ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

ASSESSMENT OF EPA'S CLEAN POWER PLAN

Evaluation of Energy Efficiency Program Ramp Rates and Savings Levels

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Acknowledgments

This Report presents the results of an independent analysis of state experience with energy efficiency program ramp rates and savings levels in the context of EPA's Draft Clean Power Plan issued in accordance with section 111(d) of the Clean Air Act.

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The report, however, reflects the analysis and judgment of the authors only, and does not necessarily reflect the views of the Environmental Defense Fund or the Natural Resources Defense Council.

About Analysis Group

Analysis Group provides economic, financial, and business strategy consulting to leading law firms, corporations, and government agencies. The firm has more than 600 professionals, with offices in Boston, Chicago, Dallas, Denver, Los Angeles, Menlo Park, New York, San Francisco, Washington, D.C., Montreal, and Beijing.

Analysis Group's energy and environment practice area is distinguished by expertise in economics, finance, market analysis, regulatory issues, and public policy, as well as significant experience in environmental economics and energy infrastructure development. The practice has worked for a wide variety of clients including energy producers, suppliers and consumers; utilities; regulatory commissions and other public agencies; tribal governments; power system operators; foundations; financial institutions; and start-up companies, among others.

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1. EXECUTIVE SUMMARY

EPA's draft Clean Power Plan, issued in the summer of 2014, sets state-specific standards for the amount of carbon dioxide (CO_2) allowed to be emitted per megawatt-hour of electricity produced at affected power generating facilities. In setting each state's standard, EPA considered *in part* the ability of states to reduce system-wide CO_2 emissions through investments in demand-side energy efficiency at the businesses and residences of the state. Based on an evaluation of historical experience with energy efficiency (EE) programs administered by utilities in leading states over the past several decades, EPA concluded that states could grow EE savings at a rate of increase of at least 0.2 percent per year, and over the initial term of the program, could sustain annual average savings of up to 1.5 percent of state retail electricity sales.

To be sure, past experience with administration of energy efficiency programs as required (and limited) by states may be a poor indicator of the potential investment in EE going forward. While there certainly have been leading states pursuing substantial investments in EE, in most states the impact on electric rates, the limitations of laws, regulations, and policy (including policies that explicitly limit the amount of spending on energy efficiency), and the financial deterrent of lowering sales hindering utility efforts and investments in energy efficiency have all served to constrain the pace, level, and effectiveness of EE investment. In its current form, EPA's proposed regulation could vastly alter this dynamic by opening the door to states, new and existing market entities, owners of affected units, and utilities all investing in energy efficiency to take advantage of the use of EE as a compliance mechanism. EPA's proposed regulations could thus dramatically alter the delivery mechanisms, pace, magnitude, and market size of energy efficiency investments across the country over the next decade, compared to customer-funded utility programs.

But there is a wealth of information and data on historical EE implementation to draw from. Particularly in recent years, energy efficiency has become a key focus of state energy policy, with U.S. customer-funded electric efficiency budgets totaling $6.3 billion in 2013, a 37 percent increase over 2010 totals, and almost four times the national spending in 2006. Lawrence Berkeley National Laboratory predicts that, by 2025, energy efficiency budgets could exceed $12.2 billion under its "high" scenario assuming that no new major policy developments (such as a national carbon policy) take place, noting that such new policy changes could "result in customer-funded energy efficiency program spending and savings that exceed the values in our High Case."[1]

EPA's analysis keys in on the experience with energy efficiency investment/savings and the setting of energy efficiency standards in several key states in order to determine the potential impact of EE as a Clean Power Plan compliance mechanism, and help identify an adequately demonstrated Best System of Emission Reduction (BSER). Given the expanded set of EE compliance strategies that could occur under the Clean Power Plan, beyond traditional modes of EE investment, this may in the end represent a lower-bound estimate on what states are capable of, where EE is a cost-effective compliance alternative. Nevertheless, in this Report we comprehensively review state and utility experience with the implementation of EE programs over many years in order to evaluate EPA's assumed ramp rates and

[1] Barbose, G. L., C.A. Goldman, I. M. Hoffman, M. A. Billingsley, "The Future of Utility Customer-Funded Energy Efficiency Programs in the United States: Projected Spending and Savings to 2025," January 2013, LBNL-5803E, available at http://emp.lbl.gov/publications/future-utility-customer-funded-energy-efficiency-programsunited-states-projected-spend (hereafter "Barbose, 2013").

sustained savings levels, and determine whether they represent reasonable assumptions for the purpose of establishing state compliance standards.

Our assessment draws from the literature on EE program implementation and performance, publicly-available data sources, and state- and utility-specific documentation on EE policies and annual EE program budgets, savings rates and potential. Specifically, our analysis includes the following components:

- Literature review and evaluation of potential data sources reporting the historical performance of energy efficiency program administrators from federal and state agencies, national labs, EE groups/consortiums, and state- and utility-level reporting on energy efficiency program impacts;
- Quantitative analysis of historical ramp rates and savings levels of energy efficiency programs at the state and utility level focused on an up-to-date evaluation of states' experience with rapid expansion of funding for energy efficiency programs, and the corresponding capture of energy savings; and
- Analysis of the links between state-driven policy changes and subsequent rapid uptake of EE investments, with results tied to the rate and annual accrual of energy efficiency savings.

For this purpose, we only considered actual state/utility historical experience. We do not try to capture how EE could expand under the Clean Power Plan, how the incentives might change in response to new EE investment opportunities, or how the industry might expand with an increase in the magnitude and geographic scope of interest in EE measures and programs. Further, wherever possible, and absent more accurate sources, we calculated ramp rates and savings levels of energy efficiency programs using the state's aggregate reported savings from energy efficiency program administrators and the state's total electric retail sales in each year. For several reasons discussed in the Report, we believe our approach and observations based on the analysis may be overly-conservative – that is, our findings likely understate the potential ramp rate and sustained savings levels for energy efficiency investments on a going-forward basis.

Summary of Key Findings

There is a wealth of experience across the U.S. with implementation of energy efficiency programs, and a very wide range of efforts undertaken by individual states. Some states have sustained relatively high levels of energy efficiency investments over decades driven by prevailing high electricity prices and/or aggressive laws and regulations focused on energy and environmental policy. Other states are new to these efforts, only recently committing significant dollars for energy efficiency. And some – including in certain states with historically low energy prices – have pursued energy efficiency in only very limited ways.

The range of policies driving energy efficiency varies widely as well, including, for example capped system benefit charges that provided a funding source for energy efficiency programs, lost base-revenues recovery guarantees that neutralize a utility's disincentive to invest in energy efficiency, utility incentives that provide a positive incentive pursue energy efficiency, loading order and energy efficiency resource standards that mandate the capture of energy efficiency savings, and decoupling policies that fully separate a utility's revenues from its sales. And there is high variability year-to-year in EE program implementation, as state-specific policies or approaches change with new administrations, changes in industry structure (e.g., deregulation), and changes in underlying costs and resource needs.

Against this background, it is useful to consider the purpose of EPA's evaluation – should it represent average performance within or across states, the lowest common denominator, or the most cost effective

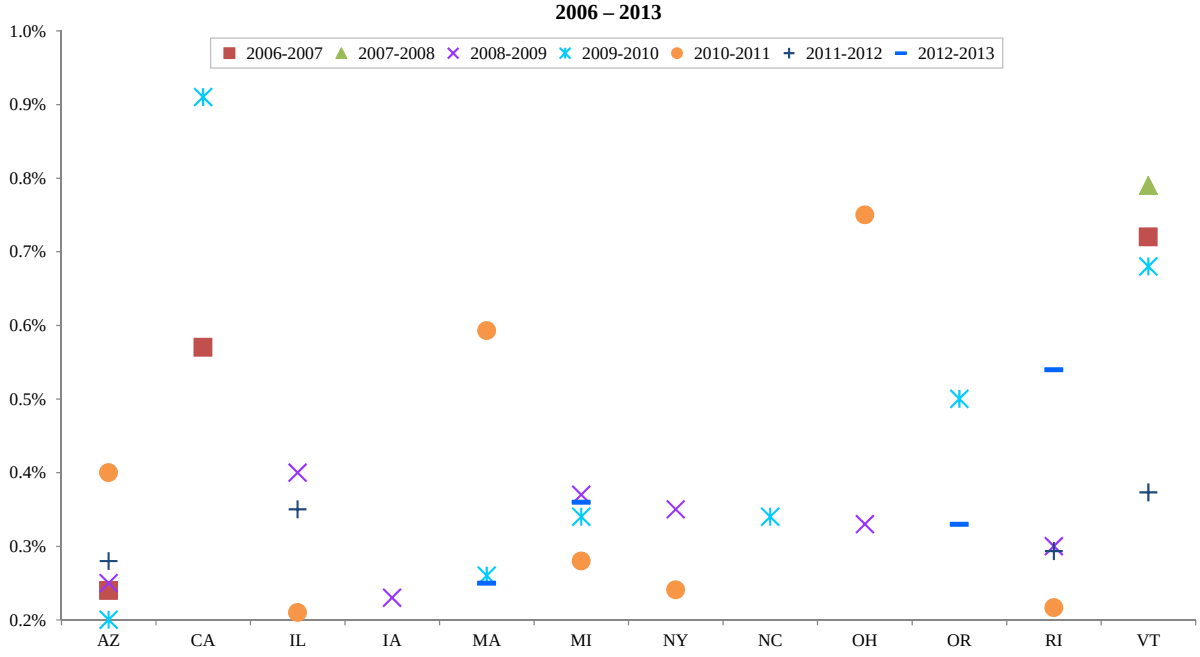
historical performance? Or should it be a bottom-up engineering assessment of the total quantity of EE that could be delivered at a cost (per ton reduced) of the next most cost-effective control strategy? Or should it reflect what appears to be a reasonable approximation of states' capabilities to achieve carbon reductions through a measured ramping-up of EE investments?

Based on our review of an expanded set of data on states' experiences with EE implementation, we find that at the very least the potential for cost effective investment in energy efficiency – meaning cost effective from the perspective of avoiding utility/ratepayer costs – is likely to exceed the values for EE ramp-up activities and sustained savings levels adopted by EPA in its own assessment. In short, if anything we expect that as part of a Clean Power Plan compliance strategy states could achieve rates of growth in EE savings in excess of 0.2 percent per year, and could likely sustain levels of energy savings (and associated emission reductions) above 1.5 percent of state retail electricity sales throughout the Clean Power Plan's compliance period.

