Laying the Foundation for Implementing a Federal Energy Efficiency Resource Standard

Laura A. Furrey, Steven Nadel, and John A. "Skip" Laitner

March 2009

ACEEE Report Number E091

© American Council for an Energy-Efficient Economy
529 14th Street, N.W., Suite 600, Washington, D.C. 20045
(202) 507-4000 phone, (202) 429-2248 fax, http://aceee.org

Contents

Acknowledgments

The authors would like to thank the Energy Foundation for funding this project. Several people provided invaluable comments and support in the completion of this report. Thank you especially to Suzanne Watson, Neal Elliott, Maggie Eldridge, Anna Chittum, Sarah Black Rachel Gold, Michael Sciortino, Therese Langer, and Renee Nida.

Executive Summary

The United States is currently faced with many challenges: finding ways to help Americans save money, decreasing the rate of unemployment, and battling global warming, all in the midst of an economic crisis. Energy efficiency is one of the most effective, short-term and long-term resources that can address all of these issues. The implementation of an Energy Efficiency Resource Standard (EERS) is a proven mechanism proven to encourage productive investments in greater levels of energy efficiency.

Energy efficiency is the cheapest, fastest, and cleanest source of energy. This report highlights the importance of energy efficiency and the various market barriers that have limited the use of energy efficiency, discusses current state actions, and explains how an EERS works to achieve large energy savings. Most importantly, this report summarizes the potential savings that the United States might attain through the adoption of a national EERS as determined by a recent ACEEE analysis and explains the methodology supporting the analysis.

The current proposals for a federal EERS, House of Representatives Bill 889 (H.R. 889), sponsored by Representative Edward Markey (D-MA), and Senate Bill 548 (S. 548), sponsored by Senator Charles Schumer (D-NY), are both known as the Save American Energy Act. These bills call for distribution utilities throughout the country to demonstrate 15% electricity savings and 10% natural gas savings by 2020.

The energy saved through the proposed federal EERS could power almost 48 million households in 2020, accounting for about 36% of the households in the United States. Moreover, this level of energy savings will save Americans almost $170 billion, create over 220,000 jobs and reduce greenhouse gas pollution by 262 million metric tons while eliminating the need to build 390 power plants. These and other impacts are summarized in the table below.

Energy Savings	**2020**	**Equivalent to:**
Annual electricity savings	364 billion kWh	
Estimated peak demand savings	117,000 MW	390 power plants
Annual direct gas savings	794 TBtu	
Program Costs and Benefits (2007$, 4.5% real discount rate)		
Cumulative Benefits	$ 247.1 billion	
Cumulative Costs	$ 78.5 billion	
Total Net Savings	**$ 168.6 billion**	
Macroeconomic Impacts		
CO2 Emissions Savings (MMT)	262	48 million automobiles
Net Jobs Created	222,000	976 manufacturing plants

An EERS focuses on natural gas and electric utilities, encouraging continually increasing energy savings over time. Currently, nineteen states are implementing a state-based EERS. Policy actions at the federal level are necessary to strengthen the continued development and implementation of EERS at the state level and expand this policy to all 50 states.

Introduction

The United States is faced with generally escalating energy prices, an aging transmission system with energy reliability concerns, global warming, and an increasing rate of unemployment, all in the midst of an economic crisis. Addressing these issues will not be simple but energy efficiency is one of the most effective solutions. "Energy efficiency" is a means of using less energy to provide the same (or greater) level of energy services. Energy efficiency is the most abundant, reliable, cleanest, cost-effective, and quickest resource available and should be our "first fuel" in the race for safe, clean, and secure energy resources. Unlike other resources such as renewable energy and coal, significant 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 (Eldridge et al. 2008; Eldridge, Elliott, and Neubauer 2008; Elliott et al. 2007a; Elliot et al. 2007b; Nadel, Shipley, and Elliott 2004; see also Laitner et al. 2009 and Erhardt-Martinez and Laitner 2008). Furthermore, investments in energy efficiency improvements, technologies, and processes generate sustainable jobs that will not require extensive retraining of the currently available workforce.

This report highlights the potential savings that the United States might attain through the adoption of a national Energy Efficiency Resource Standard (EERS). An EERS focuses on natural gas and electric utilities, encouraging continually increasing energy savings over time. Currently, nineteen states are implementing a state-based EERS. Policy actions at the federal level will play a central role in strengthening the continued development and implementation of EERS at the state level. An overview of energy efficiency is provided in addition to a discussion of various market barriers that have hindered the widespread implementation of energy efficiency resources. Following the overview is a description of what an EERS actually is and how it operates. Next is a brief history of state EERS's, providing context for how a federal EERS might complement existing state actions. The methodology and results from the ACEEE analysis of the proposed federal EERS then characterizes the cost-effectiveness and the macroeconomic benefits that are possible through implementation of a full 15% electricity and 10% natural gas efficiency standard.

BACKGROUND

The Cost of Energy

Electricity prices are usually expressed as cents per kilowatt-hour (kWh) on electricity bills, with prices varying by location. For example, in 2007, Idaho had the lowest residential electricity prices, at $0.0635/kWh, while Hawaii had the highest at over $0.24/kWh, with American residents, on average, paying about $0.11/kWh (EIA 2009c). These numbers may sound small, but the average American household uses 11,000 kWh in electricity every year (EIA 2009b), which brings energy costs to almost $1,200 every year ($100 per month). Even a small manufacturing plant with 50 employees may pay $250,000 or more each year for electricity.[1] And our demand for energy continues to grow as our population and our use of electronic appliances and devices increases.

About ninety percent of electricity in the United States is generated by coal, natural gas, and nuclear power (EIA 2009c). If new demand for energy were to be met by new power plants, at a cost between 7.3 cents per kWh and 13.5 cents per kWh (Lazard, Ltd. 2008), energy prices would rise accordingly. And these values do not even take into account the cost of additional infrastructure (i.e., transmission and distribution lines) that will be required to get this electricity to consumers.

There is a cheaper, faster, and cleaner alternative to building new, expensive, and polluting power plants: energy efficiency.

[1] From the *Annual Survey of Manufactures*, electricity use per employee is about 69,000 kWh. At an estimated price of about $0.073/kWh for industrial users (EIA 2009a), that translates to approximately $250,000 (rounded).

Cheaper

At a cost of between 0 and 5 cents per kWh (Lazard, Ltd. 2008), with an average cost of about 3 cents per kWh (Kushler, York, and Witte 2004), energy efficiency measures are a more cost-effective option. From the day they are installed, energy efficiency measures will reduce how much energy is used. Similar to the additional cost of new power plants discussed above, the cost of energy efficiency measures are added to your electricity rate, but, unlike new power plants, because you're using less energy overall, your monthly bills will be lower.

Faster

Energy efficiency is available immediately. New compact fluorescent light (CFL) bulbs or a new air-conditioner can be installed in less than a day and adding new or extra insulation to a home may take about a week. By contrast, in addition to being more expensive, new coal-fired and nuclear power plants take much longer to permit and construct. The Energy Information Administration (EIA) estimates that lead times for these plants are 4–6 years (EIA 2008b). This timeframe most likely does not include the years of delay often associated with construction of such power plants due to community opposition and regulatory uncertainty (Synapse Energy Economics, Inc. 2008).

Cleaner

Energy efficiency measures reduce the amount of energy consumed and, as a result of less energy being consumed, less fossil fuels (such as coal and natural gas) are burned. As we decrease the amount of fossil fuels we burn for energy, we also decrease the harmful pollutants and greenhouse gas emissions that are emitted into our air. Additionally, conventional power plants have the added problem of community opposition—nobody wants a coal-fired power plant, let alone a nuclear power plant, in their backyard. Few people, however, are opposed to saving money and energy.

WHY ISN'T EVERYBODY DOING IT?

Even though energy efficiency is the cheapest, fastest, and cleanest energy resource, there are a variety of reasons why it is not being implemented as widely as it could be.

Split Incentives

The term "split incentives" is often used to describe the situation where decisions about efficiency levels are made by people who will not be paying the electricity bills, such as landlords or developers of commercial office space. When the tenant, for example, is responsible for paying energy bills, there is little or no incentive for the landlord to increase his or her own expense to acquire efficient equipment (e.g., refrigerators, heaters, and light bulbs) because the landlord does not pay operating costs and will not reap the benefits of reducing those costs (Golove and Eto 1996).

Upfront Costs and Financing

When the decisions about energy efficiency are made by those paying the bills, a common problem is lack of upfront capital. Even though a highly efficient refrigerator, for example, or replacing all of the inefficient light bulbs in your home, would save money in reduced energy costs, paying for these measures all at once may be beyond the reach for some consumers. Additionally, borrowing the money is beyond the reach for some consumers, such as low-income individuals and small business owners. These classes of customers are frequently unable to borrow at any price as the result of their economic status or credit-worthiness (Golove and Eto 1996). In the commercial/industrial sector, accounting procedures often carefully review capital costs, favoring the purchase of inexpensive equipment. Long-term operating and maintenance costs, however, are generally less scrutinized (Brown and Chandler

2008). Furthermore, when operating costs are reduced, the savings typically show up in a corporate-level account and are rarely passed on to the department that made the decision and the investment. This diversion of benefits discourages energy-saving investments.

Lack of Awareness

Many customers, in all customer classes, tend to underestimate their energy consumption and, consequently, the associated environmental impacts of operating the equipment. Very often, they are not even aware that different models can consume significantly different amounts of energy and that buying more efficient products can lead to energy and utility bill savings. In the commercial/industrial sector, many purchasing decisions are made by purchasing or maintenance staff who are often unfamiliar with the relative efficiencies and operating costs of the equipment they purchase (Nadel 2006).

Emergency Decisions

Even when the purchaser is aware of variations in energy efficiency, often he or she is too busy or rushed to research the cost-effectiveness of a decision, or information on high-efficiency products is not readily available. This is most often seen in emergency purchases, as the consumer rushes to replace a broken water heater, furnace or refrigerator (Cavanagh 2008).

Limited Stocking of Efficient Products

Equipment distributors generally have limited storage space and tend to only stock equipment that is in high demand. This creates a "Catch-22" situation: when users purchase inefficient equipment distributors only stock inefficient equipment. Purchasing efficient equipment thus may require a special order, taking more time. As stated earlier, most equipment that fails needs to be replaced immediately. Thus, if efficient equipment is not in stock, even customers who want efficient equipment are often stuck purchasing standard equipment (Nadel et al. 2006).

Efficiency Bundled into Premium Products Only

Manufacturers will often produce two versions of the same product line: one commodity-grade and the other value-added. The commodity-grade line is the basic model and, typically, meets the minimum efficiency standards. The value-added line includes improved efficiency and other extra, non-energy features at a significantly higher cost than the basic model. A portion of the extra cost is for the improved efficiency but a majority of the extra cost is for the added "bells and whistles." Consumers desiring improved efficiency without the extra features usually purchase the commodity-grade model to save costs (Nadel et al. 2006).

Manufacturer Price Competition

Since manufacturers are competing to have more of their company's products in the market, if a manufacturer voluntarily increases efficiency in the basic (commodity-grade) product line, they may find it impossible to pass on even small product cost increases to consumers without risking loss of market share. This is because all of the other manufacturers' basic product lines will be available at a lower cost and most customers only look at the initial, upfront cost of the product. In contrast, mandatory standards ensure a level playing field for all manufacturers (Nadel et al. 2006).

Regulatory Barriers

There are also a variety of regulatory barriers that further limit the expanse of energy efficiency products. Utility practices, which vary not only by state but also by individual utility, often employ backup tariffs, which are charges to ensure available power should the customers' system fail, excessive liability insurance, and restrictions on connecting distributed energy sources to the grid. These challenges limit combined heat and power (CHP) installations and distributed generation investments and continue to limit the viability of such projects. (Brown and Chandler 2008; Brooks, Elswick, and Elliott 2006).

MOVING BEYOND THE BARRIERS WITH A FEDERAL STANDARD

At the state level, there has been continual progress in pushing energy efficiency past these well-known market barriers and increasing the amount of energy "acquired" through energy efficiency. This has been done through several policies such as the adoption of appliance standards and building codes and Public Utilities Commissions (PUC) orders for utilities to offer energy efficiency programs for end-use customers. In recent years, one of the most effective and widely used policies has been state-based Energy Efficiency Resource Standards (EERS).

What Is an EERS?

An EERS is a law requiring the use of energy efficiency, usually specifying how much energy needs to be saved per year. An EERS is similar in concept to a renewable electricity standard (RES). An RES requires utilities to obtain a certain amount of energy from renewable resources (wind, solar, biomass, etc.) while an EERS requires electric utilities and natural gas distributors to attain a required level of efficiency savings. The savings are "required" because, at the state level, the state legislature approves the standard which becomes state law once it is signed by the governor. Failure to comply with the law typically results in penalties, generally specified in the legislation. At the federal level, Congress would need to pass the EERS which would then be signed into law by the President.

What Legislation to Establish a Federal EERS Is Currently being Proposed?

