The National Energy Efficiency Resource Standard as an Energy Productivity Tool *

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There is a huge potential for cost-effective investments in energy efficiency throughout all sectors of the U.S. economy: on the order of 45 to 50 billion barrels of oil equivalent between now and 2030. This is about 2.5 times bigger than what some have suggested might be available from off-shore drilling in U.S. coastal waters (Laitner 2009). That magnitude of further gains in energy efficiency could generate a significant downward pressure on oil prices, and increase both the resilience and robustness of the American and the international economies - if we choose to encourage those more productive investments.

Policy solutions will play a pivotal role in strengthening the continued development, dissemination, and widespread adoption of energy-efficient technologies and systems within the U.S. economy (Brown and Chandler 2008; see also Geller et al. 2006). With a focus on the nation's natural gas and electric utilities, this article highlights the potential impacts that might emerge from the adoption of a national energy efficiency resource standard, or EERS, as an extension of state-implemented efficiency standards. We begin with a review of what an energy efficiency resource standard actually is. We provide an overview of how an EERS is now being implemented by the various states within the U.S. We then describe how a federal EERS might complement the existing state actions. We also characterize the cost-effectiveness of a proposed federal EERS. Next we describe the likely macroeconomic benefits that might emerge at the national level from the resulting productivity investments. These larger economy-wide impacts are evaluated using the DEEPER modeling framework (Laitner and Knight 2009).[1]

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Finally we explore the larger efficiency potential that might be possible through the development of complementary policies, and we then offer some conclusions based on our assessment.

Background on the EERS

An Energy Efficiency Resource Standard (EERS) is a performance-based mechanism to encourage more efficient use of electricity and natural gas. As we envision it, a federal EERS can be thought of as an energy productivity tool that can accelerate new investments in more cost-effective energy-using technologies. In effect, a federal EERS would complement existing state-level energy efficiency standards by setting a national goal for energy savings that would be implemented by retail electricity and natural gas distributors over a specific period of time. The most current federal proposal now before Congress is an EERS that would require a national 15% electricity savings and a 10% natural gas savings to be reached by 2020. Programs to stimulate this level of savings would begin in 2011. At this point, the current and anticipated state EERS actions are on track to encourage a 1.5% savings on natural gas and 7% on electricity savings – all by 2020.

The basic structure of an EERS requires electricity and natural gas distributors to achieve a particular percentage of energy savings relative to their average energy sales in the preceding two years. Savings are generally achieved by helping end-use customers save energy through energy efficiency programs, including the use of rebates and other incentives. Savings can also be achieved through implementation of new building codes and equipment efficiency standards, by improving energy efficiency in a utility's distribution system, or through the use of bilateral contracts to purchase energy savings from other utilities or third-party efficiency service providers. This latter category might include, for example, developers of combined heat and power and recycled energy systems.

States Leading by Example

EERS-like laws are already now in operation in a number of states (see Figure 1, below) as well as in different countries. State-level standards now implemented in California, Connecticut, Hawaii, Nevada, Texas and Vermont have all met or are on track for meeting their long-term targets. These states are demonstrating that the incremental savings proposed at the federal level (as we discuss below) are achievable. A majority of states with an EERS, however, are still developing regulations or are just beginning implementation.