There is a substantial body of experience with utility-driven EE performance supporting this conclusion:

- Many states and/or individual utilities have demonstrated – in many years – the ability to achieve growth in energy savings through EE investments year-on-year at rates well in excess of 0.2 percent, including a number of states that achieved *double and triple that rate*. See **Figure ES-1**. This includes states often considered first movers or leaders in EE programs, as well as states that do not fit that category.

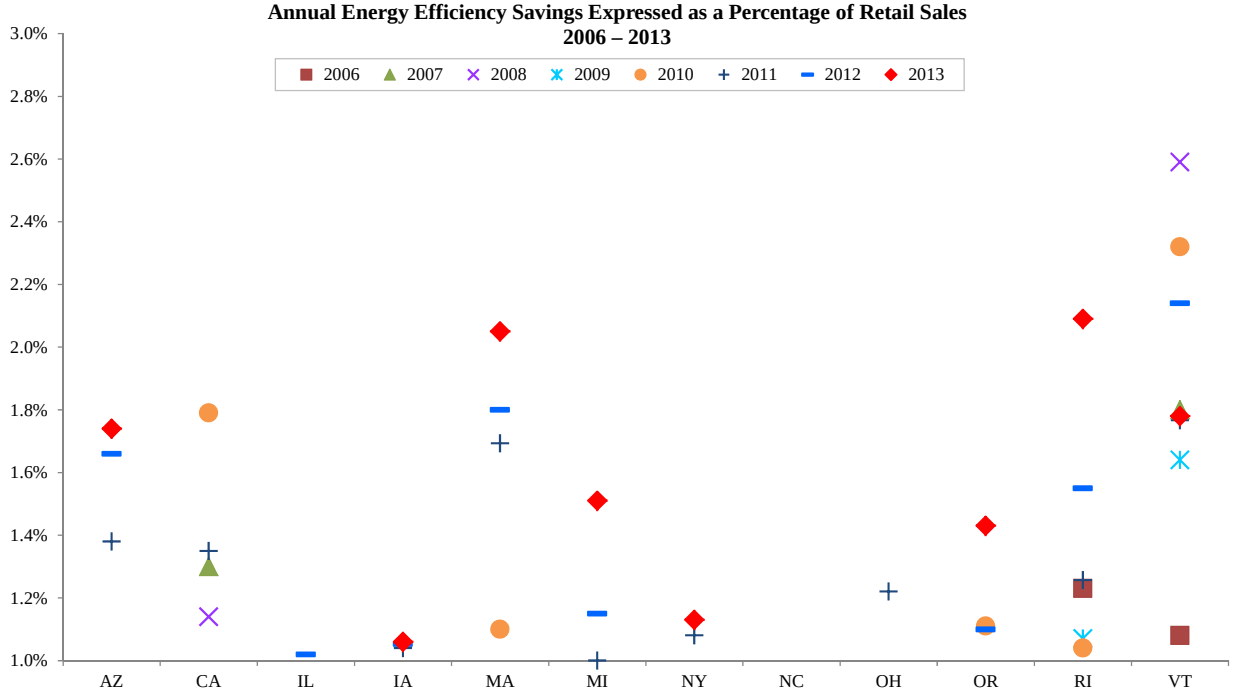
Figure ES-1
Annual Energy Efficiency Ramp Rates Expressed as a Percentage of Retail Sales
2006 – 2013



Notes & Sources:
Sources for savings vary by year. Ramp rate is calculated as the change in savings between two years. Savings data for 2013 are from the 2014 ACEEE State Scorecard when available. For 2012, sustained savings figures are from NEEP when available, otherwise savings are from Appendix H of the 2013 ACEEE State Scorecard. When neither NEEP nor ACEEE data are available for 2012, EIA Form 861 data are used. For 2011, sustained savings figures are from NEEP when available, otherwise savings are from the 2012 ACEEE State Scorecard. For the years 2006 to 2010, sustained savings are from the 2008 – 2011 ACEEE State Scorecards. Prior to 2010, incremental energy efficiency savings from the EIA are reported at a NERC region level. Savings are mapped to states for these years, first, by mapping utilities to states using EIA data from 2010 to 2012, and remaining savings were mapped using sales data for a given year.

- Many states and utilities have demonstrated the ability to rapidly change gears and increase the annual rate of savings quickly in response to changes in policy, indicating that rapid and major expansion of EE programs does not require a long lead time.
- States have demonstrated the ability to sustain high levels of EE savings over many years, in some cases at annual average savings rates over EPA's assumed 1.5 percent. See **Figure ES-2**.
- The successful demonstration of states' ability to meet aggressive ramp rate and/or sustained savings levels holds true across a wide cross-section of states and delivery mechanisms, representing different electric industry structures; different electricity costs; different parts of the country with different climates and electricity needs; different mixes of residential, commercial, and industrial customers; and vastly different modes of EE program implementation (e.g., by utilities, compacts/associations, state agencies; and third-party contractors).

Figure ES-2
Annual Energy Efficiency Savings Expressed as a Percentage of Retail Sales
2006 – 2013



Notes & Sources:
Sources for savings vary by year. Savings data for 2013 are from the 2014 ACEEE State Scorecard when available. For 2012, sustained savings figures are from NEEP when available, otherwise savings are from Appendix H of the 2013 ACEEE State Scorecard. When neither NEEP nor ACEEE data are available for 2012, EIA Form 861 data are used. For 2011, sustained savings figures are from NEEP when available, otherwise savings are from the 2012 ACEEE State Scorecard. For the years 2006 to 2010, sustained savings are from the 2008 – 2011 ACEEE State Scorecards. Prior to 2010, incremental energy efficiency savings from the EIA are reported at a NERC region level. Savings are mapped to states for these years, first, by mapping utilities to states using EIA data from 2010 to 2012, and remaining savings were mapped using sales data for a given year.

- Even though many customer-funded EE programs have historically been undertaken by regulated utilities responding to state policy mandates, highly successful implementation of energy efficiency has also been realized at municipal electric companies, electric cooperatives, and by private industries.
- Through continuous implementation of EE over multiple decades, it is becoming clear that EE is not a finite resource – that is, as states and utilities have implemented EE programs over many years, few if any have begun to see meaningful diminishing returns in EE investments. Huge energy efficiency potential remains even in states that have had sustained aggressive levels of EE investment. Evidence suggests that the point at which sustained annual savings from EE begin to

experience increased unit costs would be at annual savings rates well above the levels EPA has assumed in its evaluation of sustainable savings levels.

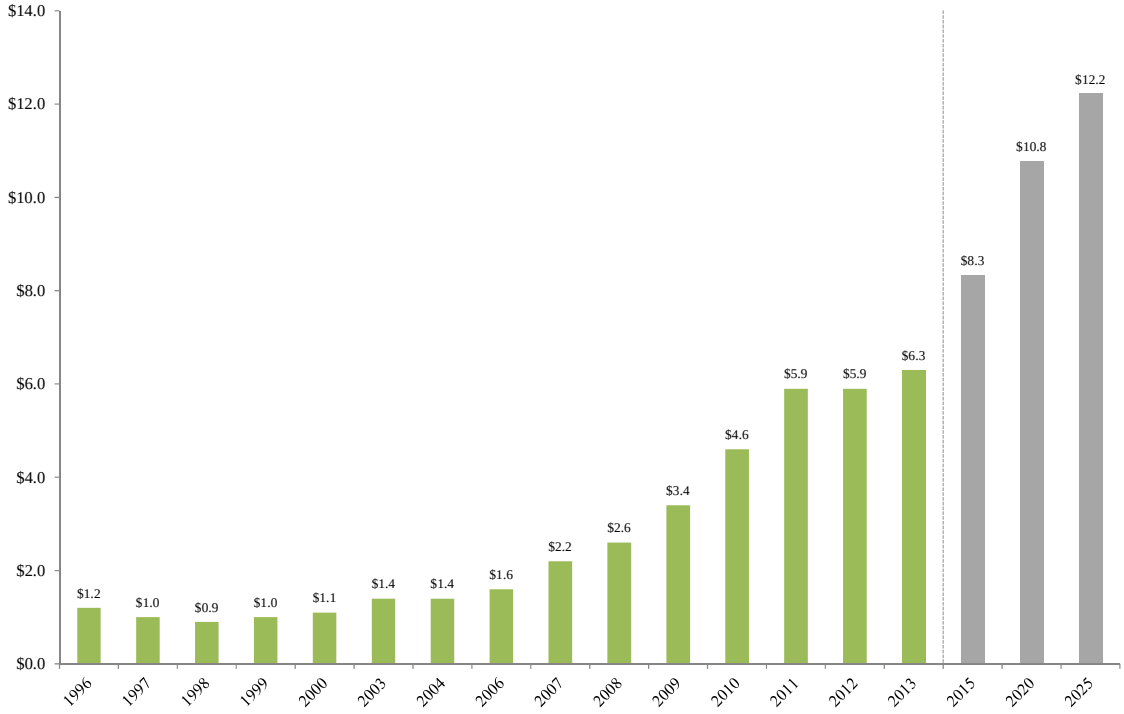
Many states throughout the U.S. have realized that energy efficiency is and should be our "first fuel." Portfolio standards, loading order requirements, integrated resource planning standards, and the like all reflect a realization that there is a vast untapped and cost-effective EE potential remaining in all the states. In developing its proposed Clean Power Plan standards, EPA assumed that states can achieve a rate of increase in energy efficiency savings of at least 0.2 percent of annual electricity sales, and sustain a level of EE savings of 1.5 percent over the compliance period. Based on our review of primarily utility-driven EE programs and data on the results of implementation, we believe that EPA's numbers are on solid ground and, if anything, understate the potential to reach and sustain high levels of EE savings.