Representative Edward Markey (D-MA) is currently sponsoring the Save American Energy Act (H.R. 889)[2] in the House of Representatives while Senator Schumer (D-NY) is currently sponsoring S. 548, also entitled the Save American Energy Act,[3] in the Senate. Both bills call for cumulative 15% electricity and 10% natural gas savings by 2020 (see Table 1).

Table 1. Proposed Federal EERS

	Electricity		Natural Gas	
Year	Annual Savings	Cumulative Savings	Annual Savings	Cumulative Savings
2011	0.33%	0.33%	0.25%	0.25%
2012	0.67%	1.00%	0.50%	0.75%
2013	1.00%	2.00%	0.75%	1.50%
2014	1.25%	3.25%	1.00%	2.50%
2015	1.25%	4.50%	1.00%	3.50%
2016	1.50%	6.00%	1.25%	4.75%
2017	1.50%	7.50%	1.25%	6.00%
2018	2.50%	10.00%	1.25%	7.25%
2019	2.50%	12.50%	1.25%	8.50%
2020	2.50%	15.00%	1.50%	10.00%

How Does an EERS Work?

An EERS typically specifies how much energy the state or utilities need to save, either on an annual basis or on a cumulative basis, or both. Savings targets are usually expressed as a percent of energy sales (the baseline) and slowly increase over time. The most current federal proposals for an EERS state the cumulative energy savings targets and implies the annual incremental values, as illustrated in Table 1. It is useful to express the standard in cumulative terms, 15% electricity savings and 10% natural gas savings by 2020, to

[2] The text of H.R. 889 is available at: http://frwebgate.access.gpo.gov/cgi- bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h889ih.txt.pdf
[3] The text of S. 548 is available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:s548is.txt.pdf

provide an incentive for long-lived and well maintained energy-saving measures. Most efficiency measures installed in early years will continue to save energy throughout the compliance period. Programs to stimulate this level of savings would begin in 2011.

How Are Savings Targets Set?

The proposed savings targets build on various studies that demonstrate significant available cost-effective savings at the state level and on actual savings targets being achieved in states with experience implementing an EERS.

Various analyses conducted by ACEEE suggest that, at the state level, efficiency gains on the order of 20%-30% are achievable by 2025 (ACEEE 2008; Eldridge et al. 2008; Elliott et al. 2007a; Elliot et al. 2007b; Geller et al. 2007; Laitner and Kushler 2007). These studies recommend a broad suite of energy policies and programs, which if implemented, could lead to cost-effective reductions in projected future use of electricity from conventional sources. These recommendations typically include adoption of an EERS, expanded Demand Response[4] initiatives, policies supporting CHP, manufacturing initiatives, state and local government facilities initiatives, more stringent appliance and equipment efficiency standards and building codes, enhanced research, development and deployment strategies, consumer outreach and education, and low-income efficiency programs.

The EERS represents the core of these policies, providing a foundation upon which the other polices may be layered to achieve the greatest savings. Implementing these types of policies and programs could, for example, lead to energy savings of 29% in Florida (Elliott et al. 2007), 22% in Texas (Elliot et al. 2007b; Laitner, Elliott, and Eldridge 2007), 19% in Virginia (ACEEE 2008), and 29% in Maryland (Eldridge et al. 2008). As these reports document, there are plenty of cost-effective energy efficiency and demand response opportunities throughout the states. However, these opportunities will not be realized without changes in policies and programs in each state. The federal EERS will enhance these states' efforts, calling for national policy and program changes.

The federal EERS implies annual savings targets, with utilities achieving 0.33% electricity and 0.25% natural gas savings in the first year of implementation, relative to average energy sales in the preceding two years (the baseline).[5] The federal EERS uses the average energy sales in the preceding two years as a baseline because the prior years' sales are known at the beginning of the target year with certainty. Using the average of two years also works to smooth out yearly variations in sales.

It is useful to set annual savings targets so that utilities have short-term goals and so that progress can be monitored on an annual basis. The initial savings targets start at modest levels, giving utilities in states without an existing EERS the opportunity to develop successful energy efficiency programs. Annual targets are higher at the end of the compliance period because savings from building codes and appliance standards build steadily in the later years. Additionally, targets have been "back-loaded" to make it easier for utilities just starting to implement energy efficiency programs. Most utilities will be able to accrue savings in the early years reducing the new savings needed in the later years.

As experience is gained, reaching the higher savings targets can be realized as utilities eliminate programs that are not performing as anticipated and build upon initial programs that are successfully achieving savings by expanding into additional sectors. Pacific Gas & Electric (PG&E), in California, provides a useful example. Beginning with a few energy efficiency programs in 1976, PG&E has continued to build successful programs, currently providing approximately 90 energy efficiency programs reaching all customer classes. Efficiency Vermont, Vermont's "efficiency utility" also continues to expand

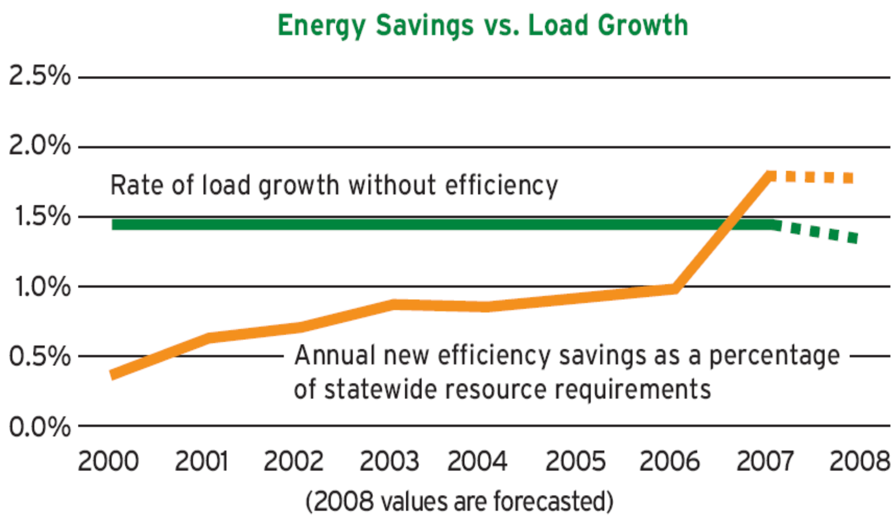
[4] Demand response programs allow the utility to reduce participating customers' energy use during times of peak demand.
[5] Savings earned after enactment of the federal bill will count toward the 2012 reporting goal. ACEEE estimates annual 0.33% electricity and 0.25% natural gas savings in 2010 and annual 0.67% electricity and 0.50% natural gas savings in 2012.

the reach of its programs, recently adding programs in multifamily housing and small new construction to its already extensive list of program areas.[6]

Increasing productivity is another method to boost energy savings. In 2007, Efficiency Vermont improved its productivity by streamlining and simplifying their processes, allowing them to reach more customers and making it easier for their customers to take advantage of savings opportunities. The number of participating businesses (those that replaced equipment or upgraded their processes) continued to grow, with 63 businesses added in 2007, a 10% increase from 2006 (Efficiency Vermont 2008b).

As a result of increased energy efficiency efforts, savings in Vermont have continued to ramp up, as shown in Figure 2. After seven years of putting efficiency programs into practice, in 2007, Vermont's efficiency savings were approximately 1.7% of what electricity sales would have been without efficiency. This was enough to offset electric energy load growth despite an increase in the number of electric customers.[7] Moreover, by the end of 2007, the portion of Vermont's electrical energy needs being met by Efficiency Vermont programs had grown to almost 7%. Preliminary estimates for 2008 energy savings are at about 2 percent. Tellingly, Vermont's savings targets continue to increase, with goals for 2009 to 2011 set at just over 2% per year.

Figure 1: Energy Savings vs. Load Growth



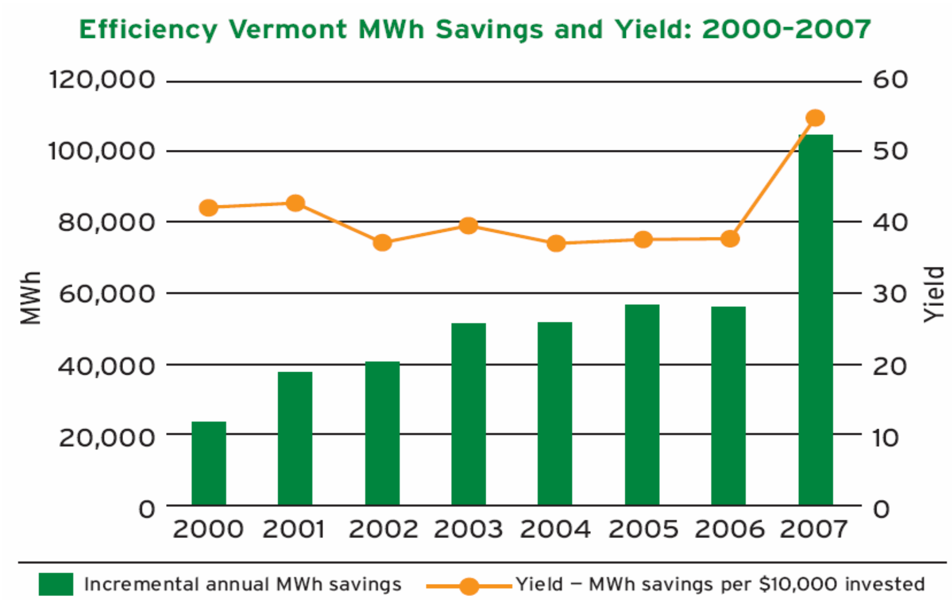
Source: Efficiency Vermont 2008a

Although the "low-hanging fruit" may be reached in earlier years, greater investments in energy efficiency can lead to greater energy savings such that continually meeting higher incremental targets is achievable. For example, Efficiency Vermont achieved approximately 20,000 megawatt-hours (MWh) in energy savings in 2000, the first year of implementation. Energy savings grew steadily over time, reaching 55,000 MWh in 2006. In that year, Efficiency Vermont received an increase in funding from the Vermont Public Service Board. As a result of that increased investment, energy savings jumped from about 55,000 MWh in 2006 to 103,000 MWh saved in 2007, completely offsetting the underlying electric load growth rate in Vermont (see Figure 2, below). Additionally, these later savings generated the most cost-effective returns to date. The yield was 53 MWh saved per $10,000 invested in 2007 compared to a yield of about 40 MWh saved per $10,000 invested in 2006 (Efficiency Vermont 2008).

[6] Programs had previously been established in new homes, existing and new businesses, efficient products, equipment replacement, and low-income markets. Services are also provided to targeted sub-markets such as colleges and universities, municipal waste and water systems, K-12 schools, industrial processes, state buildings, farms, hospitals, and ski areas (Efficiency Vermont 2008b).

[7] The Vermont Department of Public Service estimated that without the savings attributed to Efficiency Vermont, electric supply would have grown at an average rate of 1.4% (Efficiency Vermont 2008).

Figure 2: Efficiency Vermont MWh Savings and Yield: 2000-2007



Source: Efficiency Vermont 2008

The proposed ramp-up in energy savings is, therefore, a valid model to use at the national level as increasing energy savings are achievable at decreasing costs. This is even more true as new, breakthrough energy-efficient technologies make their way to the market and heightened building codes and equipment standards are taken into account. Further information on EERS details and examples can be found in Nadel (2006).

How Are Savings Actually Achieved?

At the state level, the state Public Utilities Commission (PUC) or other designated state authority, which oversees electric utilities and natural gas distributors, crafts rules clarifying how the EERS will be implemented and administered and how savings will be measured. Typically, electric utilities and natural gas distributors file plans with the PUC describing the proposed energy efficiency programs and how such programs are designed to achieve the required savings. At the federal level, the Department of Energy would retain oversight for implementation of the standard. The federal bill leaves administration to states that are willing and able and it is anticipated that most states will choose to do so.

In practice, utilities, and, in some cases, non-utility state programs, implement and administer energy efficiency programs which help consumers reduce energy use. Many energy efficiency programs utilize energy audits, which help identify where energy efficiency measures will have the biggest impact in homes and businesses, and rebates, which can help customers pay for energy efficiency measures. Rebates are usually offered for highly energy-efficient appliances such as air conditioners, water heaters, furnaces, and lighting. Incentives are also available for home retrofits, such as improving home insulation to increase energy savings. Low-interest loans may also be incorporated to help end-users afford high-efficiency appliances and home retrofits. Marketing, education, technical assistance and working with trade allies are also important aspects of end-user efficiency programs. Some utilities also provide incentives to distributors and suppliers for stocking high-efficiency products, negotiate purchase price buy-downs for efficient equipment with suppliers and retailers (Efficiency Vermont 2008)

Sometimes, combined heat and power (CHP) systems and other high-efficiency distributed generation systems savings may be used to meet the savings targets. CHP systems produce power (e.g., electricity) and usable thermal energy (e.g., steam) from a single fuel source to meet energy needs at or near the location of the CHP system. The thermal energy displaces locally produced energy from a separate system (e.g., a boiler) and the power usually displaces electricity delivered by the utility. By combining the two systems and utilizing one fuel source, inherent inefficiencies in power generation and transmission can be substantially reduced, improving the overall fuel conversion efficiency. Savings from CHP systems are credited to the extent energy is saved relative to conventional power generation of power and steam.