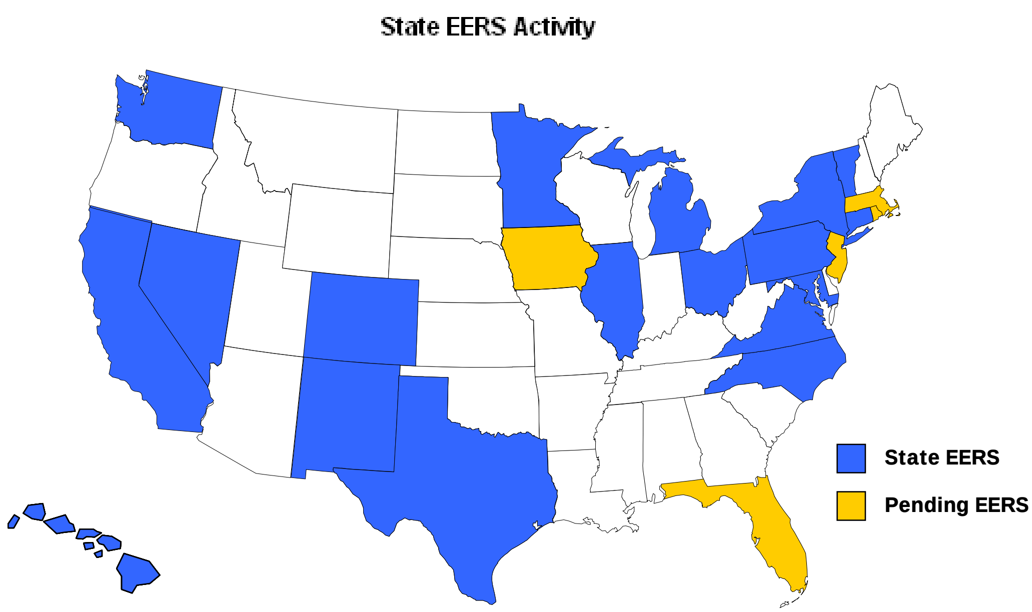

Figure 1: EERS policies are currently in place in 18 states: California, Colorado, Connecticut, Hawaii, Illinois, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Texas, Washington, Vermont, and Virginia. Several other states, including Florida, Iowa, Massachusetts, New Jersey, and Rhode Island are now actively considering similar policies.[2]

In Texas, a 1999 electricity restructuring law created a requirement for electric utilities to offset 10% of their demand 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 and directed that higher targets be investigated as utilities have had no difficultly meeting their targets and are currently exceeding them. In 2009, as a result of the investigation, it is likely that targets will increase to 30% or even 50% of load growth or the equivalent expressed as a percent of energy sales.

Hawaii's combined Renewable Energy Standard and Energy Efficiency Resource Standard (RES/EERS) sets a renewable resource requirement of 8% of kilowatt-hour (kWh) sales in 2005, rising to 20% in 2020. Efficiency qualifies as a resource under these requirements with no cap on how much efficiency may be used to meet the target. In 2001, the Nevada legislature enacted Renewable Portfolio Standard legislation. In 2005, this law was amended to increase the portfolio requirement, but also to allow the utilities to use energy efficiency programs to help meet the requirements. Under the new law, renewable energy and energy efficiency must meet 20% of the state's electricity needs by 2015, of which up to 25% can be met with energy efficiency.

Following California's 2001 electricity crisis, the primary energy resource agencies worked together along with the state's utilities and other key stakeholders and developed the *California Integrated Energy Policy Report* that includes energy savings goals for the state's investor-owned utilities (IOUs) for the period 2004 through 2013. In July 2008, the California Public Utilities Commission (CPUC) established new targets for energy savings for the years 2012 through 2020 for its regulated utilities. The new goals are expected to save over 4.5 million kilowatts (kW) and over 16 billion kWh of electricity by 2020.[3]

In Vermont an independent "efficiency utility," known as Efficiency Vermont, was created in 2000 to deliver efficiency programs for the state. It is contractually required to achieve energy savings and demand reduction goals. Efficiency Vermont cumulatively met over 7% of Vermont's electricity requirements by the end of 2007. Programs in that year alone met 1.75%

of the state's electricity needs. New goals for 2009-2011 call for an incremental saving about 2% per year.

Between 2007 and 2008, a number of states enacted new EERS legislation. In 2007, the Minnesota legislature approved a 1.5% annual energy savings target for electric and natural gas sales, at least 1% of which must come from energy efficiency. Illinois set energy efficiency targets in 2007, beginning at 0.2% in 2008 and ramping up to 2.0% annually for 2015 and subsequent years. 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. New Mexico, Maryland, Ohio, Virginia, Pennsylvania and Michigan also enacted EERS legislation in 2007 or 2008. Several other states, including Florida, Iowa, 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.

Based on the experiences as we've summarized them above, and especially given their documented economic benefits, ACEEE now recommends that the states and the federal government enact energy efficiency resource standards covering both electric and gas utilities. Under the proposed federal EERS, incremental annual savings targets generally begin at modest levels, 0.33% electricity and 0.25% natural gas savings in the first year, and ramp up to 2.5% incremental savings per year for electricity and 1.25% for natural gas. States that have been implementing EERS's demonstrate that these targets are achievable. For example, California achieved 5% savings in 2001 alone and Vermont saved about 1.75% in 2007, with Connecticut, Massachusetts, Minnesota, New York, and Rhode Island planning for similar savings in upcoming years.[4]

