electric Company, Inc. 2005. "2004 Renewable Portfolio Standard Status Report." Honolulu, Hi.: Hawaiian Electric Company, Inc.

[ICC] Illinois Commerce Commission. 2005a. *Illinois Sustainable Energy Initiative, ICC Staff Report.* http://www.icc.illinois.gov/ec/docs/050713ecEnergyRpt.pdf. Springfield, Ill.: Illinois Commerce Commission.

———. 2005b. *Resolution on Governor's Sustainable Energy Plan for the State of Illinois.* http://eweb.icc.state.il.us/e-docket/reports/view_file.asp?intIdFile=148072&strC=bd. Springfield, Ill.: Illinois Commerce Commission.

Interlaboratory Working Group. 2000. *Scenarios for a Clean Energy Future*. Washington, D.C.: Interlaboratory Working Group on Energy-Efficient and Clean-Energy Technologies, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.

Jeffords, James. 2003. "Electric Reliability Security Act of 2003." §.1754. Washington, D.C.: U.S. Senate.

Kauai Island Utility Cooperative. 2004. "Renewable Portfolio Standards (RPS) Status Report." Honolulu, Hi.: Oshima Chun Fong & Chung, LLP.

Koontz, Roger (Environment Northeast). 2006. Personal communication with S. Nadel. January.

Kushler, M., D. York, and P. Witte. 2004. *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies.* Washington, D.C.: American Council for an Energy-Efficient Economy.

Labanca, Nicola. 2006. "The Italian White Certificate System." Presentation at the Workshop on White Certificate Trading Systems in the European Union, Budapest, January 27.

Miller, P., J. Eto, and H. Geller. 1989. *The Potential for Electricity Conservation in New York State*. Washington, D.C.: American Council for an Energy-Efficient Economy.

Monjon, Stéphanie. 2005a. "The French Energy Savings Certificates System." Presentation dated Oct. 27. Paris, France: Economics Department, Ademe.

——— (Ademe, Economics Department). 2005b. Personal communication with S. Nadel. June and August.

Moore, David. 2001. "Energy Crisis: Americans Lean toward Conservation over Production." Princeton, N.J.: The Gallup Organization.

Moskovitz, David. 2000. *Profits and Progress Through Distributed Resources.* Gardner, Maine: Regulatory Assistance Project.

Nadel, Steven. 1999. "Market Transformation Evaluation: A Tale of Four Regions." In *Evaluation in Transition: Working in a Competitive Energy Industry Environment.* International Energy Program Evaluation Conference.

———. 2005. *The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts.* Report Number E053. Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, Steven, R. Neal Elliott, and Therese Langer. 2005. *A Choice of Two Paths: Energy Savings from Pending Federal Energy Legislation.* Report Number E051. Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, Steven and Howard Geller. 2001. *Smart Energy Policies: Saving Money and Reducing Pollutant Emissions Through Greater Energy Efficiency*. www.aceee.org/energy/reports.htm. Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, Steven, Toru Kubo, and Howard Geller. 2000. *State Scorecard on Utility Energy Efficiency Programs.* Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, Steven, Anna Shipley and R. Neal Elliott. 2004. "The Technical, Economic and Achievable Potential for Energy Efficiency in the U.S.: A Meta-Analysis of Recent Studies." In *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings,* 8.215–8.226. Washington, D.C.: American Council for an Energy-Efficient Economy.

[NEEP] Northeast Energy Efficiency Partnerships, Inc. 2006. *The Need for and Approaches to Developing Common Protocols to Measure, Verify and Report Energy Efficiency Savings in the Northeast*. Lexington, Mass.: Northeast Energy Efficiency Partnerships, Inc.

[NERC] North American Electric Reliability Council. 2005. *2005 Long-Term Reliability Assessment: The Reliability of Bulk Electric Systems in North America*. Princeton, N.J.: North American Electric Reliability Council.