Distribution system efficiency improvements can also count toward the savings target goal. Under the federal legislation, possible improvements include improved transformers and voltage controls or new conductors and wires that lower energy losses.

At the state level, savings from state and local building codes and state and federal equipment efficiency standards is generally not included in the state's energy savings targets. Some states with very aggressive savings targets include savings from codes and standards. At the federal level credit is given for savings from state and local building codes and state and federal equipment efficiency standards. ACEEE estimates that, of the total 15% electricity and 10% natural gas savings targets, approximately 5% electricity and 3% natural gas savings can be met through codes and standards by 2020.[8] For an electric utility or a natural gas distributor to claim savings from building codes and equipment efficiency standards, the utility must have played a significant role in achieving the savings. Generally, the more energy efficiency measures eligible for savings, the higher the targets should be.

The federal EERS also encourages, but does not require, electricity and natural gas distributors to consider energy efficiency as a resource in utility planning and procurement activities. It is recommended that electricity and natural gas distributors seek to achieve all energy efficiency that is available at lower cost than other energy supply options. This can often lead to savings that are above the legislated savings targets.

What if a Utility Cannot Achieve the Prescribed Savings?

If a retail electric utility or natural gas distributor cannot achieve the required energy savings, there are various flexibility mechanisms incorporated in the federal EERS. A utility that is unable to meet the standard may enter into a bilateral contract[9] with a nearby over-achieving utility to purchase or transfer savings. A utility may also contract with an energy service company (companies that provide financing and/or installation of energy efficient equipment and processes) or with the state to meet the performance standard. Such transfers may occur in-state or to nearby states in the same power pool[10] with state regulator permission.

At the federal level, under both H.R. 889 and S. 548, a retail electric utility or natural gas distributor also has the option of paying for the savings under the alternative compliance payment provision. If the federal EERS is being implemented by the state, a utility that cannot achieve the prescribed savings targets can pay the state $0.05 per kWh of electricity savings or $5 per million Btu of natural gas savings needed to make up any deficit with regard to the savings target. Any payments received by the state must be used to administer cost-effective energy efficiency programs in an attempt to make up for the lost savings on the part of the utility.

[8] For more information on building codes see Sachs et al. (2004), and for appliance standards see Nadel et al. (2006).

[9] Under a bilateral contract, both parties are obligated to perform their end of the bargain. For example, under a bilateral contract, Utility A might promise to sell a certain quantity of energy savings to Utility B and Utility B might promise to pay Utility A a certain price per unit of energy savings. Utility A must then sell the specified quantity of energy savings to Utility B and Utility B must pay the agreed upon price. Utility B may now claim those savings to comply with the EERS.

[10] The term 'power pool' means an association of two or more interconnected electric systems that is recognized by the Commission as having an agreement to coordinate operations and planning for improved reliability and efficiencies, including a Regional Transmission Organization or an Independent System Operator. *See* H.R. 889 Sec. 610(b)(12) and S. 548 Sec. 610(a)(15).

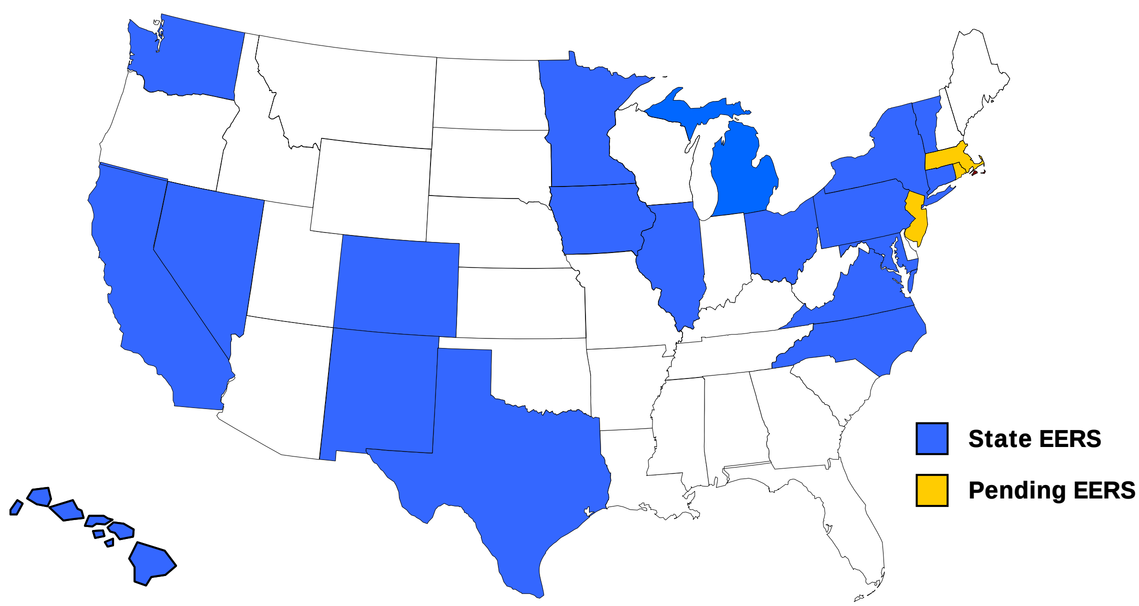
A penalty may be assessed against a retail electric utility or a natural gas distributor that fails to either achieve the specified savings target or make an alternative compliance payment. The proposed federal penalties are set at $0.10 per kWh of electricity savings shortfall and $10 per million Btu of missing natural gas savings. Penalties are higher than alternative compliance payments to encourage utilities to proactively use energy efficiency programs or the alternative compliance payment and minimize penalty situations. Penalty funds are deposited into the U.S. Treasury.

Although these options exist, it is unlikely that any state will be unable to achieve the federal savings targets if efficiency programs are actively pursued. In addition to the savings potentials discussed in "*How are savings target set?*," successful programs in many states have proven that these levels of savings are achievable throughout the United States.

STATES LEADING BY EXAMPLE

The federal proposal builds on policies currently in place in the 19 states shown in Figure 3, with several others actively considering similar policies.

Figure 3: State EERS Activity (as of March 2009)



Texas became the first state to establish an EERS in 1999, requiring electric utilities to offset 10% of load growth through end-use energy efficiency. After several years of meeting this goal at low costs, in 2007 the legislature increased the standard to 15% of load growth by 2009, 20% of load growth by 2010. A recent report commissioned by the Public Utilities Commission of Texas found that raising the goal to 50% of load growth is feasible.

As of 2000, Efficiency **Vermont**, an independent "efficiency utility" that delivers efficiency programs for the state, is contractually required to achieve energy and demand goals. Efficiency Vermont cumulatively met over 7% of Vermont's electricity requirements by the end of 2007 with 2007 programs alone met 1.7% of the state's electricity needs. The state's goals were recently updated to 2.0% per year through 2011.

In 2004, **California** set energy savings goals for investor-owned utilities for 2004 through 2013, which were expected to save more than 1% of total forecast electricity sales per year. In the early years, savings were less than 1% per year, but in 2007, measures installed that year met more than 1.5% of the state's electricity needs. In July 2008, the California PUC established new targets for energy savings for the years 2012 through 2020 for its regulated utilities. The new goals are expected to provide approximately 5% energy savings over that period.

Under **Hawaii's** Renewable Portfolio Standard (RPS) requirements, established in 2004, energy efficiency is allowed to qualify as an eligible resource. Utilities must meet 20% of electricity sales with eligible resources by 2020; however, energy efficiency minimums or maximums are not specified. In recent years, Hawaii has been achieving between 0.4–0.6% energy savings per year through energy efficiency.

Energy efficiency is an eligible resource in Tier II of **Pennsylvania**'**s** Alternative Energy Portfolio standard, which was established in 2004 as a two-tiered renewable energy standard; however, there was no minimum efficiency target. In 2008, legislation was passed requiring electric distribution companies to meet 1% electricity savings in 2011 and a total of 3% by 2013, as a percent of 2009-2010 electricity sales.

In June 2005, the **Connecticut** legislature modified its RPS to include efficiency. Starting in 2007, the state's utilities must procure a minimum 1% of electricity sales from "Class III" resources such as energy efficiency and CHP, with an additional 1% required in 2008, 2009, and 2010. In 2007, the Connecticut legislature added a requirement for utilities to acquire "all cost-effective efficiency." In response, the state's utilities filed a plan with savings averaging about 1.5% per year over the 2009-2018 period.

Nevada's RPS, originally enacted in 2001, was expanded in 2005 from 15% to 20% of electricity sales, and was amended to allow energy efficiency to meet up to 25% of the total portfolio standard. The state's utilities are quickly ramping up efficiency programs to hit the maximum allowed efficiency threshold. Energy efficiency measures installed in 2006 accounted for 0.6% of sales.

In **Washington,** a 2006 ballot initiative (I-937) was approved by the state's voters, requiring utilities to acquire all cost-effective energy efficiency. The Northwest Power and Conservation Plan is the foundation for setting efficiency targets. The most recent NWPPC plan identifies 2700 average MW of conservation savings as being cost-effective and achievable by 2025, amounting to 10.6% of projected needs in that year if additional conservation is not pursued. By 2010, each qualifying utility shall identify its achievable cost-effective energy efficiency potential through 2019. In 2006, energy efficiency measures installed that year accounted for almost 0.75% of electricity sales.

In April 2007, the **Colorado** legislature adopted a bill that called on the Colorado Public Utilities Commission (CPUC) to establish energy savings goals and provide financial incentives for utilities. In June 2008, the CPUC established an energy savings goal of about 11.5% by 2020 for Public Service Company's DSM programs, which amounts to about 1% annually.

In December 2006, **Minnesota's** Governor Pawlenty announced his Next Generation Energy Initiative, calling for 1.5% annual energy savings of electric and natural gas sales, at least 1% of which must come from energy efficiency programs operated by the utilities (savings from codes and standards and other actions can help close the gap). This plan was enacted in legislation in 2007 and requires utilities to meet the annual targets by 2010.

Governor Kaine, in **Virginia**, inserted an enactment clause into the March 2007 electricity restructuring legislation stating that the Commonwealth shall have a goal of reducing electricity consumption by 10% (of 2006 consumption) by 2022. The State Corporation Commission conducted a proceeding to evaluate the stated goal and found the goal was achievable. Presently, utilities are preparing plans to meet the goal.

In July 2007, the **Illinois** legislature set energy efficiency and demand response program requirements for utilities. With help from the Illinois Department of Commerce and Economic Opportunity (IDCEO), utilities are to meet annual savings goals of 0.2% of energy delivered in 2008, 0.4% in 2009, and so on, rising to 2.0% annually for 2015 and subsequent years. Program implementation began in 2008. For all of these programs, however, there is a rate impact cap of 0.5% of overall rates in any one year, and 2.0% of overall rates in total (i.e., relative to base rates, rates could increase 0.5% in the first year, 1.0% in the second year, etc. up to a maximum of 2.0%). If the rate impact cap is reached, the energy savings goals will be relaxed to the maximum savings that can be achieved within the rate impact cap.

In August 2007, the **North Carolina** legislature enacted a law requiring public electric utilities in the state to obtain renewable energy power and energy efficiency savings of 3% of prior-year electricity sales in 2012, 6% in 2015, 10% in 2018, and 12.5% in 2021 and thereafter. Energy efficiency is capped at 25% of the 2012-2018 targets, and at 40% of the 2021 target.

In June 2008, the **New York** State Public Service Commission approved the Energy Efficiency Portfolio Standard (EEPS), which sets a goal to reduce electricity usage 15% by 2015, a goal initially announced by Governor Spitzer in 2007. The Commission currently has an open proceeding working with utilities and the New York State Energy Research and Development Authority (NYSERDA) to expand existing programs and develop new ones. Some programs have been approved and while others are still pending.

In February, Governor Richardson signed **New Mexico** House Bill 305 into law, which requires electric and gas utilities to acquire all cost-effective and achievable energy efficiency resources. Electric utilities must achieve 5% energy savings from 2005 electricity sales by 2014 and 10% savings by 2020.

In 2008, legislation was enacted in **Maryland** that requires the state's electric utilities to reduce per-capita electricity consumption 15% by 2015, relative to 2007 per capita consumption. Utilities must meet two-thirds of the goal and the state must administer programs to reach the remaining one-third of the goal. Initial utility programs were approved in late 2008.

Also in 2008, legislation was passed in **Ohio** that requires a gradual ramp-up to a 22% reduction in electricity use by 2025. Starting in 2009, electric distribution utilities must achieve 0.3% savings, which ramps up to 1% per year by 2014, then jumps to 2% per year in 2019 through 2025.

In October 2008, Governor Granholm signed legislation passed by the **Michigan** legislature that sets mandatory energy savings goals for the state's electric and gas utilities. The goals start at 0.3% of electricity sales in 2009 and ramp up to an annual electricity savings requirement of 1% of total sales by 2012, and continue at that level each year thereafter. Savings targets for natural gas are set at 0.75% per year.