2. INTRODUCTION

Background

Energy efficiency has become a key focus of state energy policy in recent years, with U.S. customer-funded electric efficiency budgets totaling $6.3 billion in 2013, a 37 percent increase over 2010 totals, and almost four times the national spending in 2006. (See **Figure 1** below.) Over the coming years, as different states develop new programs and energy efficiency policy requirements expand, we can expect some new states to become leaders in energy efficiency. Lawrence Berkeley National Laboratory predicts that, by 2025, energy efficiency budgets could exceed $12.2 billion under its "high" scenario assuming that no new major policy developments (such as a national carbon policy) take place, noting that such new policy changes could "result in customer-funded energy efficiency program spending and savings that exceed the values in our High Case."[2]

Figure 1
U.S. Electric Energy Efficiency Program Spending ($ billions)
1996 – 2025



Notes & Sources:
[1] Figures represent electric energy efficiency program spending or budget. Figures for 1996 to 2008 represent actual program spending, including customer funded programs. Figures for 2009 to 2013 represent program budgets. ACEEE 2014 State Scorecard, Figure 2.
[2] Figures for 2015, 2020, and 2025 represent the "High" projections as reported in Barbose, Galen, et al., "The Future of Utility Customer-Funded Energy Efficiency Programs in the United States: Projected Spending and Savings to 2025," January 2013, Table B-1. Electric Energy Efficiency Program Spending Projections by State.

States have been rapidly expanding their spending on energy efficiency in recent years: according to the Edison Foundation's Institute for Electric Innovation, in 2012, five states (Indiana, South Dakota,

[2] Barbose, 2013.

Tennessee, Virginia, and West Virginia) more than doubled their electric efficiency expenditures relative to 2011 levels, and in 2011, three states (Indiana, Ohio, and Pennsylvania) had doubled their spending relative to 2010 levels.[3]

This expansion can be largely attributed to new and strengthened state policies that target the procurement of energy efficiency. These policies need not be mutually exclusive and some states have implemented various combinations of overlapping policies and mandates. Nevertheless, these policies can take many forms, including, for example:

1. Policies that provide a funding source for energy efficiency programs:
    - Program funding for energy efficiency programs embedded in utility bills paid by customers and often referred to as system benefit charges ("SBCs"). SBCs exist in 14 states and were typically established more than a decade ago as part of larger electric industry restructuring processes.[4]
2. Policies that require the consideration and assessment of meeting customers' needs through a broad range of resource options, including meeting demand for electricity through energy efficiency resources:
    - Integrated resource planning requirements exist in 34 states (primarily in the West and Southeast) and in areas served by the Tennessee Valley Authority, whereby utilities are required to plan for the long-term needs of their customers by considering and assessing a broad range of resource options, including meeting demand for electricity through energy efficiency resources.[5]
    - Utilities in 28 states are required to regularly submit a demand-side management or multi-year energy efficiency plan to their state regulator, proposing a specific portfolio of programs that meet cost-effectiveness guidelines and other policy objectives, typically on a one- to three-year cycle.[6]
3. Policies that mandate the capture of energy efficiency savings:
    - "Loading order" policies, requiring utilities to procure all cost-effective conservation and energy efficiency resources – either as a stand-alone requirement on distribution-only utilities, or on vertically-integrated companies before adding new generation resources. Currently, six states – California, Connecticut, Massachusetts, Rhode Island, Vermont, and Washington – have these types of policies in place.[7]
    - Energy Efficiency Resource Standards ("EERS"), that is, policies adopted as a matter of policy, legislation or regulation that establish specific, long-term targets for energy

[3] "Summary of Electric Utility Customer-Funded Energy Efficiency Savings, Expenditures, and Budgets," Institute for Electric Innovation, March 2014; and "Summary of Electric Utility Customer-Funded Energy Efficiency Savings, Expenditures, and Budgets (2011-2012)," Institute for Electric Innovation, March 2013.

[4] Barbose, 2013.

[5] Barbose, 2013.

[6] Barbose, 2013.

[7] Barbose, 2013.

savings to be met through customer energy efficiency programs offered by utilities or independent program administrators, are currently in place in 24 states.[8]

4. Ratemaking mechanisms and policies that overcome disincentives faced by utilities to pursue energy efficiency:

    - Policies that guarantee recovery of the costs of efficiency program expenditures and/or recovery of lost base-revenues in order to that neutralize a utility's disincentive to invest in energy efficiency.

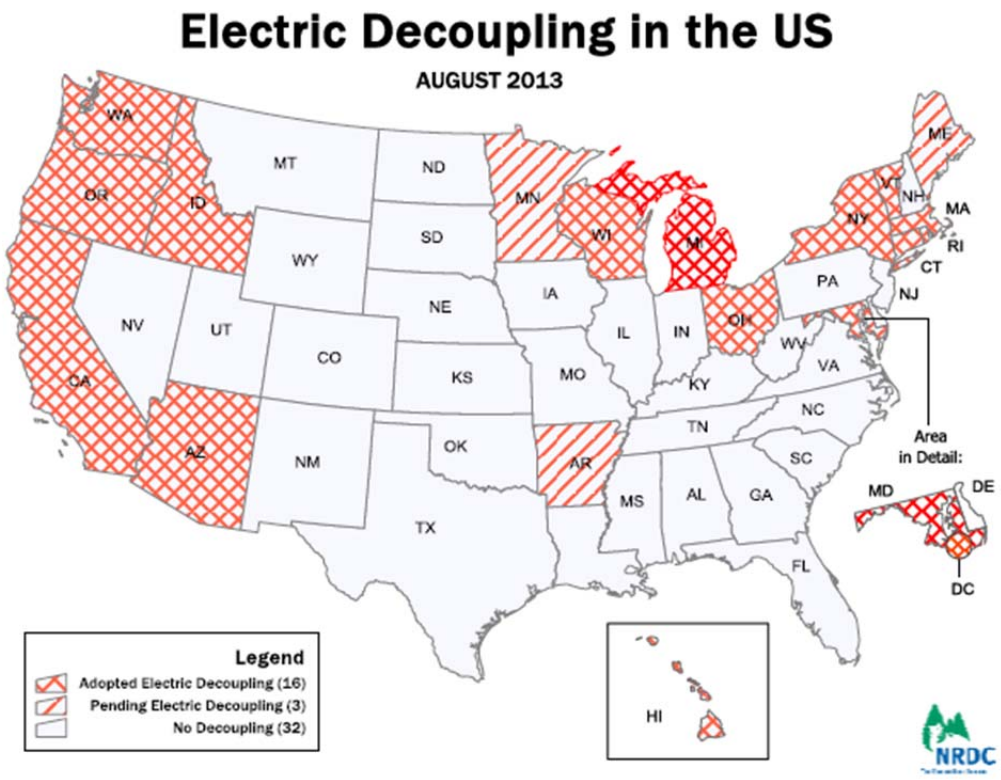
    - Revenue decoupling, that is, a rate adjustment mechanism that a "decouples" (a) the utility's ability to recover the allowed revenues from (b) the actual volume of unit sales that occurs over time via a true-up mechanism – has become increasingly popular in recent years, with 16 states having electric decoupling programs in place, and 3 more with programs pending as of August 2013. (See **Figure 2** below).

    - Performance incentives are financial incentives that reward utilities (and in some cases, non-utility program administrators) for reaching or exceeding specified program goals. Currently, 30 states have a performance incentive in place or pending for electric utilities.[9]

[8] These states include: Arizona, Arkansas, California, Colorado, Connecticut, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, Washington, and Wisconsin. In 2014, the Ohio and Indiana legislatures rolled back EERS policies that were previously in place. See ACEEE, "The 2014 State Energy Efficiency Scorecard," Report Number U1408, October 2014.

[9] ACEEE, "The 2014 State Energy Efficiency Scorecard," Report Number U1408, October 2014.

Figure 2

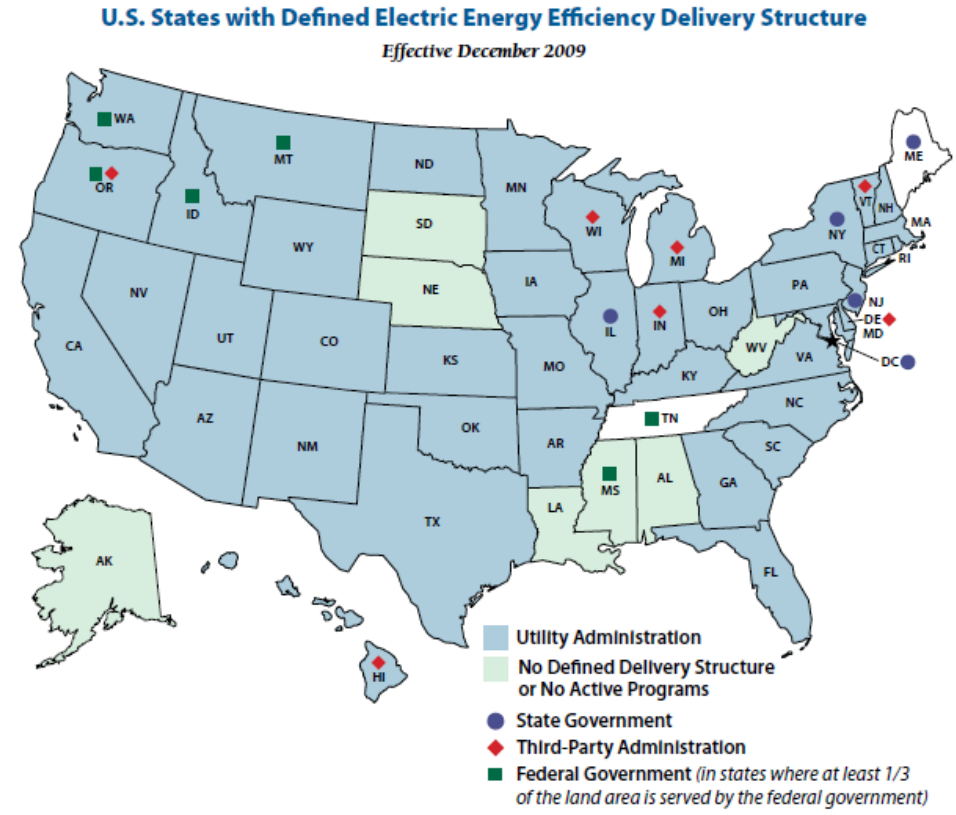


Source: Natural Resources Defense Council, available at http://www.nrdc.org/energy/decoupling/

There are several different delivery structures through which states administer energy efficiency programs. Electric utilities are by far the largest providers of customer-funded energy efficiency programs in the U.S., responsible for 89 percent of the total customer-funded electric efficiency expenditures nationwide.[10] Some states however have state government serve as program administrators, or use independent third-parties (See **Figure 3** below). There is also substantial investment in energy efficiency taking place outside of the context of customer-funded and/or state-administered programs, including through private investment in energy efficiency.

[10] "Summary of Electric Utility Customer-Funded Energy Efficiency Savings, Expenditures, and Budgets," Institute for Electric Innovation, March 2014.