[NJBPU] New Jersey Board of Public Utilities. 2005. *2005 Conceptual Draft—NJBPU Office of Clean Energy*. Newark, N.J.: New Jersey Board of Public Utilities.

[NPC] National Petroleum Commission. 2003. *Balancing Natural Gas Policy—Fueling the Demands of a Growing Economy: Volume I Summary of Findings and Recommendations.* Washington, D.C.: U.S. Department of Energy.

[NPUC] Nevada Public Utilities Commission. 2004. "In Re: Investigation and Rulemaking into Revision of Resource Planning Regulations." Docket No. 02-5030, Order and Regulations. Reno, Nevada: Public Utilities Commission of Nevada.

———. 2005. "Docket No. 05-7050, Proposed Regulations, Revised on Nov. 18, 2005, Resource Planning by Certain Electric Utilities." http://puc.state.nv.us/R_and_I/dkt_05-7050/05-7050.htm.htm. Carson City, Nevada: Public Utilities Commission of Nevada.

[NYISO] New York Independent System Operator. 2005. "The NYISO Issues Reliability Needs Assessment." Press release of December 21. Schenectady, N.Y.: New York Independent System Operator.

[OFGEM] Office of Gas and Electricity Markets. 2005. *A Review of the Energy Efficiency Commitment 2002–2005.* London, UK: Office of Gas and Electricity Markets.

Optimal Energy. 2003. *Energy-Efficiency and Renewable Supply Potential in New York State and Five Load Zones.* Draft. Bristol, Vt.: Optimal Energy, Inc.

Pagliano, Lorenzo (End-Use Efficiency Research Group, Politecnico di Milano). 2005. Personal communication with S. Nadel. July.

Pagliano, Lorenzo, Pierluigi Alari, and Gianluca Ruggieri. 2003. "The Italian Energy Saving Obligation to Gas and Electricity Distribution Companies." In *ECEEE 2003 Summer Study*, 1059–1068. European Council for an Energy-Efficient Economy.

Pavan, Marcella. 2002. "What's Up in Italy? Market Liberalization, Tariff Regulation and Incentives to Promote Energy Efficiency in End-Use Sectors. In *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings,* 5.259–5.270. Washington, D.C.: American Council for an Energy-Efficient Economy.

———. 2005. "Italian Energy Efficiency Obligation and White Certificates: Measurement and Evaluation." Presented at the Workshop on Case Studies of Current European Schemes for the Measurement and Verification of Energy Efficiency Improvements organized by the European Commission, the European Parliament and ECEEE, Brussels, March 3.

——— (Regulatory Authority for Electricity and Gas). 2006. Personal communication with S. Nadel. January.

[PPUC] Pennsylvania Public Utility Commission. 2005. "Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources, Final Order." http://www.puc.state.pa.us/ electric/electric_alt_energy_port_stnds.aspx. Harrisburg, Penn.: Pennsylvania Public Utility Commission.

Prindle, William, R. Neal Elliott and Anna Monis Shipley. 2006. *Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets in the Pacific West.* http://www.aceee.org/pubs/e062full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

Prindle, William R., Anna Monis Shipley and R. Neal Elliott. 2006. *Energy Efficiency's Role in a Carbon Cap-and-Trade System: Modeling Results from the Regional Greenhouse Gas Initiative.* Forthcoming. Washington, D.C.: American Council for an Energy-Efficient Economy.

[PSC of Colorado] Public Service Company of Colorado, the Staff of the Colorado Public Utilities Commission, the Colorado Office of Consumer Counsel, the Colorado Energy Consumers Group, the Colorado Governor's Office of Energy Management and Conservation, Western Resource Advocates, Colorado Coalition for New Energy Technologies, Southwest Energy Efficiency Project, Environment Colorado, Colorado Renewable Energy Society, the City and County of Denver, and Tri-State Generation & Transmission Association, Inc. 2004. *Comprehensive Settlement Agreement.* Re: dockets 04A-214E, 04A-215E, and 04A-216E. Denver, Colo.: Public Utilities Commission of the State of Colorado.