In a report to the **Iowa** General Assembly in January 2009, the Iowa Utility Board estimated that savings from the three investor-owned utilities in Iowa (including Interstate Power and Light Company and Black Hills Corporation (formerly Aquila) would reach 1.4% of retail electric sales and 1.0% of natural gas sales by 2013. Most recently, in March 2009, the IUB approved MidAmerican Energy Company's Energy Efficiency Plan which calls for 1.5% electricity savings by 2010 and 0.85% natural gas savings by 2013.

Several other states, including **Massachusetts**, **New Jersey**, and **Rhode Island** are now actively considering similar policies. In Massachusetts and Rhode Island, recent laws have required utilities to acquire "all cost-effective efficiency resources;" regulators are using this framework to set annual energy savings targets which are anticipated to reach almost 20% energy savings by 2020. The Board of Public Utilities in New Jersey is authorized to adopt an electric and a gas energy efficiency portfolio standard, with goals as high as 20% savings by 2020 relative to predicted consumption in 2020. Actual goals are still under development.

Success in the States

California, Connecticut, Hawaii, Nevada, Texas and Vermont have had the most experience with implementation of an EERS and, as such, are considered some of the most successful states in operating energy efficiency programs. All of these states have consistently increased their annual energy savings goals over time and have been achieving or are on track to achieving their stated energy savings goals.

In Nevada, for example, the Sierra Pacific Power and Nevada Power Companies offer the "Sure Bet Program" to commercial business, industrial and institutional customers. The Sure Bet Program is an incentive program designed to facilitate the implementation of cost effective energy efficiency improvements in businesses. Technical services are also made available to customers, providing help in assessing energy saving opportunities for customers that are committed to installing electric energy efficiency equipment (NVEnergy 2009). All of Texas' larger investor-owned utilities utilize standard offer programs to provide incentives to energy service companies to offset a portion of the upfront cost associated with energy efficiency measures. Additionally, many of the utilities operate programs to train and educate air conditioning installers and building owners and managers on building operations. There are also programs which encourage the sale of higher-efficiency equipment (Texas Energy Efficiency 2009). These states have employed combinations of a variety of energy efficiency programs to achieve their success. Reaching continually increasing energy savings targets requires more than simply providing customers with incentives and rebates, as these states have shown. Outreach, training and education, customized programs, and increasing access to all customer classes have helped California, Connecticut, Hawaii, Nevada, Texas, and Vermont become the leaders in EERS implementation at the state level.

The nineteen states that are implementing an EERS are positioned to achieve a little over 5% electricity savings by 2020. These states are, therefore, on track to achieve about one-third of the national goal of 15% electricity savings by 2020. Similar action in the remaining thirty-one states and the District of Columbia is necessary to reduce our electricity demand by the remaining 10% to reach the full 15% by 2020. Enacting an EERS at the state level in these non-participating states may not be a realistic possibility.[11] Federal action is therefore needed to bring these states up to the standard being met by the nineteen states actively pursuing a state EERS. Additionally, many states are lacking a natural gas component in their EERS. This provision in the federal proposal is needed to encourage more widespread natural gas savings. Based on ACEEE analyses done to date, the realization of 15% electricity and 10% natural gas savings is shown to be on of the most beneficial mechanisms for creating new jobs and achieving significant energy savings at the national level.

Why Should the States Who Are Already Leading the Way on this Issue Be Involved in a National Policy?

In some of the states that currently have an EERS, little to no direct electricity savings would be realized under the federal proposals. This is because the state EERS calls for greater energy savings than the federal 15% electricity savings target. Nearly all of these states do, however, stand to achieve increased natural gas savings as a result of the federal EERS. These states further benefit because the federal EERS will promote savings in nearby states, helping to reduce demand and energy prices throughout the region. On a regional basis, a federal EERS stands to reduce energy bills, increase jobs, and reduce carbon emissions far beyond what any individual state can achieve on its own. Furthermore, even in states with an EERS, businesses will benefit from a federal EERS, through increased business for energy-saving equipment and services as companies in one state provide efficient goods and services in neighboring states.

Will a Federal Policy Potentially Weaken State Efforts?

Under the current federal proposal, any state may apply to the Secretary of the Department of Energy to administer the EERS at the state level. The state must implement energy efficiency programs that either meet or exceed the savings targets that are proposed at the federal level. For states that currently have an EERS that is on target to reach 15% electricity savings by 2020, the federal policy should not weaken those efforts. The federal policy will strengthen implementation of natural gas savings programs in EERS states, as most do not have natural gas savings targets. As part of the process, there will be a periodic

[11] Some utilities in states with an EERS have supported an EERS that they consider reasonable, in states without an EERS there is often utility opposition. This utility opposition, combined with more general opposition to government mandates of any sort reduce the likelihood of a state EERS in many states that currently do not have an EERS.

review of state implementation, with each state being reviewed at least every four years. This review is important to ensure that the federal requirements are being achieved.

ANALYSIS OF A 15% ELECTRICITY SAVINGS AND 10% NATURAL GAS SAVINGS STANDARD

ACEEE has developed a spreadsheet model to estimate the resulting electricity and natural gas savings, peak demand savings, avoided carbon dioxide emissions, and job creation from the implementation of the proposed 15% electricity and 10% natural gas federal EERS.

Methodology

Electricity & Natural Gas Savings

Electricity savings are calculated on an annual basis. The starting point is the electricity sales forecast reported in AEO 2009 (EIA 2009).[12] These sales are then reduced to "applicable electricity sales" because the EERS only applies to those utilities with sales greater than 750 million kWh per year.[13] The savings from the prior year, as a result of the EERS, are then subtracted from the given year's applicable electricity sales. This value is then multiplied by that same year's annual incremental energy efficiency target, the federal standard (see Table 1) minus any basecase efficiency being attained at the state level for that given year,[14] to determine electricity savings in the given year.[15]

Natural gas savings are estimated similarly to electricity savings, taking into account applicable sales (greater than 2.5 billion cubic feet annually),[16] the prior year's natural gas savings as a result of the EERS, and basecase efficiency. Basecase efficiency data is not as readily available for natural gas as it is for electricity and as such, the "basecase" natural gas efficiency is estimated to be 0.15% per year (CEE 2008).

Peak demand is the amount of capacity needed during periods in which electricity is consumed for a short time frame, an hour, for example, at a significantly higher than average rate. Peak demand variations occur on daily, monthly, seasonal and yearly cycles. Peak demand reductions are calculated by multiplying a kW/kWh conversion factor by electricity savings (EIA 1999). The ACEEE model also accounts for estimated transmission and distribution losses and includes a 10% reserve margin.

Costs & Savings

In determining program costs, it is assumed that the energy efficiency measures come at a levelized[17] cost of 3 cents per kWh for electricity measures (Kushler, York, and Witte 2004) and 30 cents per therm for natural gas measures (Elliott et al. 2003); that measures have a 13 year average life (Eto et al. 1995); and that the utility pays one-third of the program costs and the customer pays two-thirds of the cost as an investment in the efficiency measure. This last assumption, based on various utility programs, estimates that the utility provides an incentive of approximately one-third of the total cost of the efficiency measure

---

[12] *Annual Energy Outlook 2009* (EIA 2009a) is used as a reference for national electricity and natural gas values. *Annual Electric Utility Data* (EIA 2007) and the *Natural Gas Navigator* (EIA 2008a) are used as references for individual state values. All information is provided by the Energy Information Administration and is publicly available at www.eia.doe.gov.

[13] Applicable sales account for approximately 89% of all electricity sales (EIA 2007).

[14] See Appendix B.

[15] Note that this analysis differs slightly from the EERS detailed in H.R. 889 and S. 548 as electricity sales for the preceding 2-year period are not averaged in determining annual incremental electricity savings.

[16] Applicable natural gas sales account for almost 98% of total natural gas sales (EIA 2004).

[17] Like the mortgage on a house, "levelized" cost is the payment necessary each year to recover the total investment and annual interest payment at a specified interest rate over the life of the measure. For example, it may require $0.29 per kWh to install an efficiency measure. If we assume payment over 13 years at 4.5 percent interest rate, the levelized cost would be about $0.03/kWh.

while the customer pays the remaining two-thirds. The upfront cost of savings (which is approximately $0.29/kWh or $2.90/therm) is multiplied by annual energy savings to get a dollar figure, which is then amortized over 5 years at a 4.5% real annual interest rate.

To generate a consistent estimate of net benefits that includes the time value of money, the annual flow of program costs and investments are compared to the benefits as they are discounted over time. Discounting, which attempts to value future costs, is often used in cost-benefit analyses to compare values over time. The value of one dollar in 2009 will not be worth one dollar ten or twenty years from now.[18] Discounting accounts for this change so that our values better reflect future costs and benefits from today's financial perspective.[19]

Benefits (primarily energy bill savings) are calculated similarly. The annual energy savings are multiplied by the annual price of energy as reported in *Annual Energy Outlook 2009* (EIA 2009a) to determine how much money is saved as a result of the EERS. A 4.5% annual real discount rate is also applied to the benefits.

Avoided Carbon Dioxide Emissions

This analysis also estimates the amount of carbon dioxide emissions that will be reduced as a result of 15% electricity and 10% natural gas savings by 2020. This value is calculated by multiplying the amount of saved electricity, in kWh, and natural gas, in therms, by the carbon dioxide emissions per kWh and per therm, respectively. These carbon dioxide emissions values are derived from *Annual Energy Outlook 2009* as well (EIA 2009a).

Jobs

Based on 2007 economic accounts for the U.S., electric and natural gas utilities support approximately 7 direct and indirect jobs per million dollars of revenue. All other sectors of the economy support about 17 direct and indirect jobs per million dollars of revenue.[20] Subsequently, as a result of energy savings, every $1 million in lost revenue in the electric and natural gas industry supports, on average, 7 fewer jobs in the economy. But if businesses and consumers have a savings of $1 million, an average of 17 jobs is gained. In this case the economy is better off by 10 net jobs on the positive side of the ledger.

ACEEE utilized a DEEPER modeling framework[21] to match both the positive and negative changes in revenues to the appropriate sector multipliers to determine the net job impacts of an EERS. These multipliers are modified over time to reflect changes in labor productivity as reported by the *Annual Energy Outlook 2009* reference case. The most current version of the *Annual Energy Outlook* suggests that labor productivity will increase by about 1.9 percent per year over the 2010-2020 time frame (EIA 2009a). This means that $1 million in spending in 2030 will support only 64 percent of the jobs yielded in the base year of the model. In the example above, a net gain of 10 jobs in 2006 might be only 7 jobs by 2030.

Results

Standard units of energy consumption or production (e.g., kWh, kW, therms, or Btu) are, most often, not meaningful measures for most people when relating the value of energy savings. More useful examples are monetary savings, avoided power plants, and vehicles removed from the roadways. Converting energy savings into these more understandable elements simply requires statistics that are readily available from public and non-profit agencies specializing in the gathering and analysis of energy data.

[18] A dollar in 2020, at a 4.5% discount rate would be worth $0.62 today, in 2009 ($1/(1.045^{(2020\text{-}2009)}) = \$0.62$).

[19] This analysis is conducted in "real" terms meaning that all analyses are done in 2007 dollars meaning energy prices nor the discount rate reflect inflation to get to nominal dollars in years beyond 2007.

[20] Values created in IMPLAN job creation software available at http://www.implan.com.

[21] DEEPER is the **D**ynamic **E**nergy **E**fficiency **P**olicy **E**valuation **R**outine, a quasi-dynamic input-output model used for many of the state and national policy assessments undertaken by ACEEE.

These include the United States Energy Information Administration (EIA) or the International Energy Agency (IEA).

The federal EERS proposes to achieve a total of 15% electricity and 10% natural gas savings between 2011 and 2020. At this point, the current and anticipated state EERS actions are on track to encourage a 1.5% savings on natural gas and 5.10% on electricity savings for that same period. The full analysis is included as Appendix A to this report. Results are summarized in Table 2.

Table 2. 15% Electricity and 10% Natural Gas Energy Savings Potential by 2020

Energy Savings	**By 2020**	**Equivalent to:**
Annual electricity savings	364 billion kWh	
Estimated peak demand savings	117,091 MW	390 power plants
Annual direct gas savings	794 TBtu	
Program Costs and Benefits (2007$, 4.5% real discount rate)	**By 2020**	
Cumulative Benefits	$ 247.1 Billion	
Cumulative Costs	$ 78.5 Billion	
Total Net Savings	**$ 168.6 Billion**	
Macroeconomic Impacts	**By 2020**	
CO_2 Emissions Savings (MMT)	262	48 million automobiles
Net Jobs Created	222,000	976 manufacturing plants[22]

If the federal standard were to achieve the full 15% electricity savings and 10% natural gas savings, including any basecase energy efficiency, electricity savings would total 497 billion kWh while natural gas savings would reach 924 trillion Btu by 2020. Peak demand would be reduced by 159,800 MW—the equivalent of avoiding 532 power plants, 300 MW each. This level of energy savings would save American consumers $228.1 billion (net) and create 310,500 net jobs. Additionally, 348 million metric tons of carbon dioxide emissions would be avoided—the equivalent of removing almost 64million vehicles from the road in 2020. Below we provide results in more detail that *exclude* basecase energy efficiency savings.