Figure 3



Source: *RAP 2009 Policy Grid Update*

Approach

EPA's draft Clean Power Plan sets state-specific standards for the amount of CO_2 allowed to be emitted per megawatt-hour of electricity produced at affected facilities. In setting the standards applicable to each state's power plants, EPA used a standardized methodology based on assumptions about the amount of emissions reduction that could occur through investments and operational changes at affected power plants, through efficiency improvements at certain existing carbon-emitting generating sources, expanded use of existing and new low- and zero-carbon generating sources, and through energy efficiency. (EPA refers to these as its "building blocks.") EPA's fourth building block focuses on increased deployment of demand-side energy efficiency in order to reduce the amount of electric generation required and lower carbon emissions. As part of this building block, EPA assumes that states can scale or "ramp" their energy efficiency programs at a rate of 0.2 percent of total electric retail sales (measured as the kWh of incremental energy efficiency savings as a percentage of total retail sales annually) beginning in 2017, until that state achieves a savings rate of 1.5 percent of total electric retail sales in that year. States are then assumed to maintain or "sustain" this 1.5 percent savings level through the compliance period.

While EPA's draft Clean Power Plan and supporting documents provide analyses and cite evidence in support of these key energy efficiency assumptions, additional information and analysis on savings levels and ramp rates available in the literature or experienced by individual states and companies reinforces and corroborates EPA's core conclusions. In this Report, we evaluate the reasonableness of EPA's assumptions by undertaking an extensive analysis of the actual historical experience of states and program administrators in capturing savings from energy efficiency and considering how the Clean Power Plan assumptions about EE compare in this broader context.

Our analysis included the following components:

- Identification and evaluation of potential data sources reporting the historical performance of energy efficiency program administrators including, for example, data from the Energy Information Administration, the American Council for an Energy Efficient Economy ("ACEEE"), the Consortium for Energy Efficiency ("CEE"), and regional energy efficiency organizations (e.g., the Northeast Energy Efficiency Partnership ("NEEP"), the Southwest Energy Efficiency Project ("SWEEP"), the Midwest Energy Efficiency Alliance ("MEEA"), etc.) as well as state- and utility-level reporting on energy efficiency program impacts;
- Analysis of historical ramp rates and savings levels of energy efficiency programs at the state and utility level to provide an up-to-date evaluation of states' experience with rapid expansion of funding for energy efficiency programs, and the corresponding capture of energy savings; and
- Consideration of the extent to which significant policy changes (e.g., introduction of energy efficiency resource standards, requirements to capture all cost-effective energy efficiency, etc.) led to rapid increases in state energy efficiency spending and determination of the extent to which the Clean Power Plan could represent a significant national policy change relative to past state efforts to implement energy efficiency.

Wherever possible, Analysis Group calculated ramp rates and savings levels of energy efficiency programs using the state's aggregate reported savings from energy efficiency program administrators and the state's total electric retail sales in each corresponding year. There are a variety of reasons why a state's total retail sales may overstate the scope of sales that the energy efficiency program savings correspond to. For example, some state policies stipulate that small or municipal utilities are excluded from requirements to administer energy efficiency programs and some states have provisions allowing large and/or industrial customers to "opt-out" of energy efficiency programs (and any corresponding customer funding of such programs). These provisions would shrink the relevant baseline of electric sales, resulting in higher savings rates than Analysis Group's methodology would produce. As noted by ACEEE, among the states with EERS as of January 2014, the proportion of total electric sales covered by the state's EERS ranges from a low of 53 percent (in Arkansas) to a high of 100 percent (in Hawaii, Maine, Maryland, Michigan, Minnesota, New York, Vermont, and Wisconsin).[11] For this and other reasons discussed throughout the Report, we expect that our method may underestimate actual state experience with energy efficiency capture and thus our findings may be viewed as overly-conservative,

[11] Downs, Annie and Cui, Celia. "Energy Efficiency Resource Standards: A New Progress Report on State Experience," ACEEE Report Number U1403, April 2014.

particularly in the context of the vastly expanded EE funding and delivery mechanisms that may be available as compliance options under the Clean Power Plan.

3. EPA'S CLEAN POWER PLAN

Overview

On June 2, 2014, the U.S. EPA proposed rules to reduce CO_2 emissions from existing electric generating units (EGUs) through section 111(d) of the Clean Air Act (CAA).[12] The proposed rules, called the "Clean Power Plan," are anticipated to ultimately lower CO_2 emissions from the power sector by 30 percent relative to levels in 2005. EPA proposes a two-part goal structure: an "interim goal" that states must meet on average over the ten-year period from 2020-2029 and a "final goal" that states must meet at the end of that period in 2030 and thereafter. Under the CAA, EPA establishes the target level of emission rate reductions for each state, and the states develop (and submit to EPA for approval) State Plans to meet EPA's requirements.

EPA's proposal sets state-specific standards in terms of pounds of CO_2 allowed to be emitted per megawatt-hour (MWh) of electricity produced at affected facilities. In setting the standards applicable to each state's power plants, EPA used a standardized methodology based on assumptions about the amount of emissions reduction that could occur through investments and operational changes at affected power plants, through zero-carbon generating sources, and through energy efficiency. No state, however, is required to use all of those approaches, or to use them in the manner suggested by EPA's analysis.

States may choose from a wide variety of potential compliance mechanisms, actions and investments. Among the many options are: modifications at existing EGUs to increase their power-production efficiency; operating limits at EGUs; real or shadow prices on carbon emissions; emission-averaging across power plants; participation in single state or multi-state market-based emission-trading programs; reliance on non-fossil alternatives, including ones that reduce demand through energy efficiency (and therefore reduce output at fossil plants), and others that retain/increase low/zero-CO_2 emitting resources (e.g., new renewable energy and existing or new nuclear capacity).

EPA's Proposed Clean Power Plan:

- State-specific targets to reduce CO_2/MWh produced at existing fossil-fuel power plants.
- Two compliance periods: 2020-2029 (averaging compliance over the decades, to meet an interim target) and another by 2030.
- State Plans to be submitted to EPA to show how the state and the power plants within it will comply with the targets.
- States have the flexibility to propose a wide variety of options in their plans, including actions that directly affect emissions from fossil power plants (EGUs) and actions that indirectly affect those EGUs' emissions (such as through energy efficiency, policies that encourage more investment in zero-carbon power generation technologies, or changes to electric transmission infrastructure).
- States may propose market-based mechanisms.
- States may join together for regional plans.
- States may use a "rate-based" approach (i.e., CO_2/MWh) or a "mass-based" approach (i.e., a total amount of CO_2 allowed to be emitted in the state, sometimes also called a CO_2 budget or cap).

Each state will choose what elements to include in its State Plan for compliance. States may also be able to layer on various approaches as part of their State Plans. For example, rather than requiring a certain average level of emissions at each plant, a state with vertically integrated utilities could decide to allow all

[12] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule, Environmental Protection Agency, 40 CFR Part 60, Federal Register, Vol. 79, No. 117, June 18, 2014 (hereafter the "Clean Power Plan").

of the plants owned by a particular company to average the emissions across its fleet. States can determine how to adopt cost-sharing approaches so that those customers that benefit from such flexibility may share some of those benefits with customers of other electric companies needing to do more.

Importantly, the Clean Power Plan allows a state to meet requirements through market-based approaches that leave the market to determine the cheapest compliance options, minimizing the state's overall compliance costs. As an extension of this, states may also decide to enter into agreements with other states that establish an overall blended-average emissions cap, and allow owners of plants in multiple states to trade their emissions reductions so that on average, all plants in the relevant states achieve the average emission-reduction target.

The Clean Power Plan's Four Building Blocks

In setting its state-specific standards, EPA used four building blocks that can be used to reduce carbon emissions. EPA then analyzed historical data about emissions and the power sector to create a consistent national formula for reductions that reflects these four building blocks. The formula applies the building blocks to each state's specific information, yielding a carbon intensity rate for each state (i.e., CO_2 emissions per MWh). These building blocks and assumptions are as follows:

1. *Improved Heat Rates.* Fossil fuel power plants can undergo improvements in equipment and processes to use less fossil fuel to create the same amount of electricity, thus lowering carbon emissions. In setting its state emissions goals, EPA assumed that coal steam electric generating units in each state would undergo an average heat rate improvement of six percent.
2. *Increased Dispatch of Existing Low-Emitting Power Sources.* Less carbon pollution can be generated by using lower-emitting power plants more frequently to meet demand and using the most carbon-intensive power plants less frequently. EPA assumed that increased generation from existing and under-construction natural gas combined cycle ("NGCC") plants would substitute for generation from coal-fired generating units, up to an average NGCC capacity factor of 70 percent.
3. *Expanded Use of Zero and Low-Emitting Power Sources.* Expanding renewable generating capacity, such as solar and wind, and using low-emitting nuclear facilities can lower carbon emissions. EPA assumed that new clean generation, including new nuclear generation under construction, moderate deployment of new renewable generation, and continued use of existing nuclear generation would occur in each state, based on the assumption that under-construction and existing nuclear capacity would achieve an average capacity factor of 90 percent, as well as state-specific assumptions about renewable generation growth.
4. *Increased Deployment of Demand-Side Energy Efficiency.* Reducing demand for electricity will reduce the amount of generation required, lower carbon emissions, and will save consumers and business who consume less power money. EPA assumed that states would increase annual savings from energy efficiency at a rate of 0.2 percent of sales per year, until reaching a savings level of 1.5 percent annually.

Spotlight on Building Block Four (Increased Deployment of Energy Efficiency)

In support of its fourth building block, EPA's draft Clean Power Plan identifies a number of features of state experience with energy efficiency programs to date, future state requirements for the capture of energy efficiency savings, and estimates of the amount of energy efficiency potential available across the states. Based in part on this analysis, EPA describes its methodology and assumptions regarding state's abilities to scale their energy efficiency programs in the future, and maintain energy efficiency savings levels over time.

In setting its state-specific standards, EPA's fourth building block assumes that states can scale or "ramp" their energy efficiency programs at a rate of 0.2 percent of total electric retail sales (measured as the kWh of incremental energy efficiency savings as a percentage of retail sales annually) beginning in 2017,[13] until that state achieves a savings rate of 1.5 percent of total electric retail sales in that year. States are then assumed to maintain or "sustain" this 1.5 percent saving level through the compliance period.