[PUCT] Public Utility Commission of Texas. 2005a. *Report to the 79th Texas Legislature, Scope of Competition in Electric Markets in Texas.* Austin, Tex.: Public Utility Commission of Texas.

———. 2005b. *Chapter 25, Substantive Rules Applicable to Electric Service Providers; Subchapter H, Electric Planning; Division 2, Energy Efficiency and Customer-Owned Resources.* §25.181. Public Utility Commission of Texas.

Schiller, Steven, Chris Schroeder, John Mapes, Brian Henderson, and William Gruen. 2002. "Rate Payer Funds for Performance Contracting—Three Approaches to Measurement and Verification and Market Outreach." In *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings*, 5.278–5..284. Washington, D.C.: American Council for an Energy-Efficient Economy

Schwarzenegger, Arnold. 2004. Letter to CPUC President Peevey. April 28. Sacramento, Calif.: Office of the Governor.

Sherrick, Joseph (Pennsylvania Department of Environmental Protection, Office of Energy and Technology Deployment). 2006. Personal communication with S. Nadel. January.

Shirey, Linda. 2005. *Report on the Capacity, Demand and Reserves in the ERCOT Region.* Taylor, Tex.: ERCOT.

Sierra Pacific Power Company. 2005. "Docket 05-10003: Sierra Power Company to Increase Its Annual Revenue Requirement for General Rates to All Classes of Electric Customers within its Service Territory for Relief Properly Related Thereto, Schedule H-39." Reno, Nevada: Regulatory Filing with the Public Utilities Commission of Nevada.

Smith, Tom (Public Citizen). 2006. Personal communication with S. Nadel. February.

TekMarket Works, Megdal & Associates, Architectural Energy Corporation, RLW Analytics Resource Insight, B & B Resources, Ken Keating and Associates, Ed Vine and Associates American Council for an Energy-Efficient Economy, Ralph Prahl and Associates, and Innovologie. 2004. *The California Evaluation Framework*. Prepared for the California Public Utility Commission and the Project Advisory Group. http://calmac.org/publications/california_evaluation_framework_june_2004.pdf. Sacramento, Calif.: California Public Utility Commission.

Tuffey, Tom (Penn Future). 2006. Personal communication with S. Nadel. January.

[UCS] Union of Concerned Scientists. 2005. "Table C-1. State Minimum Renewable Electricity Requirements (Revised as of Oct. 2005). http://www.ucsusa.org/clean_energy/clean_energy_policies/clean-energy-policies-and-proposals.html . Cambridge, Mass.: Union of Concerned Scientists.

U.S. Senate. 2005. *H.R.6: Energy Policy Act of 2005 (Engrossed Amendment as Agreed to by Senate).* Washington, D.C.: U.S. Senate.

Voogt, Monique and Maxim Luttmer. 2006. "White Certificate Systems; The Concept, Experiences and Market Opportunities." Presentation at the Workshop on White Certificate Trading Systems in the European Union, Budapest, January 27.

Wang, Devra (Natural Resources Defense Council). 2005. Personal communication with S. Nadel (based on California investor-owned utilities' Earnings Assessment Proceeding Annual Reports, 2004). December.

Webster, P.J., G.J. Holland, J.A. Curry, and R.R. Chang. 2005. "Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment." *Science,* 309, 16 September, 1844–1846.

[WGA] Western Governors' Association. 2006. *Clean and Diversified Energy Initiative: Energy Efficiency Task Force Report.* Denver, Colo.: Western Governors' Association.

Winka, Michael (New Jersey Board of Public Utilities). 2006. Personal communication with S. Nadel. January.

York, Dan and Marty Kushler. 2005. *ACEEE's 3rd National Scorecard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State-Level Activity.* http://www.aceee.org/pubs/u054full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

For More Information

California

1. California Public Utility Commission energy efficiency docket: http://www.cpuc.ca.gov/static/hottopics/1energy/a0506004.htm .