Electricity and Natural Gas Savings

A national EERS at these levels would produce electricity savings of 364 billion kWh and natural gas savings of 794 trillion Btu. This level of savings would offset currently projected electricity and natural gas load growth over the 2011–2020 period (EIA 2009). One metric often used to relate this value is by expressing the number of households that could be powered by the energy saved. The energy saved through the proposed federal EERS could power over 48 million households in 2020, accounting for about 36% of the households in the United States.[23] Alternatively, this is more than enough energy to provide power to California and all of New England[24] for that year.[25]

One of the more compelling illustrations of an energy efficiency analysis is the number of power plants that can be avoided by achieving energy savings. This estimate utilizes peak demand savings to determine the number of power plants avoided. Power plants are needed to meet peak demand, and as such, peak demand is used as a prime rationale for constructing new power plants. To find the number of power plants prevented, the value of peak demand savings is divided by the capacity of an average,

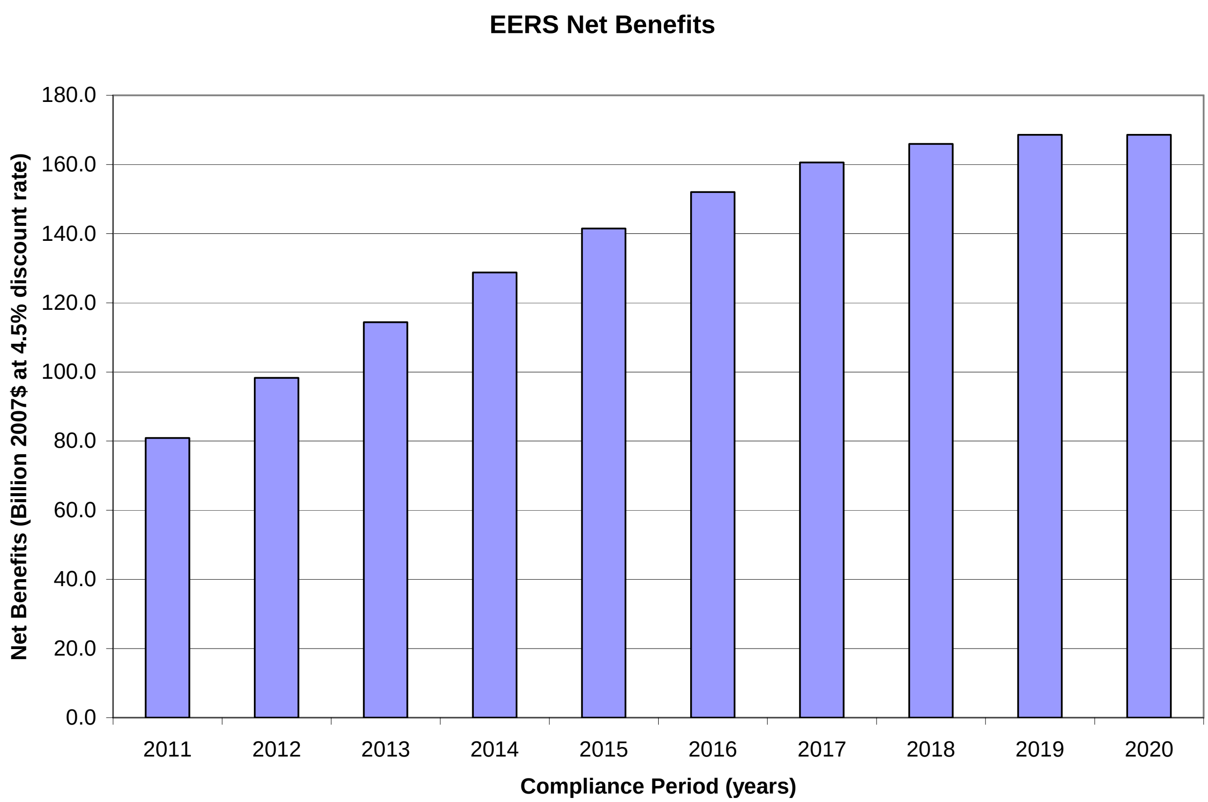
[22] Assumes 50 jobs in a small manufacturing plant; from IMPLAN 2007, the multiplier is 4.91or 246 total jobs supported by the manufacturing plant.
[23] Based on EIA 2005 Residential Energy Consumption Survey national annual average energy consumption per household of 95 million Btu.
[24] The New England region includes the states of Maine, New Hampshire, Vermont, Rhode Island, Connecticut and the Commonwealth of Massachusetts.
[25] Based on 2007 electricity sales in those states (EIA 2009d).

medium sized power plant—300 MW. It is estimated that peak demand will be reduced by approximately 117,000 MW by implementing the proposed federal EERS. This is roughly the equivalent of 390 power plants that will not be built.

Costs and Savings

By 2020, under the proposed federal EERS, customers will have invested approximately $78.5 billion in energy efficiency measures. This level of investment will yield almost $170 billion in net benefits as a result of energy efficiency measures installed in 2020.[26] "Net benefits" are the total savings gained from energy efficiency measures minus the program costs and investments associated with the measures. These benefits average about $1,280 in savings per household from efficiency measures installed by 2020.[27]

Figure 4: Net Benefits Resulting from 15% Electricity and 10% Natural Gas Savings by 2020



Jobs

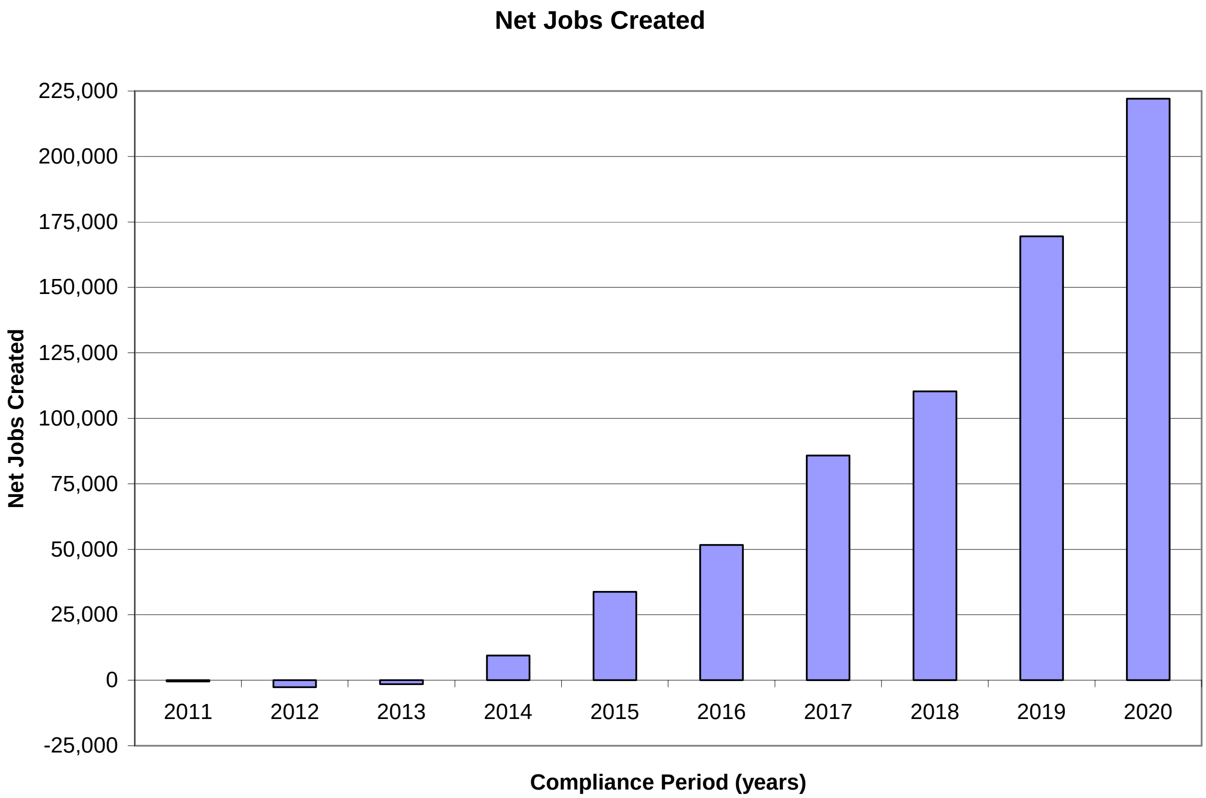
A major advantage to implementation of an EERS is increased employment. At the national level, ACEEE estimates that 222,100 net jobs will be created by 2020 as a result of the proposed EERS. Although jobs will be lost in the electricity and natural gas sectors as a result of such savings, the energy savings attributable to the federal EERS provides a net increase in jobs in various other sectors such as construction and manufacturing. The loss of jobs is most evident in the early years of implementation as investments in energy efficiency measures are being made but savings have not yet started to accrue.

[26] Energy efficiency measures installed as of 2020 will continue to save energy, accruing benefits without the cost, for the life of those measures, which we estimated at 13 years. The benefits are expressed taking these savings into account.

[27] Estimating approximately 132 million U.S. households in 2020, derived from information provided at www.census.gov.

However, as greater energy savings are realized, the number of jobs increases proportionally, as illustrated in Figure 5.

Figure 5: Net Jobs Resulting from 15% Electricity and 10% Natural Gas Savings by 2020

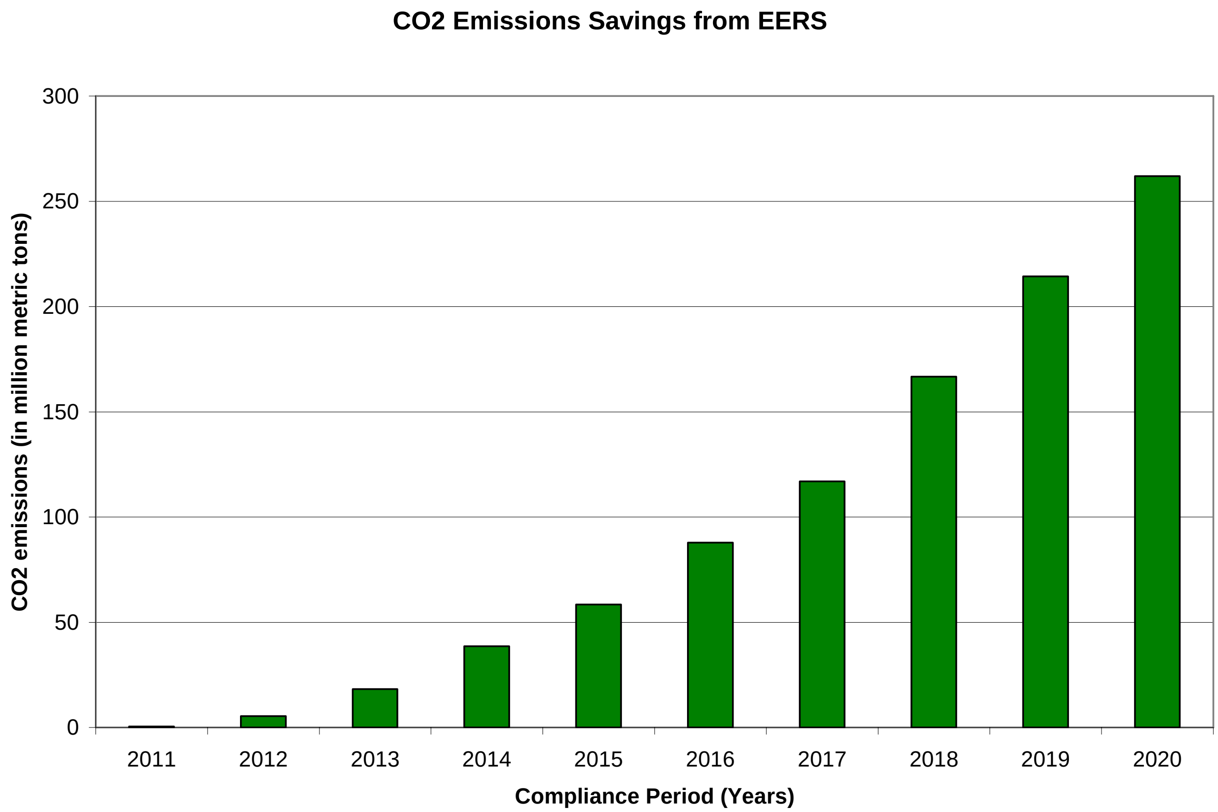


Avoided Carbon Dioxide Emissions

Another important metric is the amount of carbon dioxide emissions that have been prevented by energy savings. In 2020, carbon dioxide emissions will be reduced by 262 MMT—the equivalent of taking almost 48 million automobiles off the road for that year.[28] This is a substantial benefit that can positively impact global climate change.