Evidence Offered by EPA in Support of its Energy Efficiency Assumptions

Chapter five of EPA's Greenhouse Gas Abatement Measures Technical Support Document[14] ("GHG TSD") provides background on demand-side energy efficiency as an abatement measure to reduce carbon dioxide and further explains EPA's findings in support of its assumptions regarding state's ability to achieve carbon reductions through these programs. The GHG TSD observes that efficiency programs have traditionally resulted from a number of different policy approaches or "drivers." These include states with the following types of policies:

- energy efficiency resource standards ("EERS") (24 states);[15]
- system benefit charges that fund energy efficiency programs (14 states);
- integrated resource planning requirements (34 states);
- demand-side management plan or multi-year energy efficiency budget (28 states); and
- statutory requirements to acquire all cost effective energy efficiency (6 states).[16]

In describing its assumption regarding states' ability to ramp their energy efficiency programs, EPA finds that 0.2 percent per year is a "rate consistent with past performance and future requirements of leading states."[17] In support of that assumption, EPA cites the following:

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[13] EPA set each state's level of EE performance (incremental savings) in 2017 to its 2012 level of performance. This approach reflects neither improvement nor decline in performance between 2012 and 2017 and any improvement in EE savings performance between 2012 and 2017 will benefit a state in meeting its state EE goals for future compliance periods.

[14] Technical Support Document (TSD) for Carbon Pollution Guidelines for Existing Power Plants: Emission Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units, GHG Abatement Measures, Docket ID No. EPA-HQ-OAR-2013-0602, hereafter "GHG TSD".

[15] These states include: Arizona, Arkansas, California, Colorado, Connecticut, Hawaii, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, Washington, and Wisconsin. In 2014, the Ohio and Indiana legislatures rolled back EERS policies that were previously in place. See ACEEE, "The 2014 State Energy Efficiency Scorecard," Report Number U1408, October 2014.

[16] GHG TSD, pp. 5-12, 5-13.

[17] Clean Power Plan, p. 34872.

1. Based on its analysis of Form 861 data from the U.S. Energy Information Administration ("EIA") of the historical performance of energy efficiency programs, EPA divided program administrators into two groups: (1) a moderate group, defined as programs that achieved from 0.8 to 1.5 percent maximum incremental savings levels, and (2) a high group, defined as programs that achieved greater than 1.5 percent maximum incremental savings levels. EPA then calculated the rate at which each entity had increased savings overt time and calculated average values for each sub-group. EPA found an average rate of improvement of incremental annual savings rate of 0.3 percent per year for the moderate group, and 0.38 percent for the high group.[18]
2. Based on its review of ACEEE's "2013 State Energy Efficiency Scorecard,"[19] EPA identifies 10 states that have an EERS policy with a defined ramp-up schedule (Arizona, Arkansans, Colorado, Illinois, Indiana, Massachusetts, Michigan, Ohio, Oregon, and Rhode Island). These 10 states require annual ramping of energy efficiency savings of between 0.11 percent (Colorado) to 0.40 percent (Rhode Island), with an average of 0.21 percent annually.[20]

Similarly, in describing its assumption on sustained savings levels, EPA finds that "twelve leading states have either achieved – or have established requirements that will lead them to achieve – annual incremental savings rates of at least 1.5 percent of the total electricity demand that would otherwise have occurred" and concludes that "we consider the 1.5 percent annual incremental savings rate to be a reasonable estimate of the energy efficiency policy performance that is already achieved or required by leading states and that can be achieved at reasonable costs by all states given adequate time."[21]

In support of its assumption that states can achieve annual savings of 1.5 percent, EPA cites three key types of information:

1. Based on its analysis of EIA Form 861 data for the year 2012, EPA identified three states (Arizona, Maine, and Vermont) that achieved at least 1.5 percent annual incremental savings from their energy efficiency programs in 2012, and another eight (California, Connecticut, Iowa, Michigan, Minnesota, Oregon, Pennsylvania, and Wisconsin) that achieved between 1.0 percent and 1.49 percent.[22]
2. Based on its review of ACEEE's 2014 "State EERS Activity Policy Brief,"[23] EPA finds that 11 states are required to achieve 1.5 percent or greater annual savings as a percentage of total retail sales from energy efficiency under state EERS policy on or before 2020, and an additional five states are required to achieve between 1.0 percent and 1.49 percent. Of the 11 states that will achieve 1.5 percent by 2020, nine of these (Colorado, Illinois, Indiana, Massachusetts, Minnesota, New York, Ohio, Rhode Island, and Washington) are incremental to the three states that already achieved 1.5 percent in 2012.

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[18] GHG TSD, pp. 5-34, 5-35, 5-69, and 5-70.

[19] ACEEE, "2013 State Energy Efficiency Scorecard," November 2013.

[20] GHG TSD, pp. 5-69 – 5-72.

[21] Clean Power Plan, p. 34872.

[22] GHG TSD, pp. 5-32 – 5-33.

[23] ACEEE, State Energy Efficiency Resource Standard (EERS) Activity Policy Brief, February 24, 2014, available at www.aceee.org/files/pdf/policy-brief/eers-02-2014.pdf.

3. Finally, EPA cites a variety of literature on energy efficiency potential that are supportive of the reasonableness of its assumptions, including:
    - A 2013 study by Lawrence Berkeley National Laboratory that projects that under its "high" scenario, 20 states would be achieving 1.5 percent or higher levels of annual incremental savings from energy efficiency by 2025, with 11 of those states reaching or exceeding 2.0 percent. The study presumes that no new major policy developments, such as a national carbon policy, take place and explicitly notes that such a policy change could "result in customer-funded energy efficiency program spending and savings that exceed the values in our High Case."[24]
    - Two recent meta-analyses of energy efficiency potential at the state and regional levels (Sreedharan 2013, Eldridge 2008) and one meta-analysis at the utility level conducted by EPA for the Clean Power Plan.[25]
    - Three recent analyses of energy efficiency potential at the national level that find average annual achievable potential of: between 0.2 and 0.4 percent (realistic to maximum achievable, Electric Power Research Institute ("EPRI") 2009), between 0.5 and 0.6 percent (achievable to high achievable, EPRI 2014), and 1.5 percent per year (ACEEE 2014). EPA notes that the two EPRI studies used a bottom-up, engineering approach in forming their estimates while ACEEE used a top-down, policy-based approach.[26]

A review of these potential studies reveals the highly case-specific nature of rigorous and thorough EE potential analyses, which produce reasonable potential estimates in a manner that, while generally consistent in approach, reflect the diversity of EE program approaches, maturity, and regulatory/political context. As a result, each individual study may use different definitions of EE potential and rely on different specific methods and underlying assumptions, reflecting, e.g., whether or not achievable potential should reflects a budget cap or constraint.[27] As an example, studies with longer study periods tend to have lower energy potential estimates (all else equal) because technology improvements so far into the future are not incorporated sufficiently, and assumptions about customer participation may not be accurately reflected.[28] Given the multitude of assumptions that go into potential studies, it is then not surprising to find disparate results across studies.

While EPA's GHG TSD provides analysis and cites evidence in support of its key energy efficiency assumptions – states' ability to ramp their energy efficiency programs at 0.2 percent of total retail sales annually and sustain savings levels of 1.5 percent – additional evidence on these factors is available in the literature and from the experience of diverse states and utilities. Below we offer additional evidence relevant to EPA's assumptions, in light of the paradigm shift that the Clean Power Plan represents from

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[24] Barbose, 2013.

[25] Sreedharan, P, "Recent estimates of energy efficiency potential in the USA," Energy Efficiency Journal, January 2013; Eldridge et. al., "State-Level Energy Efficiency Analysis: Goals, Methods, and Lessons Learned," ACEEE Summer Study on Energy Efficiency in Buildings, 2008; and GHG TSD, Appendix 5-1.

[26] EPRI, U.S. Energy Efficiency Potential Analysis through 2035, April 2014; and ACEEE, "Change Is in the Air: How States Can Harness Energy Efficiency to Strengthen the Economy and Reduce Pollution," April 2014, Report E1401. .

[27] Kramer, Chris and Glenn Reed, "Ten Pitfalls of Potential Studies," RAP, November 2012, p. 5.

[28] Neubauer, Max, "Cracking the TEAPOT: Technical, Economic, and Achievable Energy Efficiency Potential Studies," ACEEE, Report U1407, August 2014, p. 28.

past state efforts to implement energy efficiency, and given our own extensive analysis of the historical experience of states and program administrators in capturing savings from energy efficiency.

4. CONTEXT FOR REVIEW OF EPA'S METHOD & CONCLUSIONS REGARDING RAMP RATES AND SUSTAINED SAVINGS

EPA expects that states can invest in EE as the most cost-effective means of securing carbon emission reductions. By including explicit opportunities to harness EE, EPA has opened the door to states developing compliance approaches that include investment in EE programs and measures – by states, compliance entities, or others (e.g., through revenues created from the sale of allowances in cap-based approaches or other compliance mechanisms). This introduces the possibility of an expanded set of EE investments, to supplement traditional utility programs, and an expanded set of EE investors and providers that are motivated to invest in EE, rather than deterred – as have utilities in the past – by an underlying profit disincentive. Further, the geographic scope of EE investment will likely expand, creating new business opportunities, since it will no longer be limited to utility-administered EE programs in states that find it in their economic, energy and/or environmental policy interests to require such investment.

States' prior experience with EE program ramping/savings levels varies substantially across states, and over time within states. State EE has been largely the result of utility-driven investments constrained by legislation and regulation limiting EE practices to those deemed appropriate from a state regulatory perspective. A handful of states have, at times, allowed for relatively aggressive levels of investment in EE by utilities, where investments are found to be cost-effective relative to alternative investments. But investment in EE in states has rarely – if ever – approached a rate of growth or sustained levels that would be justified solely based on cost effectiveness, or actual technical or economic potential. The pace and level of historical EE investments, and the performance of utility EE programs, have also sometimes faced the headwind of fundamental disincentives at utilities for investment in programs that reduce revenues and profits (incentives, lost-base revenue adjustments and decoupling rate designs partially – but not fully – address these disincentives). Thus, while EPA set state emissions rate using an adequately demonstrated BSER, the pace and level of past EE investments must be viewed as a poor indicator of the *potential* pace and level of state EE investment within states.