Colorado

1. Xcel Colorado Least Cost Plan Docket including settlement agreement: http://www.dora.state.co.us/puc/docket_activity/HighprofileDockets/04A-214E_-215E_-216E.htm

Connecticut

1. Law:
http://www.cga.ct.gov/2005/ACT/PA/2005PA-00001-R00HB-07501SS1-PA.htm

2. Energy Conservation Management Board website including annual reports:
http://www.state.ct.us/dpuc/ecmb/

Illinois

1. Further information on the Illinois Sustainable Energy Plan including the EERS can be found at: http://www.icc.illinois.gov/ec/ecEnergy.aspx .

Nevada

1. Law:
http://www.leg.state.nv.us/22ndSpecial/bills/AB/AB3_EN.pdf

2. PSC Regulations:
http://puc.state.nv.us/R_and_I/dkt_05-7050/05-7050.htm.htm

New Jersey

1. Clean Energy Program Web site, N.J. Board of Public Utilities:
http://www.bpu.state.nj.us/cleanEnergy/cleanEnergyProg.shtml

Pennsylvania

1. Public Utility Commission Web site on the AEPS law:
http://www.puc.state.pa.us/electric/electric_alt_energy_port_stnds.aspx

Texas

1. Copies of the law and other information can be found at http://texas.efficiencylink.net/.

2. Texas Senate Bill 7:
http://www.capitol.state.tx.us/cgi-bin/tlo/viewtext.cmd?LEG=76&SESS=R&CHAMBER=S&BILLTYPE=B&BILLSUFFIX=00007&VERSION=5&TYPE=B

3. §25.181. Energy Efficiency Goal:
http://www.puc.state.tx.us/rules/subrules/electric/25.181/25.181.doc

4. Energy Efficiency Implementation Project 25.184:
http://www.puc.state.tx.us/rules/subrules/electric/25.184/25.184ei.cfm

Vermont

1. Efficiency Vermont website (including Annual Reports):
http://www.efficiencyvermont.org/

2. Public Service Board website:
http://www.state.vt.us/psb/

3. Act 61 (SPEED Program):
http://www.leg.state.vt.us/database/status/summary.cfm?Bill=S%2E0052&Session=2006

U.K.

1. Department for Environment Food and Rural Affairs Web page for the Energy Efficiency Commitment:
http://www.defra.gov.uk/environment/energy/eec/index.htm

Italy

1. Presentations on the Italian Energy Efficiency Obligation:
http://www.eceee.org/library_links/downloads/ESD/Bottom-up.3March05.Pavan.pdf
http://www.ewc.polimi.it/pmeet.php

France

1. Industry Ministries Web site on energy-saving certificates (in French):
http://www.industrie.gouv.fr/cgi-bin/industrie/frame23e.pl?bandeau=/energie/developp/econo/be_eco.htm&gauche=/energie/developp/econo/me_eco.htm&droite=/energie/developp/econo/cee-sommaire.htm

2. ADEME website on energy-saving certificates (in French):
http://www.ademe.fr/htdocs/actualite/manifestations/certificats.htm