[28] It is estimated that an average 12,000 vehicle miles are traveled per year, that average vehicle fuel economy is 20 miles per gallon, and that 20 lbs of carbon dioxide are emitted per gallon of fuel in the U.S. There are 2,204.6 pounds per metric ton. With these assumptions each car emits about 5.44 metric tons of carbon dioxide equivalent.

Figure 6: Avoided Carbon Dioxide Emissions Resulting from 15% Electricity and 10% Natural Gas Savings by 2020



State by State Analysis

These federal energy savings values can also be broken down and illustrated on a state by state basis. ACEEE estimates that approximate levels of savings could be realized as shown in Table 3.[29]

[29] These values differ slightly from the values in the main analysis because state-level and national-level data come from different sources. Overall differences in the numbers are generally small.

Table 3: State Benefits from a Federal EERS

State	Annual electricity savings (GWh)	Estimated Peak Demand Savings (MWh)	Annual Direct Gas Savings (TBtu)†	Equivalent Number of Households††	Net Energy Savings (Million 2006$)	Net Jobs Created	CO_2 Emission Savings (MMT)
Alabama	12,440	4,001	5.81	1,426,166	$3,641	5,202	9.8
Alaska	565	182	3.35	97,260	$412	552	0.5
Arizona	10,431	3,355	6.34	1,211,309	$3,567	5,148	6.0
Arkansas	6,425	2,066	7.34	782,220	$1,779	2,572	4.2
California*	23,729	7,631	83.92	3,487,030	$12,051	20,808	16.0
Colorado*	4,509	1,450	18.96	694,378	$1,490	2,338	4.3
Connecticut**	0	0	7.19	75,653	$400	509	0.4
Delaware	1,556	500	1.97	191,493	$880	1,178	1.3
District of Columbia	1,818	585	2.88	229,806	$1,132	1,505	1.6
Florida	33,553	10,791	5.76	3,742,348	$14,007	19,754	20.6
Georgia	18,972	6,102	15.52	2,245,134	$6,326	8,894	15.2
Hawaii*	980	315	0.00	107,505	$645	1,308	0.7
Idaho	1,889	608	3.76	246,877	$324	485	1.3
Illinois*	9,661	3,107	58.16	1,672,275	$3,642	6,648	12.3
Indiana	13,702	4,407	22.97	1,745,181	$3,637	5,350	13.6
Iowa*	2,307	742	11.72	376,514	$690	1,078	2.9
Kansas	5,148	1,656	10.34	673,810	$1,609	2,302	5.6
Kentucky	11,205	3,604	8.30	1,316,931	$2,090	3,259	10.6
Louisiana	11,713	3,767	20.85	1,504,742	$4,314	6,034	8.1
Maine	929	299	0.50	107,186	$395	740	0.6
Maryland*	1,598	514	13.87	321,257	$1,495	810	2.0
Massachusetts**	0	0	15.66	164,855	$971	1,230	0.8
Michigan*	5,641	1,814	44.89	1,091,476	$2,303	4,196	6.6
Minnesota*	0	0	21.10	222,114	$755	988	1.1
Mississippi	5,854	1,883	4.96	694,523	$1,935	2,731	4.1
Missouri	10,223	3,288	15.26	1,282,303	$2,828	4,121	10.7
Montana	1,088	350	3.29	154,011	$342	533	0.8
Nebraska	2,706	870	6.74	367,854	$745	1,097	3.0
Nevada*	3,710	1,193	6.05	470,753	$1,482	2,391	2.5
New Hampshire	746	240	1.53	97,987	$378	715	0.5
New Jersey**	9,943	3,198	35.89	1,468,786	$7,181	10,256	9.8
New Mexico*	1,068	344	4.64	166,025	$438	533	0.8
New York*	3,175	1,021	61.35	994,189	$3,774	4,813	5.4
North Carolina*	13,840	4,451	10.31	1,627,183	$3,017	6,426	11.5
North Dakota	1,079	347	1.97	139,101	$270	402	1.1
Ohio*	5,629	1,810	43.89	1,079,599	$2,857	5,111	7.4
Oklahoma	6,535	2,102	11.31	836,119	$2,130	3,025	4.7
Oregon	3,295	1,060	7.91	444,744	$799	1406	2.4
Pennsylvania*	19,059	6,129	36.08	2,471,039	$8,464	11,319	17.1
Rhode Island**	0	0	2.64	27,761	$165	209	0.1
South Carolina	11,662	3,751	4.68	1,328,925	$3,102	4,495	9.5
South Dakota	719	231	2.34	103,485	$242	347	0.8
Tennessee	13,026	4,189	8.61	1,519,999	$3,505	5,104	12.3
Texas*	36,669	11,793	55.96	4,612,538	$14,559	22,791	21.6
Utah	2,615	841	8.88	380,343	$683	1,060	2.0
Vermont*	0	0	0.56	5,947	$30	38	0.0
Virginia*	8,473	2,725	14.31	1,080,348	$2,342	3,744	7.5
Washington*	6,249	2,010	13.57	828,531	$1,406	2,341	4.5
West Virginia	5,132	1,651	4.34	608,890	$922	1,447	4.9
Wisconsin	6,269	2,016	20.71	905,886	$2,392	3,721	6.7
Wyoming	2,056	661	2.01	246,763	$342	544	1.5

* States with an EERS (See Appendix B).
** States with a pending EERS (See Appendix B).
† State natural gas savings targets not considered.
†† This value is derived by dividing the total energy savings (for residential, commercial, and industrial customers) in a state by the energy use of an average U.S. household. This value is provided as an illustrative example of the total quantity of energy savings and is not a true reflection of where energy savings will be achieved.

How Long Would It Take for an Average Consumer to See a Return on their Investment in Energy-Efficient Measures?

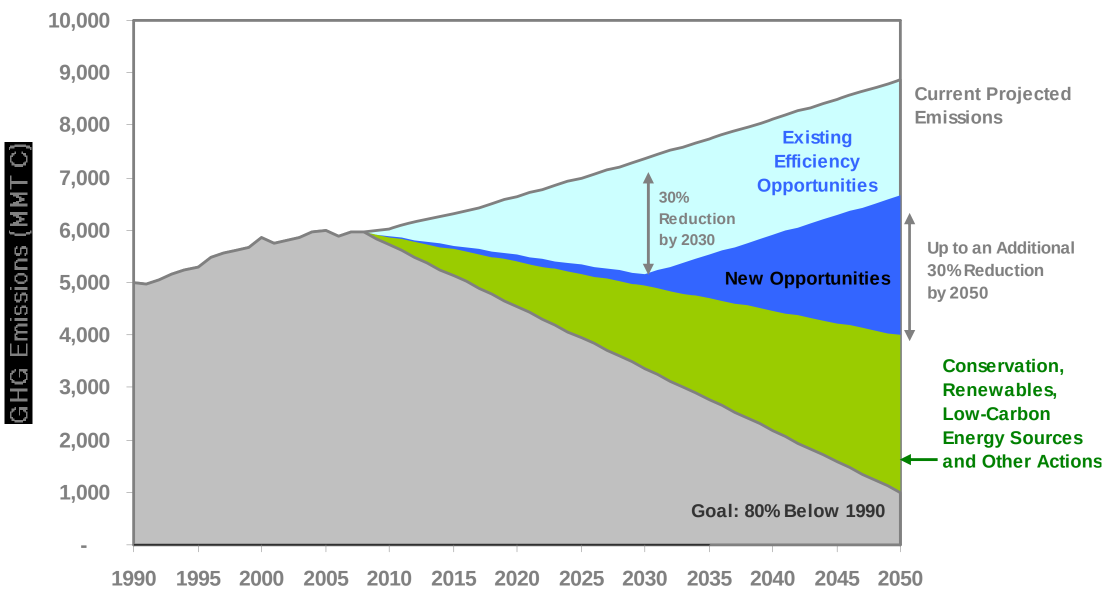
Energy efficiency measures have varying rates of return depending on the type of measure (lighting, insulation, etc.), the type of customer (residential, business, industrial, institutional, etc.), geographic location, and customer usage. The rate of return will, therefore, be different for every residence or business, for example, based on these, and other, factors. On average though, electric and natural gas energy efficiency measures have a payback period of about 4 years based on the data used and cited in our analysis.

ENERGY EFFICIENCY AND THE ENVIRONMENT

How Does Energy Efficiency Fit into a Comprehensive Energy Solution?

While an EERS, and other energy efficiency policies and programs, can provide significant energy savings, additional resources are necessary if greenhouse gas emissions are to be reduced to the levels proposed to be necessary to curb global warming. As Figure 7 illustrates, conservation, renewable resources, and other low-carbon energy sources are also necessary to help the United States decrease our emissions levels. It is also anticipated that new and improved technologies will be introduced in later years while power plants will gradually need to be replaced, adding to overall energy savings and emissions reductions. Wide-scale energy efficiency is the means to achieve the greatest emissions reductions in the least amount of time.

Figure 7: Preliminary ACEEE Analysis of Steps to Meet Long-Term Climate Change Goals



Although an EERS can lay the foundation for increased energy efficiency, it is not the sole means to achieve the needed energy savings. Advanced building codes and more stringent appliance standards, improved and integrated building operation techniques, tighter, more energy efficient building construction, to name a few, are all areas which can increase the benefits of energy efficiency in the United States.

How Does an EERS Work with a Renewable Energy Standard?

Energy efficiency is important in its own right and should not merely be a safety valve in a renewable energy standard (RES). A meaningful EERS, such as H.R. 889 or S. 548, will reduce overall energy demand, making RES targets easier to meet. An RES and an EERS are complimentary policies that, when properly implemented, can work together to reduce energy demand and dependency on conventional fossil fuels, positively affecting climate change.

How Will an EERS Help the Environment?

Almost fifty percent of electricity comes from coal. As electricity use drops, so does the amount of coal being burned at the power plant. The need for additional power plants is also reduced . In addition to reduced carbon dioxide emissions discussed above, an EERS can help reduce sulfur oxides (SO_x) and nitrogen oxides (NO_x) which have also been found harmful to our environment. Additional environmental harms associated with coal combustion include mercury, asthma, tuberculosis, and other problems associated with lung diseases. In fact, the major source of mercury in the air is the combustion of coal at power plants. (Synapse Energy Economic, Inc. 2008).

CONCLUSION

Expanding investments in energy efficiency programs at the national level will save consumers money, promote economic development, and reduce emissions of air pollutants and greenhouse gases that contribute to global warming. With net energy bill savings on the order of $170 billion and jobs totaling over 220,000, the proposed federal Energy Efficiency Resource Standard stands out as one of the most effective means of encouraging a more productive economy. In these tough economic times, this is one investment that the United States can count on to provide positive returns:

- $168.6 billion in savings
- 220,000 net jobs created
- 262 MMT of carbon dioxide emissions avoided
- 390 power plants that will not be built

Implementing a national EERS is a simple first step toward positive changes in the way the United States uses energy. The opportunity for energy savings in the U.S. goes beyond what is achievable with an EERS alone. A comprehensive federal energy policy that strongly encourages and promotes advanced building codes and appliance standards, research, development and demonstration projects, consumer education and outreach, and technology advancements, in addition to an EERS, can deliver significant productivity benefits that provide large savings on our electricity bills, that provide significant reductions in carbon dioxide emissions, and that provide a source of new job creation—but only if we choose to develop those options.

References

[ACEEE] American Council for an Energy-Efficient Economy, Summit Blue Consulting, ICF International, Synapse Energy Economics. 2008. *Energizing Virginia: Efficiency First*. ACEEE Report Number E085. Washington, D.C.: American Council for an Energy-Efficient Economy.

Brooks, Susanne, Brett Elswick, and R. Neal Elliot. 2006. *Combined Heat and Power: Connecting the Gap between Markets and Utility.* ACEEE Report IE062. Washington, D.C.: American Council for an Energy-Efficient Economy.

Brown, Marilyn A. and Sharon (Jess) Chandler, 2008. "Governing Confusion: How Statutes, Fiscal Policy, and Regulations Impede Clean Energy Technologies." *Stanford Law and Policy Review,* (19) 3: 472-509.

Cavanagh, Ralph. 2008. *Energy Efficiency in Buildings and Equipment: Remedies for Pervasive Market Failures*. Prepared for the National Commission on Energy Policy. Available at http://www.bipartisanpolicy.org/files/news/finalReport/III.1.a%20-%20Remedies%20for%20Failures.pdf.

[CEE] Consortium for Energy Efficiency. 2008. *2008 Industry Report Table 12: Estimated 2007 U.S. Annual Energy Savings Impacts*. Available at http://www.cee1.org/ee-pe/2008/member_impacts.php. Washington, D.C.: Consortium for Energy Efficiency.

Efficiency Vermont. 2008a. *2007 Annual Report Executive Summary*. Burlington, VT: Efficiency Vermont.

_____. 2008b. *2007 Annual Report*. Burlington, Vt.: Efficiency Vermont.

Ehrhardt-Martinez, Karen and John A. "Skip" Laitner. 2008. *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture*. ACEEE Report E083. Washington, DC: American Council for an Energy-Efficient Economy.