The concept of ramping up savings may initially seem counterintuitive. For electricity and natural gas distributors that are not currently operating energy efficiency programs, the lower targets at the beginning of the implementation period allows these utilities to start programs and gain experience operating such programs. As the utilities continue to gain that experience, they can build from their initial programs, expanding into sectors that were not initially included in their programs and/or reaching more customers in all customer classes, achieving increased savings. California's Pacific Gas & Electric (PG&E) provides a useful example. Beginning with a few energy efficiency programs in 1976, PG&E has continued to expand, building on successful programs, currently providing approximately 90 energy efficiency programs to reach all customer classes. Efficiency Vermont also continues to expand the reach of its programs, currently working in the existing and new homes, existing and new businesses, efficient products, equipment replacement, and low-income markets. They also provide services to targeted sub-markets such as colleges and universities, municipal waste and water, schools, industrial processes, state buildings, farms, hospitals, and ski areas.

Although the "low-hanging fruit" may be reached in the earlier years, greater investments in energy efficiency lead to greater increases in energy savings so continually reaching higher incremental targets in later years 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, 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). 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 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).

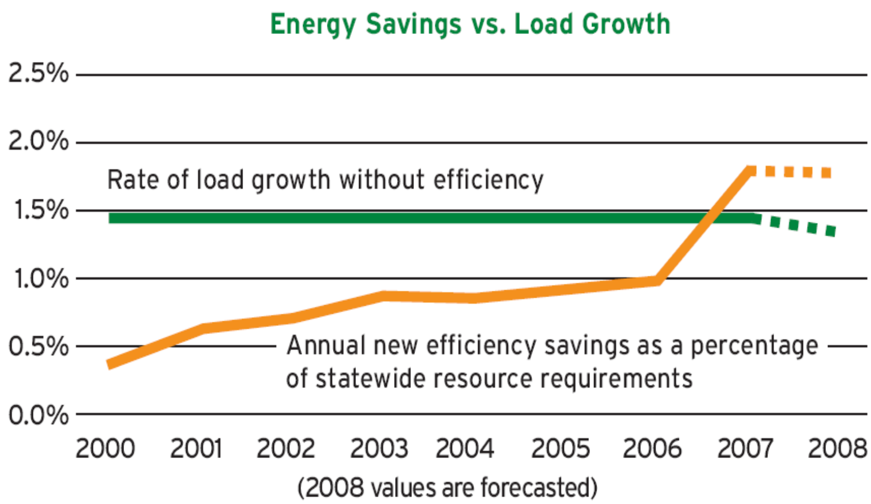

Figure 2: Energy Savings v. Load Growth in Vermont (Efficiency Vermont 2008)

Ensuring a Cost-Effective Implementation

Although the 15% electricity savings target may seem aggressive, a recent ACEEE study for the state of Maryland found that electricity use reductions of 22% by 2020 and 29% by 2025 are not only achievable, but they are highly cost-effective (Eldridge et al. 2008b). Currently, new conventional base-load production sources generate electricity at a levelized cost between $0.07 and $0.135 per kilowatt-hour (Lazard 2008). By way of comparison, Lazard (2008) also points to evidence suggesting that energy efficiency may range in cost from $0.0 to $0.05 per kWh. Hence, as long as program costs are a reasonably small part of the total policy costs, energy efficiency improvements will be significantly less expensive than building and operating new generating capacity. By definition, then, implementing a national EERS would commit every state to utilizing this least-cost resource and establish a baseline level of cost-effective and achievable energy savings.

The Economy-Wide Benefits

In evaluating the macroeconomic impacts of a federal EERS we presume that state EERS programs are already functioning. Hence, we are interested in assessing the benefits of the incremental efficiency gains that might follow from a federal EERS. As we suggested, for example, we anticipate that state actions now underway will generate a total 7% of national level savings by 2020. In effect, the federal EERS would extend the national savings from 7% to 15%. Following Kushler et al. (2004), we assume that the levelized cost of energy efficiency for the federal increment is about $0.03 per kilowatt-hour saved (or about midway in the range established by Lazard). Because the states have generally not focused on natural gas savings, the federal EERS would generate a substantially larger increment than for electricity savings – extending the national savings from 1.5% to 10% by 2020. We assume that natural gas efficiency gains would have a comparable level of cost-effectiveness as for electricity.