Belgium

1. Presentation on the Flanders Regional Utility Obligations:
http://www.eceee.org/library_links/esd.lasso#3March

Appendix: Analysis of Savings and Costs of a National EERS

Estimated Savings from and Costs of a National EERS

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Electricity sales per AEO2006 (TWh)	3700	3767	3847	3911	3978	4047	4116	4173	4234	4300	4370	4433	4501	4564	4629
Electricity sales after allowing for prior year EEI	3700	3767	3838	3882	3920	3960	3999	4026	4057	4092	4132	4163	4201	4232	4266
Natural gas sales per AEO2006 (TBtu, R+C+I)	15,193	15,402	15,679	15,912	16,078	16,260	16,416	16,498	16,612	16,793	16,931	17,018	17,104	17,215	17,340
Natural gas sales after allowing for prior year EE	15,193	15,402	15,640	15,833	15,959	16,140	16,295	16,376	16,489	16,669	16,806	16,892	16,978	17,088	17,212
Savings from an EERS															
Annual target (%)	0.0%	0.25%	0.50%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%
Electric savings from current year programs (TWh)		9.4	19.2	29.1	29.4	29.7	30.0	30.2	30.4	30.7	31.0	31.2	31.5	31.7	32.0
Annual elec. savings (including prior year installations)		9.4	28.6	57.7	87.1	116.8	146.8	177.0	207.4	238.1	269.1	300.3	331.8	363.6	386.2
Estimated peak demand savings (MW)		3,028	9,200	18,563	28,018	37,570	47,215	56,927	66,712	76,583	86,549	96,591	106,723	116,931	124,191
Average heat rate Btu/kWh (including T&D los	10,831	10,836	10,803	10,786	10,764	10,668	10,671	10,629	10,588	10,555	10,527	10,507	10,478	10,462	10,424
Gas savings from current year programs (TBtu)		39	78	119	120	121	122	123	124	125	126	127	127	128	129
Annual gas savings (including prior year installations)		39	117	235	355	476	598	721	845	970	1096	1223	1350	1478	1569
Total savings, all fuels (quads)		0.14	0.43	0.86	1.29	1.72	2.17	2.60	3.04	3.48	3.93	4.38	4.83	5.28	5.59
Program costs															
Program costs (billions)															
Electric		0.9	1.9	2.8	2.8	2.9	2.9	2.9	2.9	3.0	3.0	3.0	3.0	3.1	3.1
Gas		0.4	0.8	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Customer investments		2.6	5.2	7.9	8.0	8.1	8.2	8.2	8.3	8.4	8.4	8.5	8.6	8.6	8.7
Total costs		3.8	7.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0
Discounted costs (2005$, 4.5% real discount rate)		3.5	6.9	10.0	9.6	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.2	7.0	6.7
Program benefits and net benefits															
Average end-use electric price (cents/kWh)	8.2	7.8	7.6	7.4	7.3	7.2	7.1	7.2	7.2	7.1	7.1	7.1	7.2	7.3	7.2
Average end-use gas price ($/1000cf, wtd avg F	9.72	9.04	8.71	8.31	8.01	7.79	7.70	7.78	7.68	7.46	7.44	7.49	7.66	7.80	7.80
Program benefits (billions)															
Electric		0.7	2.2	4.3	6.4	8.4	10.5	12.8	14.9	17.0	19.2	21.4	23.8	26.4	28.0
Gas		0.3	1.0	1.9	2.8	3.6	4.5	5.5	6.3	7.0	7.9	8.9	10.0	11.2	11.9
Total		1.1	3.1	6.2	9.1	12.0	15.0	18.2	21.2	24.0	27.1	30.3	33.9	37.6	39.9
Discounted benefits (2005$, 4.5% real disc. rate)		1.0	2.8	5.2	7.3	9.2	11.0	12.8	14.3	15.4	16.7	17.9	19.1	20.3	20.6
Cumulative net benefits		-2.5	-6.6	-11.4	-13.7	-13.8	-11.8	-7.7	-1.7	5.6	14.6	24.9	36.8	50.1	64.0
Benefit/cost ratio	2.6														
Power sector CO_2 emissions (MMT)	2369	2395	2450	2500	2533	2554	2605	2624	2643	2661	2691	2722	2761	2799	2835
Natural gas consumption CO_2 emissions (MMT)	880	891	906	919	927	938	947	953	958	972	982	987	993	998	1005
CO_2 emissions savings from EERS	0.0	8.2	25.0	50.5	75.8	100.8	126.7	151.7	176.4	201.2	226.2	251.3	276.8	302.5	320.3

S. Nadel, ACEEE, 1/11/06