Consequently, past experience with administration of energy efficiency programs as required (and limited) by states must be viewed as an imperfect and extremely conservative indicator of the potential investment in EE going forward. While there certainly have been leading states pursuing substantial investments in EE, in most states the rate, policy and financial disincentives have all served to constrain the pace, level, and effectiveness of EE investment. In its current form, EPA's proposed regulation could alter this dynamic by opening the door to states, new and existing market entities, owners of affected units, and utilities all investing in energy efficiency to take advantage of the use of EE as a compliance mechanism. EPA's proposed regulations could thus dramatically alter the delivery mechanisms, pace, magnitude, and market size of energy efficiency investments across the country through the compliance period, compared to current customer-funded utility programs.

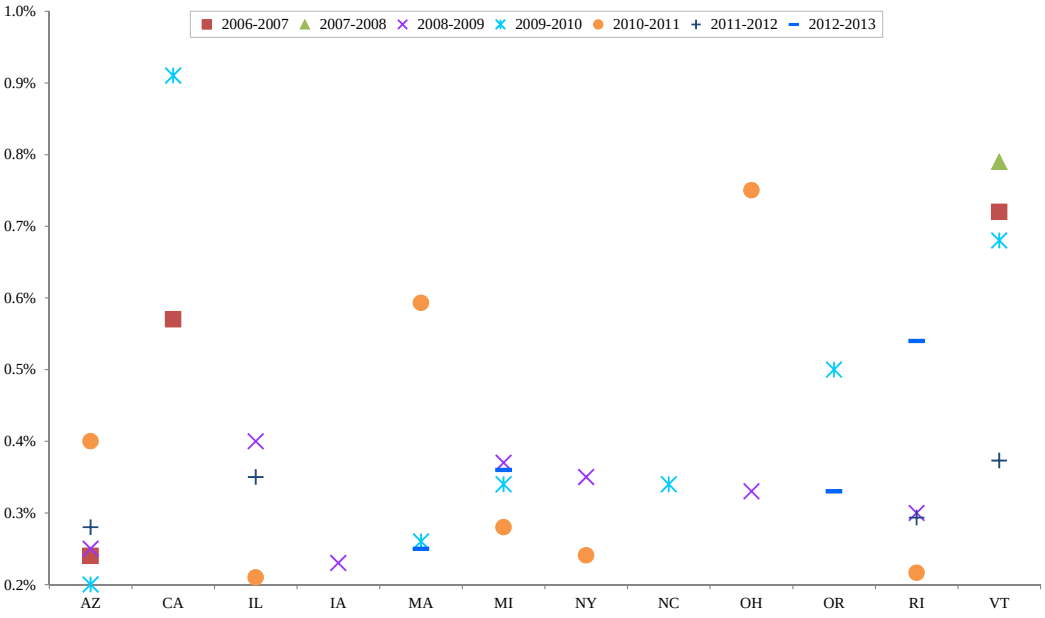
In short, we expect that the possibility of complying with the Clean Power Plan's requirements in whole or in part through EE installations will unshackle EE investment from constrained state regulatory policy, and open up EE activity to new players, new programs, an expanding market for EE services, and new revenues. In our view this is a fundamental consideration in judging the value of historical data, and must

be kept in mind when judging the reasonableness of EPA's key assumptions surrounding states' ability to scale and sustain energy efficiency programs.

5. STATE & UTILITY EXPERIENCE WITH RAMPING ENERGY EFFICIENCY PROGRAMS

As described above, in its fourth building block used to set state-specific standards of the amount of CO_2 allowed to be emitted per megawatt-hour of electricity produced at affected facilities, EPA assumes that states can scale or "ramp" their energy efficiency programs at a rate of 0.2 percent of total electric retail sales (measured as the kWh of incremental energy efficiency savings as a percentage of retail sales annually) beginning in 2017. Based on the methodology described in Section 2, Analysis Group assessed the reasonableness of EPA's ramp rate assumption by evaluating the actual historical experience of states and program administrators in capturing savings from energy efficiency, and found that numerous examples exist of states and utilities that achieved energy efficiency ramp rates at or above 0.2 percent annually, and in a number of instances at levels that greatly exceeded 0.2 percent. As shown in **Figure 4**, program administrators in a number of states have achieved ramp rates of their energy efficiency programs at or in excess of 0.2 percent since 2006, and most of these states achieved these ramp rates across multiple years. This figure is illustrative and not meant to represent a comprehensive cataloging of every instance in which a state or utility achieved these levels of incremental savings; many more states and utilities achieved ramp rates at or above 0.2 percent that are not profiled below. For example, at least the following states have achieved a ramp rate at, or above, 0.2 percent in at least one year between 2006 and 2012: Arizona, California, Connecticut, District of Columbia, Hawaii, Idaho, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, and Wisconsin.

Figure 4
Annual Energy Efficiency Ramp Rates Expressed as a Percentage of Retail Sales
2006 – 2013



Notes & Sources:
Sources for savings vary by year. Ramp rate is calculated as the change in savings between two years. Savings data for 2013 are from the 2014 ACEEE State Scorecard when available. For 2012, sustained savings figures are from NEEP when available, otherwise savings are from Appendix H of the 2013 ACEEE State Scorecard. When neither NEEP nor ACEEE data are available for 2012, EIA Form 861 data are used. For 2011, sustained savings figures are from NEEP when available, otherwise savings are from the 2012 ACEEE State Scorecard. For the years 2006 to 2010, sustained savings are from the 2008 – 2011 ACEEE State Scorecards. Prior to 2010, incremental energy efficiency savings from the EIA are reported at a NERC region level. Savings are mapped to states for these years, first, by mapping utilities to states using EIA data from 2010 to 2012, and remaining savings were mapped using sales data for a given year.

Often ramp rates of this magnitude have followed changes in state level policies requiring or otherwise increasing annual spending on energy efficiency programs. These same types of policy commitments and corresponding changes in energy efficiency spending by states may result from compliance with the Clean Power Plan, and therefore we could see ramp rates that exceed 0.2 percent annually in many more than 12 states.

Below we provide more detail on a number of real-world examples of this EE ramping performance. While these examples represent a wide cross section of geographies, customer bases, electricity pricing contexts, and public policies, they are not meant to represent a comprehensive cataloging of every instance in which a state or utility achieved these levels of incremental savings.

Arizona

Electric customers in Arizona receive their power from one of two investor-owned utilities (IOUs) (Arizona Public Service Company and Tucson Electric Power Company), Salt River Project (a public power utility), or from one of 13 electric cooperatives in the state. Both of the state's IOUs, Salt River Project, and some of the state's electric cooperatives offer energy efficiency programs in the areas in

which they distribute electricity.[29] The dramatic success of these programs in recent years is illustrated in **Figure 5** below.[30] Since 2006, Arizona has significantly expanded its energy conservation program offerings by continually increasing the levels of energy efficiency savings its programs captured, in addition to achieving strong ramp rates between each year. Between 2006 and 2013, annual savings from energy efficiency increased by 1.57 percent of total retail sales, reaching a high of 1.74 percent of retail sales in 2013. In addition, the average ramp rate between 2006 and 2013 was 0.22 percent, including a high of 0.40 percent achieved between 2010 and 2011. This strong energy efficiency performance, both in terms of program ramp rates and savings levels are reflective of the "most improved" title given to Arizona by ACEEE' in its 2010 State Energy Efficiency Scorecard, along with a corresponding climb from a ranking of 28 out of 51 in 2008 (the 2008 State Scorecard reports on 2006 savings levels) to a top 15 ranking in each of the last three years.[31]

Arizona's success with its energy efficiency programs can be traced, in large part, to changes in its energy policies which drive program spending and efficiency savings levels. Energy efficiency programs in Arizona are funded through a non-bypassable systems benefits charge or through an adjustor mechanism, depending on the utility.[32] This system benefits charge was introduced in September 1999, when the Arizona Corporation Commission (ACC) – the state's regulator of public utilities – instructed utilities to include such a charge in their restructuring plans. In February 2006, the ACC more than quintupled the charge from $0.000875/kwh to $0.004988/kw, providing increased funding for energy efficiency, renewable energy, and low-income programs.[33]

The ACC also enacted EERS policies in 2010 for electric and natural gas utilities. Electric utilities with revenues greater than $5 million were required to save a certain percentage of electricity sales, starting with 1.25 percent in 2011. The EERS established a cumulative energy savings goal of 22 percent by 2020. These goals also apply to the electric cooperatives; however, the rule requires that the utilities achieve at least 75 percent of the annual savings requirement. These savings can be achieved in many ways, including, but not limited to, demand-side management programs, peak demand reductions, building codes, and combined heat and power installations.[34]

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[29] "Arizona Utility Energy Efficiency Programs," Southwest Energy Efficiency Project, accessed October 23, 2014, available at http://www.swenergy.org/programs/utilities/arizona.htm.

[30] Annual incremental energy efficiency savings from ACEEE State Energy Efficiency Scorecards, 2008 – 2014. Ramp rate calculated as the difference between incremental savings between two years.

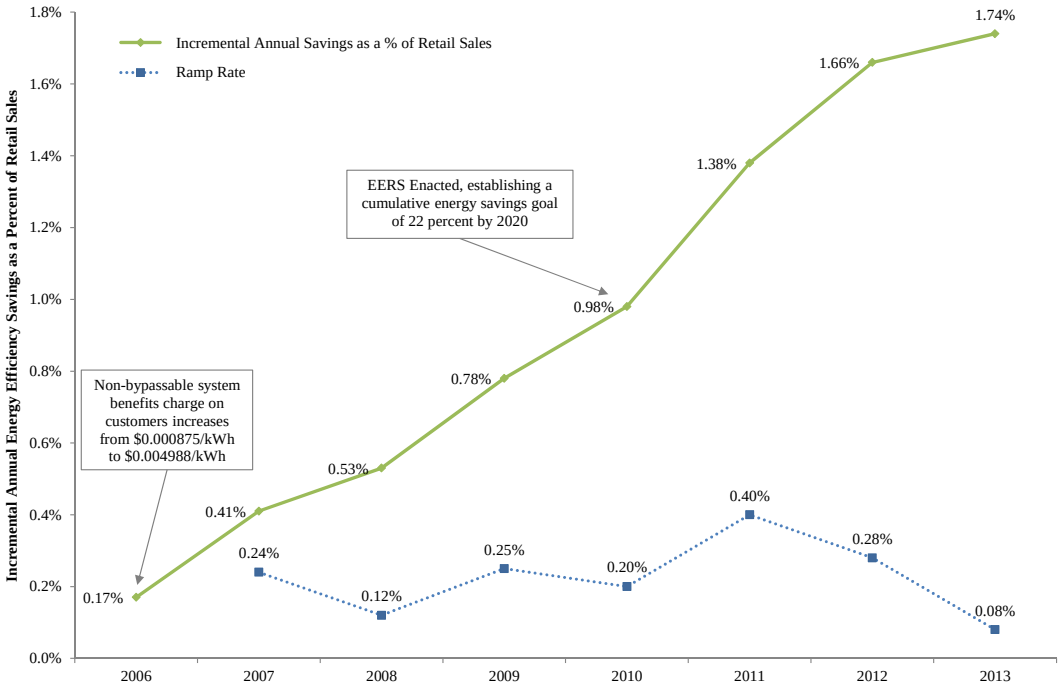
[31] ACEEE State Energy Efficiency Scorecards, 2008-2014.