Given these assumptions, our analysis suggests that the efficiency increments needed to achieve a 15% electricity savings (instead of a 7% savings) and a 10% natural gas savings (instead of a 1.5% savings), a federal EERS would drive a cumulative economy-wide investment of $109 billion (in constant 2006 dollars) over the period 2011 through 2020. As we summarize the information in Table 1, these more productive investments would generate a steady rise in efficiency gains so that in the year 2020 the U.S. economy would be using 282 billion fewer kWh of electricity compared to the savings anticipated only by state-level actions alone. Natural gas savings would be on the order of 1,200 trillion Btu compared to state actions alone. Moreover, those same investments would also reduce the peak electric demand by an estimate 90,000 megawatts. Assuming a typical power plant might be about 600 MW, this implies the equivalent of 150 coal-fired power plants that would not have to be built within this analytical period. Moreover, a cumulative $109 billion investment would save businesses and consumers $35 billion in 2020 alone. The cumulative energy bill savings over the full life of all installed energy efficiency measures would be about $462 billion (in undiscounted constant 2006 dollars).

With combined program and investment costs of $148 billion, the net energy bill savings might approach $314 billion over the life of the measures. Furthermore, carbon dioxide (CO_2) emissions would be reduced by 250 million metric tons in 2020 — equivalent to taking 42 million automobiles off the road for that year. When total program costs and investments are compared to total consumer savings, the total resource cost ratio (assuming a real discount rate of 4.5%) is about 3:1. Again, these investments and savings are additional to investments and savings currently being undertaken in those states that have already implemented some form of an EERS.

Table 1. Federal EERS Energy Costs and Savings Data for Key Benchmark Years

Electricity	**2012**	**2015**	**2020**
Incremental annual electricity savings (billion kWh)	0.5	16	63
Cumulative electricity savings (billion kWh)	0.5	41	282
Cumulative state electricity savings (billion kWh)	34	116	244
Federal percent change from base case	0.02%	1.20%	8.0%
State percent change from base case	0.98%	3.30%	7.0%
Total percent change from base case	1.0%	4.5%	15.0%
Natural Gas			
Incremental annual natural gas savings (TBtu)	52	124	187
Cumulative natural gas savings (TBtu)	67	404	1218
Cumulative state natural gas savings (TBtu)	43	108	212
Federal percent change from base case	0.45%	2.75%	8.50%
State percent change from base case	0.30 %	0.75%	1.50%
Total percent change from base case	0.75%	3.5%	10%
Costs and Savings			
Annual program costs (billion 2006 dollars)	0.55	2.72	7.94
Annual total investments (billion 2006 dollars)	1.55	7.62	22.22
Annual energy bill savings (billion 2006 dollars)	0.65	7.0	35.0
Annual net jobs created (actual)	700	41,000	247,000
Annual CO_2 emissions savings (million metric tons)	4	50	250

Source: ACEEE internal analysis (2009).

We can also get a sense of the macroeconomic benefits by mapping our estimates of program spending, the added technology investments, and the resulting energy bill savings into the DEEPER Modeling framework (Laitner and Knight 2009). Because energy-related expenditures are so much less labor intensive than almost all other consumer expenditures within the U.S. economy, our working analysis suggests a net increase of 700 jobs in 2012 which increases to 247,000 net jobs per year by the year 2020.[5]

Conclusions

With net energy bill savings likely to exceed $300 billion, the energy efficiency resource standard represents one of the largest opportunities for capturing cost-effective energy productivity gains. National investments in greater energy efficiency levels will save consumers money, promote economic development, and reduce emissions of air pollutants and greenhouse gases that contribute to global warming. Bottom line? An Energy Efficiency

Resource Standard is a smart way to encourage a more productive economy – if we choose to implement it.

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[1] 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.

[2] For a description of current policies in all of these states, see the ACEEE paper on EERS's at: http://www.aceee.org/energy/state/policies/State_EERS%20Summary_11-12-08.pdf.

[3] The California report is available from: http://www.californiaenergyefficiency.com/docs/EEStrategicPlan.pdf.

[4] For a description of successful state policies, see Eldridge et al (2008a).

[5] Based on 2006 economic accounts for the U.S., the electric and natural gas utilities support fewer than 8 direct and indirect jobs per million dollars of revenue. All other sectors of the economy support about 19 direct and indirect jobs per million dollars of revenue. Hence, a cost-effective movement away from energy consumption should support a small but net positive gain in the nation's employment base. This is true even when we factor in labor productivity gains. For more information on this point, see Laitner and Knight (2009).