[EIA] Energy Information Administration. *Annual Energy Outlook 2009 with Projections to 2030*. 2009a. DOE/EIA-0383(2009). Washington, D.C.: U.S. Department of Energy.

_____. 2009b. Energy Information Administration. 2009. *Electric Sales, Revenue, and Price—Table 5. U.S. Average Monthly Bill by Sector, Census Division, and State 2007*. Available at http://www.eia.doe.gov/cneaf/electricity/esr/table5.html. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 2009c. *Energy in Brief—What Everyone Should Know about Energy.* Available at http://tonto.eia.doe.gov/energy_in_brief/electricity.cfm. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 2009d. *Electric Power Annual. State Historical Tables for 2007: Retail Sales of Electricity by State by Sector by Provider*. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 2008a. *Natural Gas Navigator: Natural Gas Consumption by End-Use, State Series*. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 2008b. *Assumptions to the Annual Energy Outlook 2008. Table 38. Cost and Performance Characteristics of New Central Station Electricity Generating Technologies*. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 2007. *Annual Electric Utility Data: EIA 861 Data File for 2006*. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 2004. *Natural Gas Navigator: Natural Gas Consumption by End-Use, State Series*. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

_____. 1999. *Electric Utility Demand-Side Management 1999*. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

Eldridge, Maggie, R. Neal Elliot, and Max Neubauer. 2008. *State-Level Energy Efficiency Analysis: Goals, Methods, and Lessons Learned*. 2008 ACEEE Summer Study on Energy Efficiency in Buildings. Washington, D.C.: American Council for an Energy-Efficient Economy.

Eldridge, Maggie, R. Neal Elliott, William Prindle, Katie Ackerly, John "Skip" Laitner, Vanessa McKinney, Steve Nadel, Max Neubauer, Alison Silverstein, Bruce Hedman, Anne Hampson, and Ken Darrow. 2008. *Energy Efficiency: The First Fuel for a Clean Energy Future — Resources for Meeting Maryland's Electricity Needs***.** ACEEE Report E082. Washington, D.C.: American Council for an Energy-Efficient Economy.

Elliott, R. Neal, Maggie Eldridge, Anna Shipley, John "Skip" Laitner, Steven Nadel, Philip Fairey, Robin Vieira, Jeff Sonne, Alison Silverstein, Bruce Hedman, and Ken Darrow. 2007a. *Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demand*. ACEEE Report E072. Washington, D.C.: American Council for an Energy-Efficient Economy.

Elliott, Neal, Maggie Eldridge, Anna Shipley, John "Skip" Laitner, Steven Nadel, Alison Silverstein, Bruce Hedman, and Mike Sloan. 2007b. *Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs*. ACEEE Report E073. Washington, D.C.: American Council for an Energy-Efficient Economy.

Elliott, R. Neal, Anna Monis Shipley, Steven Nadel, and Elizabeth Brown. 2003. *Natural Gas Price Effects Energy Efficiency and Renewable Energy Practices and Policies*. ACEEE Report E032. Washington, D.C.: American Council for an Energy-Efficient Economy.

Eto, J., S. Kito, L. Shown, and R. Sonnenblick. 1995. *Where Did the Money Go? The Cost and Performance of the Largest Commercial Sector DSM Programs*. LBL-38201/UC-1322. Berkeley, Calif.: Lawrence Berkeley Laboratory; Energy & Environment Division.

Geller, Howard, Sara Baldwin, Patti Case, Kevin Emerson, Therese Langer, and Sarah Wright. 2007. *Utah Energy Efficiency Strategy: Policy Options*. Boulder, Colo.: Southwest Energy Efficiency Project.

Golove, William H. and Joseph H. Eto. 1996. *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency*. LBL-38059, UC-1322. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Kushler, Martin, Dan York, and Patti Witte. 2004. *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies*. ACEEE Report E042. Washington, DC: American Council for an Energy-Efficient Economy.

Laitner, John A. "Skip," Chris Poland Knight, Vanessa L. McKinney, and Karen Ehrhardt-Martinez. 2009. *Semiconductor Technologies: The Potential to Revolutionize U.S. Energy Productivity*. Forthcoming. Washington, D.C.: American Council for an Energy-Efficient Economy.

Laitner, John A. "Skip" and Vanessa McKinney. 2008. *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments*. ACEEE Report E084. Washington, D.C.: American Council for an Energy-Efficient Economy.

Laitner, John. A. "Skip," and Martin Kushler. 2007. *More Jobs and Greater Total Wage Income: The Economic Benefits of an Efficiency-Led Clean Energy Strategy to Meet Growing Electricity Needs in Michigan*. ACEEE Report E07X. Washington, D.C.: American Council for an Energy-Efficient Economy.

Laitner, John "Skip," R. Neal Elliott and Maggie Eldridge. 2007. T*he Economic Benefits of an Energy Efficiency and Onsite Renewable Energy Strategy to Meet Growing Electricity Needs in Texas*. ACEEE Report E076. Washington, D.C.: American Council for an Energy-Efficient Economy.

Lazard, Ltd. 2008. *Levelized Cost of Energy Analysis — Version 2.0*. Presented to the NARUC Summer Meeting, June 2008. New York, N.Y.: Lazard, Ltd.

Nadel, Steven. 2006. *Energy Efficiency Resource Standards: Experience and Recommendations.* ACEEE Report E063. Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, Steven, Anna Shipley and R. Neal Elliot. 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.* Washington, DC: American Council for an Energy-Efficient Economy.

Nadel, Steven, Andrew deLaski, Maggie Eldridge, and Jim Kleisch. 2006. *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards.* Report Number ASAP-6/ACEEE-A062. Washington, D.C.: American Council for an Energy-Efficient Economy. Boston, Mass.: Appliance Standards Awareness Project.

NVEnergy. 2009. *Nevada Sure Bet.* http://www.nvenergy.com/saveenergy/business/incentives/surebet. Accessed March 2009.

Sachs, Harvey M., Steven Nadel, Jennifer Thorne Amann, Marycel Tuazon, and Eric Mendelsohn: ACEEE; Leo Rainer: Davis Energy Group; G. Todesco, D. Shipley, and M. Adelaar: Marbek Resource Consultants. 2004. *Emerging Energy-Saving Technologies and Practices for the Buildings Sector as of 2004*. Washington, D.C.: American Council for an Energy-Efficient Economy.

Synapse Energy Economics, Inc. 2008. *Don't Get Burned: The Risks of Investing in New Coal-Fired Generating Facilities*. Cambridge, Mass.: Synapse Energy Economics, Inc.

Texas Energy Efficiency. 2009. http://www.texasefficiency.com. Austin,Texas: Electric Utility Marketing Managers of Texas

APPENDIX A: Estimated Savings From and Costs of a National EERS

Appendix A: Estimated Savings From and Costs of a National EERS

#		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	Reference Case																								
1	Electricity sales per AEO2009 (TWh)	3789	3831	3887	3905	3928	3959	4002	4045	4093	4131	4161	4196	4239	4284	4333	4372	4416	4460	4510	4556	4606			
2	Applicable electricity sales	3375	3412	3461	3478	3499	3526	3564	3603	3645	3679	3705	3737	3775	3815	3859	3894	3933	3972	4016	4058	4102			
3	Electricity sales after allowing for prior year EERS	3375	3412	3461	3473	3478	3480	3492	3492	3495	3456	3412	3373	3411	3451	3495	3529	3573	3628	3699	3765	3849			
4	Natural gas sales per AEO2009 (TBtu, R+C+I)	9,592	9,672	9,752	9,782	9,815	9,852	9,901	9,918	9,944	9,955	10,006	10,052	10,098	10,133	10,169	10,161	10,163	10,157	10,180	10,181	10,209			
5	Applicable natural gas sales	9,362	9,440	9,518	9,547	9,579	9,616	9,663	9,680	9,705	9,716	9,766	9,811	9,855	9,890	9,924	9,917	9,919	9,913	9,936	9,937	9,964			
6	Natural gas sales after allowing for prior year EERS	9,362	9,440	9,508	9,504	9,479	9,435	9,402	9,315	9,237	9,146	9,096	9,018	9,062	9,096	9,131	9,133	9,169	9,220	9,323	9,405	9,536			
	Energy Savings from an EERS																								
7	Incremental annual electric target (%)	0.00%	**0.33%**	**0.67%**	**1.00%**	**1.25%**	**1.25%**	**1.50%**	**1.50%**	**2.50%**	**2.50%**	**2.50%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
8	Basecase annual efficiency (% of sales)	0.45%	0.49%	0.53%	0.55%	0.50%	0.52%	0.38%	0.39%	0.40%	0.45%	0.44%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
9	Incremental efficiency (%)	0.00%	0.00%	0.14%	0.45%	0.75%	0.73%	1.12%	1.11%	2.10%	2.05%	2.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
10	Total annual efficiency (%)	0.00%	0.00%	0.14%	0.59%	1.34%	2.06%	3.18%	4.29%	6.39%	8.44%	10.50%	10.50%	10.50%	10.50%	10.50%	10.50%	10.50%	10.50%	10.50%	10.50%	10.50%			
11	Electric savings from current year programs (TWh)	0.0	0.0	4.9	15.6	26.0	25.3	39.0	38.9	73.3	70.7	70.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
12	Annual elec savings (including prior year installations)	0.0	0.0	4.9	20.5	46.5	71.8	110.7	149.6	223.0	293.7	364.1	364.1	364.1	364.1	364.1	359.2	343.6	317.6	292.3	253.4	214.4	141.1	70.4	0.0
13	Estimated peak demand savings (MW)	0	0	1,567	6,597	14,956	23,077	35,605	48,126	71,710	94,454	117,091	117,091	117,091	117,091	117,091	115,524	110,495	102,136	94,015	81,486	68,965	45,381	22,637	0
14	Average heat rate Btu/kWh (including T&D losses)	10,764	10,668	10,671	10,629	10,588	10,555	10,527	10,507	10,478	10,462	10,424	10,387	10,354	10,321	10,293	10,262	10,222	10,183	10,142	10,090	10,056	10,023	9,989	9,956
15	Annual gas target (%)	0.00%	**0.25%**	**0.50%**	**0.75%**	**1.00%**	**1.00%**	**1.25%**	**1.25%**	**1.25%**	**1.25%**	**1.50%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
16	Basecase efficiency (% of sales)	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%			
17	Incremental efficiency	0.00%	0.10%	0.35%	0.60%	0.85%	0.85%	1.10%	1.10%	1.10%	1.10%	1.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
18	Incremental Gas savings from current year programs (TBtu)	0.00	9.67	33.51	57.25	80.80	80.42	103.64	102.69	101.83	100.83	123.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
19	Annual gas savings (including prior year installations)	0.00	9.67	43.17	100.42	181.22	261.64	365.28	467.97	569.80	670.63	793.64	793.64	793.64	793.64	783.97	750.47	693.22	612.42	532.00	428.36	325.67	223.84	123.01	0.00
20	Total savings, all fuels (quads)	0.00	0.01	0.10	0.32	0.67	1.02	1.53	2.04	2.91	3.74	4.59	4.58	4.56	4.55	4.53	4.44	4.21	3.85	3.50	2.98	2.48	1.64	0.83	0.00
	Costs (Billion 2007$)																								
	Program costs																								
21	Electric	0.0	0.0	0.5	1.5	2.5	2.4	3.8	3.8	7.1	6.8	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
22	Gas	0.0	0.1	0.3	0.6	0.8	0.8	1.0	1.0	1.0	1.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
23	Customer investments	0.0	0.2	1.6	4.1	6.6	6.4	9.5	9.5	16.1	15.6	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
24	Total costs	0.0	0.3	2.4	6.2	9.9	9.7	14.3	14.3	24.2	23.4	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
25	Annual costs amortized (4.5% real interest rate)	0.0	0.1	0.5	1.4	2.3	2.2	3.3	3.3	5.5	5.3	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
26	Costs recognized	0.0	0.1	0.6	2.0	4.3	6.5	9.7	12.4	16.5	19.6	22.8	19.6	16.3	10.8	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Discounted costs (2007 $, 4.5% real discount rate)	0.0	0.0	0.4	1.4	2.9	4.2	6.0	7.3	9.3	10.6	11.8	9.7	7.7	4.9	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Program Benefits and Net Benefits (Billion 2007$)																								
28	Average end-use electric price (cents/kWh)	9.0	9.0	9.0	9.0	9.0	9.0	9.1	9.1	9.2	9.3	9.4	9.4	9.4	9.5	9.7	9.8	10.0	10.2	10.3	10.4	10.5	10.5	10.5	10.5
29	Average end-use gas price ($/1000cf, wtd avg R,C,I)	7.99	7.91	7.93	7.89	7.96	8.02	8.12	8.24	8.42	8.57	8.52	8.37	8.48	8.51	8.75	8.95	9.22	9.52	9.63	9.80	9.89	9.9	9.9	9.9
	Gross program benefits (billions)																								
30	Electric	0.0	0.0	0.4	1.8	4.2	6.5	10.1	13.7	20.6	27.4	34.2	34.2	34.4	34.7	35.2	35.3	34.4	32.3	30.1	26.3	22.4	14.8	7.4	0.0
31	Gas	0.0	0.1	0.3	0.8	1.4	2.0	2.9	3.7	4.7	5.6	6.6	6.5	6.5	6.6	6.7	6.5	6.2	5.7	5.0	4.1	3.1	2.2	1.2	0.0
32	Total	0.0	0.1	0.8	2.6	5.6	8.5	12.9	17.4	25.3	33.0	40.8	40.7	40.9	41.3	41.8	41.9	40.6	38.0	35.1	30.3	25.6	16.9	8.5	0.0
33	Discounted benefits (2007$, 4.5% real disc. rate)	0.0	0.1	0.6	1.8	3.8	5.5	8.0	10.3	14.2	17.8	21.1	20.1	19.4	18.7	18.1	17.4	16.1	14.4	12.7	10.6	8.5	5.4	2.6	0.0
34	Cumulative net benefits	0.0	0.0	0.1	0.5	1.4	2.8	4.8	7.8	12.7	20.0	29.3	39.7	51.4	65.1	80.9	98.3	114.4	128.8	141.5	152.1	160.6	165.9	168.6	168.6
35	Benefit/cost ratio																								
36	Power sector CO2 emissions (MMT)	2388	2407	2428	2428	2423	2437	2451	2468	2485	2496	2495	2497	2516	2530	2549	2568	2588	2615	2641	2676	2720			
37	Natural gas consumption CO2 emissions (MMT)	524	528	533	534	536	538	540	541	543	544	547	550	553	555	557	557	557	557	558	558	560			
38	CO2 emissions savings from EERS	0.0	0.5	5.4	18.2	38.6	58.4	87.8	116.8	166.5	214.1	261.7	260.1	259.5	258.5	257.1	252.1	239.4	219.7	200.4	172.3	144.5	95.1	31.2	0.0
39	Net Jobs Created		-488	-2665	-1504	9,477	33,804	51,670	85,827	110,340	169,563	222,116	294524	291073	287861	286406	281303	267703	245863	223053	189506	156724			