[32] "Arizona," ACEEE State Energy Efficiency Policy Database, accessed October 23, 2014, available at http://www.aceee.org/energy-efficiency-sector/state-policy/arizona/177/all/191.

[33] "Arizona," EPA State and Local Climate and Energy Program, accessed October 26, 2014, available at http://www.epa.gov/statelocalclimate/state/tracking/individual/az.html.

[34] "Arizona Incentives/Policies for Renewables & Efficiency, Energy Efficiency Standards," DSIRE, accessed October 23, 2014, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ27R&re=0&ee=0.

Figure 5
Arizona's Annual Energy Efficiency Savings and Ramp Rates
Expressed as a Percentage of Retail Sales
2006 – 2013



Notes & Sources:
[1] Incremental annual energy efficiency savings as a percentage of retail sales from ACEEE State Energy Efficiency Scorecards, 2008 – 2014.
[2] Ramp rate is calculated as the change in percentage savings between two years.

Illinois

In 2007, the Illinois legislature passed the Illinois Power Agency Act (IPAA), which paved the way for energy efficiency program expansion and led to a rapid increase in energy efficiency savings across the state. The IPAA created an EERS, which required savings from energy efficiency of 0.2 percent of electric sales in 2009, to be ramped up to 2 percent of annual savings in 2016 and beyond.[35]

The IPAA also divided responsibility for achieving savings targets between the state's IOUs and the Illinois Department of Commerce and Economic Opportunity (DCEO), whereby DCEO is directed to implement 25 percent of total efficiency measures and target its programs toward state and local governments, school districts, and low-income customers. Spending and savings for the remaining 75 percent of energy efficiency programs are assigned to utilities.[36]

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[35] "Illinois Incentives/Policies for Renewables & Efficiency," DSIRE, accessed October 15, 2014, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL19R&re=0&ee=1. Savings of 0.2 percent in 2009 are savings over sales from the previous year. Similarly, savings of 2 percent in 2016 are over sales from 2015.

[36] Downs, Annie and Cui, Celia. "Energy Efficiency Resource Standards: A New Progress Report on State Experience," ACEEE Report Number U1403, April 2014.

Under the IPAA, spending for electric efficiency programs is capped and thus EE program savings levels and corresponding ramp rates are implicitly limited as a result. In 2008, energy efficiency costs passed on to electric consumers were limited to an increase of not more than 0.5 percent of per-kilowatt costs from the previous year. The legislation increased this spending limit and established a rate cap of 2.015 percent. The Illinois Commerce Commission (ICC) predicted that these limits would begin to constrain attainment of the savings required by the EERS in June 2011 for the Ameren service territory, and in June 2013 for the ComEd service territory. As a result, the ICC allowed these utilities to alter their savings targets downward in order to meet revised targets without exceeding their spending limits beginning in June 2011 and June 2013 for Ameren and ComEd respectively.[37]

As illustrated in **Figure 6**, Illinois was successful in rapidly expanding its energy efficiency programs. Between 2008 and 2013, annual savings from energy efficiency programs increased from negligible amounts to nearly one percent of retail sales by 2013. The average ramp rate of these programs during this time was 0.26 percent.[38] Both savings levels and the corresponding ramp rates decreased between 2012 and 2013, due to the budget constraints associated with hitting the IPAA's mandated rate cap described above.

In addition to energy efficiency savings achieved through the IPAA, Section 16-111.5B of the Public Utilities Act allows for additional energy efficiency procurement as part of the utility resource planning process. Under this Act, utilities are able to include assessment of cost-effective energy efficiency programs and measures in their annual Energy Procurement Plans. The ICC then reviews these procurement plans and can approve the capture of EE savings to the extent that it determines that the plan captures the full potential for achievable cost-effective energy savings.[39] These EE program expenditures are not subject to the aforementioned EERS rate cap, and therefore provide an opportunity for the capture of additional energy savings beyond those mandated in the EERS.[40] Over the next several years contributions from these expenditures are expected to grow significantly, accounting for nearly half of projected EE savings achieved in Illinois in 2016-2017.[41]

[37] Downs, Annie and Cui, Celia. "Energy Efficiency Resource Standards: A New Progress Report on State Experience," ACEEE Report Number U1403, April 2014.

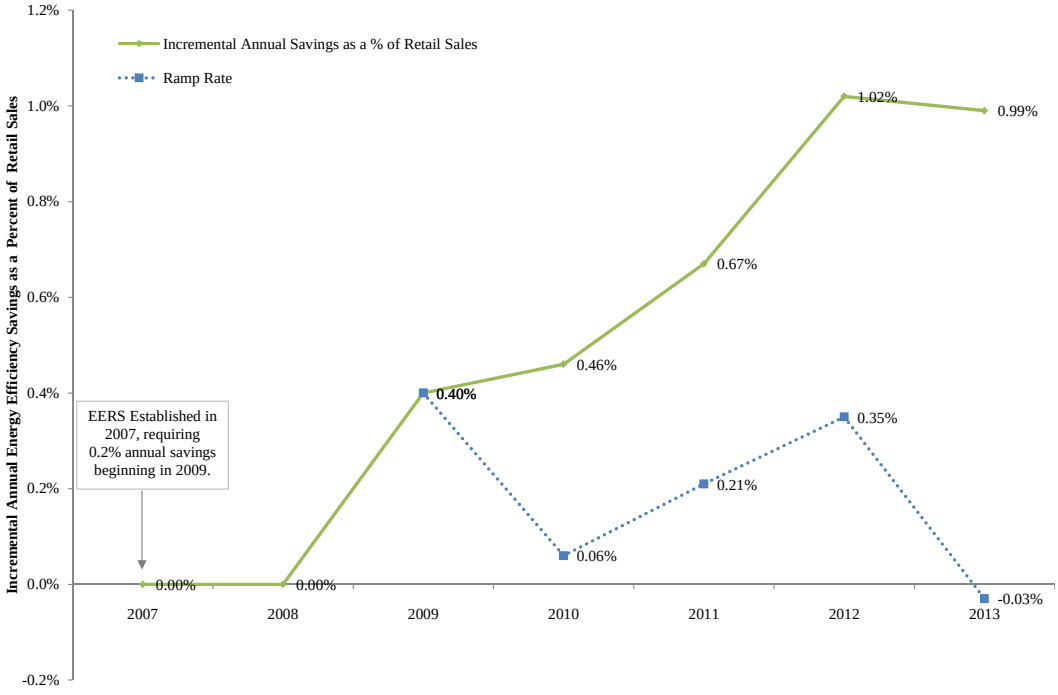
[38] ACEEE State Scorecards, 2008-2014.

[39] "Energy Efficiency Policies and Practices in Illinois," MEEA, accessed September 12, 2014, available at http://www.mwalliance.org/node/1859.

[40] "Illinois," ACEEE State Energy Efficiency Policy Database, accessed September 8, 2014, available at http://database.aceee.org/state/illinois.

[41] Analysis by Natural Resources Defense Council.

Figure 6
Illinois' Annual Energy Efficiency Savings and Ramp Rates
Expressed as a Percentage of Retail Sales
2007 – 2013



Notes & Sources:
[1] Incremental annual energy efficiency savings as a percent of retail sales from ACEEE State Energy Efficiency Scorecards, 2008 – 2014.
[2] Ramp rate is calculated as the change in percentage savings between two years.

Michigan

The restructuring of Michigan's electric industry during the mid-1990s ended almost all utility-administered energy efficiency programs. However, this changed in October 2008 with the passage of Public Act 295 (Act 295, or Act). The Act required that utilities offer energy efficiency programs to all customer classes, funded through a customer charge, and set annual savings goals. Act 295 also provided the Michigan Public Service Commission with the authority to approve or reject energy efficiency plans submitted by the utilities. Under the Act, spending on energy efficiency programs is capped based on specified percentage of revenues from retail sales; spending for 2009 was capped at 0.75 percent of total sales revenues for that year, 1.0 percent in 2010, 1.5 percent in 2011 and 2.0 percent in 2012 and each year thereafter.[42] As a result, the limit on energy efficiency program spending could potentially constrain the attainment of higher EE savings levels and corresponding ramp rates.

As part of mandated energy efficient programs, Act 295 established an energy efficiency resource standard for the state's electric and gas utilities known as the "Energy Optimization Standard." Under the EERS, electric utilities were required to achieve incremental savings of 0.3 percent in 2009, 0.5 percent in

[42] "Michigan," ACEEE State Energy Efficiency Policy Database, accessed October 24, 2014, available at http://www.aceee.org/sector/state-policy/michigan.