Notes (keyed to row number):

1 AEO 2009. Net Generation by Fuel Type, Total Electricity Sales by Sector (EIA 2009).
2 Applicable electricity sales (>750,000 MWh) are 89.06% of all electricity sales based on analysis of EIA Electricity Annual data for 2007.
4 Industrial includes only that portion of sales handled by local gas distribution companies, derived by ACEEE from EIA Natural Gas Annual.
5 Applicable gas sales (>1250 Mcf) are 97.6% of all Natural gas sales based on analysis of EIA Natural Gas Annual data for 2004 (EIA 2004).
7 H.R. 889, introduced February, 2009. See also S. 548, introduced March, 2009.
8 State by State EERS analysis (Appendix B)
13 kW/kWh factor from EIA reports Electric Utility DSM (1999); added 8% for T&D losses and 10% for reserve margin
14 Average Heat Rate derived from electric losses in AEO 2006
15 H.R. 889, introduced February, 2009. See also S. 548, introduced March, 2009.
16 0.1476% savings derived from the Consortium for Energy Efficiency 2008 Industry Report Table 12: Estimated 2007 U.S. Annual Energy Savings Impacts. (CEE 2008).
21 Based on levelized cost of 3 cents/kWh (Kushler, York, and Witte 2004), 13 year measure life (Eto, J., et al. 1995) and 4.5% discount rate; utility pays 1/3 of total cost.
22 Based on levelized cost of 30 cents/therm (Elliott, et al. 2003), 13 year measure life (Eto, J., et al. 1995) and 4.5% discount rate; utility pays 1/3 of total cost.
23 Utility pays 1/3 of program costs, customer investments account for remaining 2/3 of costs.
28 AEO 2009. Net generation by fuel types, end-use prices (EIA 2009).
29 Weighted average for Residential, Commercial, and Industrial natural gas prices, derived from AEO 2009 (EIA 2009). Industrial includes only that portion of sales handled by local gas distribution companies, derived by ACEEE from EIA Natural Gas Annual.
36 AEO 2009. Carbon dioxide emissions by sector and source (EIA 2009).
37 AEO 2009, Residential, Commercial, and Industrial Carbon Dioxide Emissions by sector and source (EIA 2009 Table 18). Industrial includes only that portion of sales handled by local gas distribution companies, derived by ACEEE from EIA Natural Gas Annual.
39 Jobs values estimated from IMPLAN software and AEO 2009 labor productivity rate (EIA 2009).

Appendix B: State Energy Efficiency Resource Standard Savings

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
California	0.9%	0.9%	0.8%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	Energy savings goals are interim and will be updated in 2010 and include utility-specific goals as well as total market gross goals.
estimated savings (% of 2007 sales)	2,409	2,428	2,067	1,805	1,625	1,541	1,570	1,574	1,586	1,572	1,559	
Colorado	0.42%	0.44%	0.47%	0.49%	0.52%	0.55%	0.58%	0.61%	0.64%	0.67%	0.67%	Targets were extrapolated to demonstrate state-wide values, not just the specific targets established by the Colorado Public Utilities Commission for Public Service Company.
estimated savings (% of 2007 sales)	213	224	238	252	266	280	296	311	327	342	343	
Connecticut	1.00%	1.00%	1.00%	1.25%	1.50%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1% 2007 target, 4% 2010 target (1%/year). Thereafter derived from utility filed plans.
estimated savings (% of 2007 sales)	341	341	341	427	512	597	597	597	597	597	597	
Hawaii	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	Assumes Hawaii will continue to achieve savings similar to those in recent years.

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
estimated savings (% of 2007 sales)	64	64	64	64	64	64	64	64	64	64	64	
Illinois	0.60%	0.80%	1.00%	1.40%	1.80%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	Electric utilities shall implement cost-effective energy efficiency measures to meet the following incremental annual energy savings goals: 0.2% of energy delivered in the year commencing June 1, 2008; rising by 0.2% of sales each year to reach 1% of energy delivered in the year commencing June 1, 2012; 1.4% in the year commencing June 1, 2013; 1.8% in the year commencing June 1, 2014; and 2% in the year commencing June 1, 2015 and each year thereafter. SB1592 Sec. 12-103
price cap assumption	0.30%	0.40%	0.50%	0.70%	0.90%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	Assuming half the legislated targets are met due to cost cap.
estimated savings (% of 2007 sales)	443	591	739	1,035	1,330	1,478	1,478	1,478	1,478	1,478	1,478	
Iowa	1.00%	1.00%	1.20%	1.40%								For investor-owned utilities, proposed performance goals collectively reach 1.4 percent of retail MWh sales by 2013

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
estimated savings (% of 2007 sales)	447	447	536	626								
Maryland	1.00%	1.25%	1.50%	1.75%	1.75%	2.00%						Maryland utilities are required to provide cost-effective energy efficiency and conservation programs that are designed to achieve at least 5% per capita electricity savings by the end of 2011 and 10% savings by the end of 2015. The Maryland Energy Administration is responsible for an additional 5% savings by 2015. Savings are percentages of 2007 per capita sales.
Maryland MEA	0.25%	0.50%	0.75%	1.00%	1.00%	1.25%						
estimated savings (% of 2007 sales)	816	1142	1468	1794	1794	2121						
Maryland total	1%	2%	2%	3%	3%	3%						
Massachusetts	1.25%	1.50%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	Plans call for doubling savings over 5 years.
estimated savings (% of 2007 sales)	710	852	994	994	994	994	994	994	994	994	994	

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
Michigan	0.50%	0.75%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	SB213 established an energy efficiency resource standard (“energy optimization savings standard”) for utilities in 2008. Electric utilities must achieve 0.3% savings for 2009; 0.5% in 2010; 0.75% in 2011; and 1.0% in 2012 and each year thereafter.
estimated savings (% of 2007 sales)	548	821	1,095	1,095	1,095	1,095	1,095	1,095	1,095	1,095	1,095	
Minnesota	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	Minnesota's Next Generation Act (2007) calls for 1.5%/year starting in 2010.
estimated savings (% of 2007 sales)	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
Nevada	0.50%	0.38%	0.38%	0.38%	0.38%	0.50%						Energy efficiency measures may meet up to 25% of the following renewable energy targets (percent of total amount of electricity sold by the provider to its retail customers in Nevada during that calendar year): 2005 and 2006: 6% (1.5%); 2007 and 2008: 9% (2.25%); 2009 and 2010: 12% (3%); 2011 and 2012: 15% (3.75%); 2013 and 2014: 18% (4.5%); 2015 and beyond: 20% (5%)
estimated savings (% of 2007 sales)	178	133	133	133	133	178	0	0	0	0	0	
New Mexico	0.50%	0.50%	0.75%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	Targets are 5% by 2014 and 10% by 2020. Incremental values are estimates.
estimated savings (% of 2007 sales)	110	110	165	221	221	221	221	221	221	221	221	
New York	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%						15% (relative to projected use in 2015) by 2015
estimated savings (% of 2007 sales)	2,984	2,984	2,984	2,984	2,984	2,984						

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
North Carolina	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.50%	0.75%	0.75%	Energy efficiency measures may meet 25% of 2012, 2015, and 2018 REPS goals and 40% of 2021+ goals. These translate as 0.75% EE savings by 2012, 1.5% by 2015, 2.5% by 2018 and 5% by 2021, with incremental years interpolated.
estimated savings (% of 2007 sales)	328	328	328	328	328	328	328	328	655	983	983	
Ohio	0.5%	0.7%	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%	1.0%	2.0%	2.0%	Senate Bill 221 calls for electric distribution utilities to achieve 0.3% savings in 2009, ramps up to 1% per year by 2014, then jumps to 2% per year in 2019 through 2025.
estimated savings (% of 2007 sales)	808	1,131	1,292	1,454	1,615	1,615	1,615	1,615	1,615	3,231	3,231	
Pennsylvania	0.5%	0.5%	1.0%	1.0%								1% total annual goal by 2011; assume 0.5% each year 2010-2011 to reach that; relative to base year; 3% total annual goal by 2013.
estimated savings (% of 2007 sales)	756	756	1,512	1,512								

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
Rhode Island	1.25%	1.50%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	Estimate same as Massachusetts since the largest utility is the same in the 2 states.
estimated savings (% of 2007 sales)	100	120	140	140	140	140	140	140	140	140	140	
Texas	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%	10% of load growth by Dec. 31, 2007, 15% of load growth by Dec. 31, 2008, and 20% of load growth by Dec. 31, 2009. A study is underway to see whether the target can be increased to 30% of load growth in 2010 and 50% of load growth in 2015. We apply these to 2%/year annual growth.
estimated savings (% of 2007 sales)	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	1,342	
Vermont	2.0%	2.0%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	Efficiency Vermont is planning to achieve an additional 2% savings per year for 2009-2011.
estimated savings (% of 2007 sales)	117	117	106	106	106	106	106	106	106	106	106	
Virginia	0.25%	0.50%	0.50%	0.50%	0.50%	0.75%	0.75%	0.75%	1.00%	1.00%	1.00%	10% reduction in consumption (from 2006 levels) by 2022. Incremental values are estimated.

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
estimated savings (% of 2007 sales)	278	556	556	556	556	833	833	833	1,111	1,111	1,111	
Washington	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%		By January 1, 2010, using methodologies consistent with those used by the Pacific Northwest electric power and conservation planning council in its most recently published regional power plan, each qualifying utility shall identify its achievable cost-effective conservation potential through 2019. The most recent NWPPC plan identifies 2700 average MW of conservation savings as being cost-effective and achievable by 2025, amounting to 10.6% of projected needs in that year if additional conservation is not pursued. In 2006 savings were 0.74% of sales, a figure we extend through 2019.
estimated savings (% of 2007 sales)	625	625	625	625	625	625	625	625	625	625		

State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Notes
Total State EERS Savings (GWh)	14,637	16,133	17,746	18,511	16,751	17,562	12,323	12,344	12,976	14,920	14,284	
% of 2007 Sales	0.39%	0.43%	0.47%	0.49%	0.45%	0.47%	0.33%	0.33%	0.35%	0.40%	0.38%	
Other States (incremental savings 2006; *Scorecard*)	2,085	2,085	2,085	2,085	2,085	2,085	2,085	2,085	2,085	2,085	2,085	
% of 2007 Sales	0.056%	0.056%	0.056%	0.056%	0.056%	0.056%	0.056%	0.056%	0.056%	0.056%	0.056%	
Total Savings (GWh)	16,722	18,218	19,831	20,596	18,837	19,647	14,409	14,429	15,061	17,006	16,369	
% of 2007 Sales	0.45%	0.49%	0.53%	0.55%	0.50%	0.52%	0.38%	0.39%	0.40%	0.45%	0.44%	
Cumulative % of 2007 Sales	0.45%	0.93%	1.46%	2.01%	2.51%	3.04%	3.42%	3.81%	4.21%	4.66%	5.10%	