2010, 0.75 percent in 2011, and 1.0 percent for 2012 through 2015 (with the percentage of incremental savings is based on the total electric sales in the previous year). Savings from IOUs represent 88.9 percent of the statewide electric savings targets; savings from municipal utilities represent 7.8 percent of savings; and savings from electric cooperatives represent 3.4 percent of statewide targets.[43]

The majority of programs in Michigan are administered by the electric utilities themselves, but Efficiency United, a third party program administrator, also oversees a small number of energy efficiency programs and is funded through an alternative compliance payment mechanism specified in Act 295. Large electric customers in Michigan, as determined by their peak use, may administer their own programs.[44]

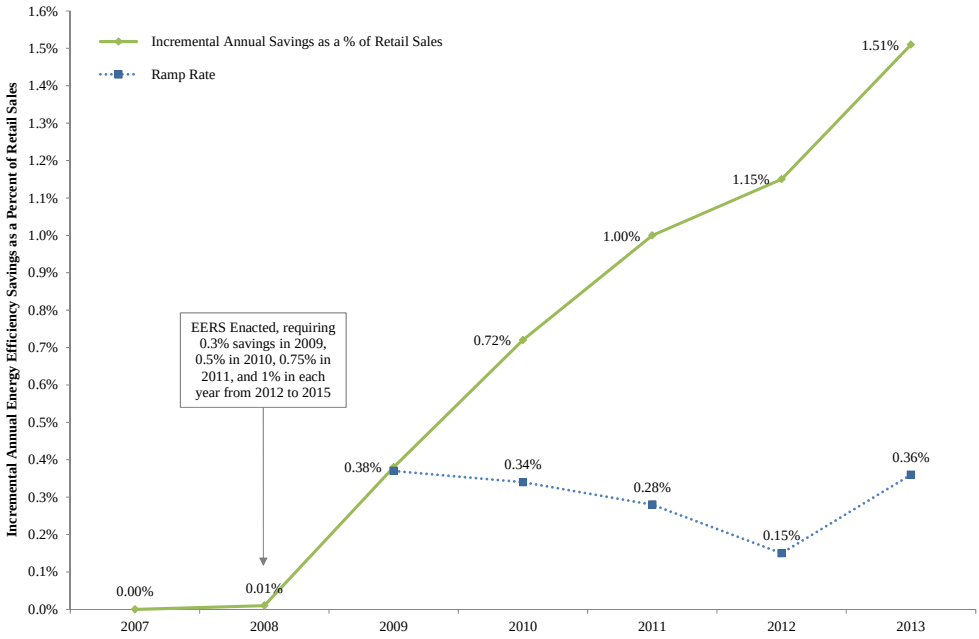
As part of Act 295, the Michigan Public Service Commission releases an annual report on the various energy optimization programs offered in the state. **Figures 7** and **8** depict Michigan's successful scaling of its energy efficiency programs. **Figure 7** illustrates that between 2008 and 2009, Michigan program administrators scaled their energy efficiency programs at a rate of 0.38 percent. Furthermore, program administrators were able to sustain this level of growth over a sustained period of time: between 2009 and 2013, savings from energy efficiency programs ramped at an average of 0.3 percent annually. Within a period of five years, Michigan went from essentially no energy efficiency savings to annual savings of 1.51 percent of retail sales.

For each of the years from 2009 through 2012, Michigan's energy efficiency program administrators have saved more than originally envisioned in the EERS planning documents, as illustrated in **Figure 8**.

[43] "Michigan," ACEEE State Energy Efficiency Policy Database, accessed October 24, 2014, available at http://www.aceee.org/sector/state-policy/michigan.

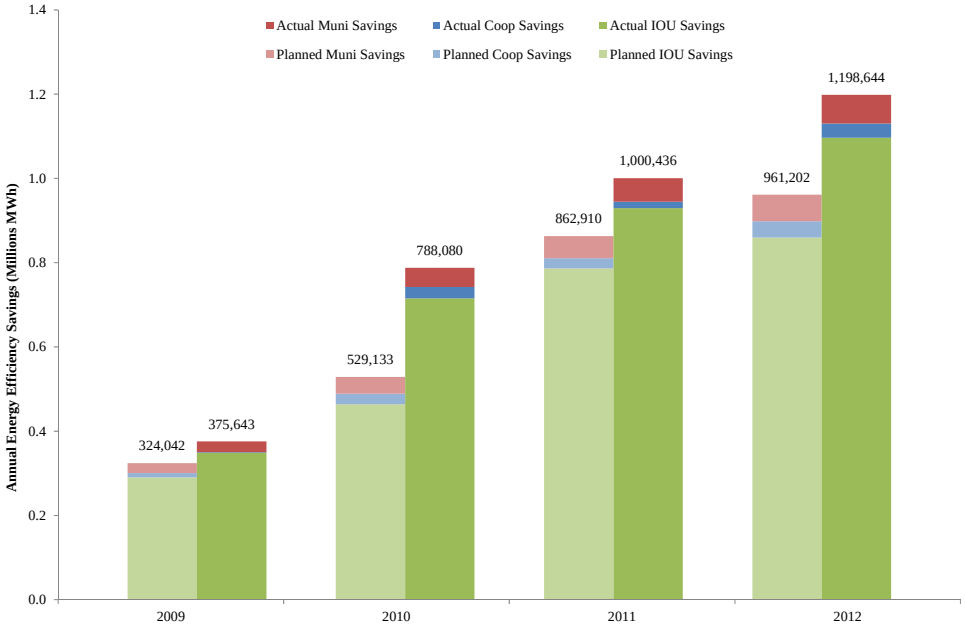
[44] "Michigan," ACEEE State Energy Efficiency Policy Database, accessed October 24, 2014, available at http://www.aceee.org/sector/state-policy/michigan.

Figure 7
Michigan's Annual Energy Efficiency Savings and Ramp Rates Expressed as a Percentage of Retail Sales
2007 – 2013



Notes & Sources:
[1] Incremental annual energy efficiency savings as a percent of retail sales from ACEEE State Energy Efficiency Scorecards, 2008 – 2014.
[2] Ramp rate is calculated as the change in percentage savings between two years

Figure 8
Michigan's Planned and Actual Annual Energy Efficiency Savings
2009 – 2012



Notes & Sources:
[1] Quackenbush, John D., et. al., "2013 Report on the Implementation of P.A. 295 Utility Energy Optimization Programs," Appendix C, Michigan Public Service Commission Department of Licensing and Regulatory Affairs, November 26, 2013.

Ohio

Ohio's SB 221:

- Requires reduction in both retail sales and peak demand
- Retail Energy Sales:
  - Cumulative goal of energy savings of 22 percent by 2025
  - Annual savings goals were set for each year from 2009 through 2025
  - Annual savings for 2009 required a reduction of 0.3 percent in sales (baseline for sales is the average sales from the previous three years)
  - The savings requirement increased to 0.5 percent in 2010, 0.7 percent in 2011, and 0.8 percent in 2012
- Peak Demand:
  - SB 221 requires a reduction of 0.75 percent each year in peak demand for the period 2009 through 2018
  - Peak demand reduction targets will be reevaluated in 2018

The adoption of energy-focused state policies in Ohio led to a dramatic increase in savings from energy efficiency within the state. In particular, in May 2008 the Governor of Ohio signed Senate Bill Number 221 (SB 221), establishing an energy efficiency standard for electric distribution utilities.[45] Since 2009, SB 221 has required electric distribution utilities to implement energy efficiency programs that both reduce sales and peak demand.[46]

Soon after SB 221 took effect, annual energy efficiency savings increased dramatically within the state.[47] **Figure 9** illustrates the annual incremental savings from energy efficiency programs in Ohio between 2006 and 2012.[48] Savings in the two years following the enactment of SB 221 increased eight-fold (400 GWh) between 2008 and 2009, and nearly three-fold (900 GWh) between 2009 and 2010. This represents an achieved ramp rate over this same time period of 0.27 percent and 0.29 percent of annual retail sales, respectively. Furthermore, savings levels were maintained or increased from 2010 to 2012. In addition to the increased savings, the utilities saved significantly more GWh than required by SB 221 in every year.

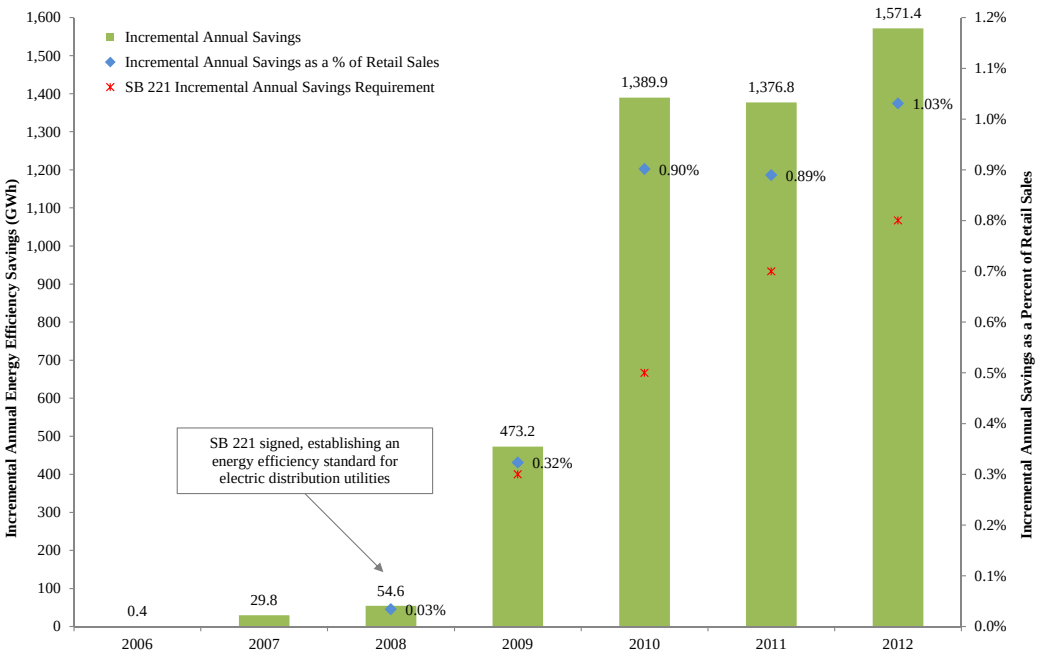
[45] "Amended Sub. SB 221 Implementation Timeline Goals," Public Utilities Commission of Ohio, April 24, 2009, available at http://www.puco.ohio.gov/emplibrary/files/media/publications/sb221%20timeline.pdf.

[46] Amended Substitute Senate Bill Number 221, Section 4928.66 (A)(1)(a)-(b), 127th General Assembly, available at http://www.legislature.state.oh.us/BillText127/127_SB_221_EN_N.pdf.

[47] Amended Substitute Senate Bill Number 221, 127th General Assembly, available at http://www.legislature.state.oh.us/BillText127/127_SB_221_EN_N.pdf. See also "Amended Sub. SB 221 Implementation Timeline Goals," Public Utilities Commission of Ohio, April 24, 2009, available at http://www.puco.ohio.gov/emplibrary/files/media/publications/sb221%20timeline.pdf.

[48] Savings data for 2006 to 2008 as reported in ACEEE State Energy Efficiency Scorecards, 2008-2010. Savings data for 2009 to 2012 as reported in "Benefits of Energy Efficiency in Ohio," Midwest Energy Efficiency Alliance, available at http://www.mwalliance.org/sites/default/files/uploads/MEEA_2014_Ohio-EE-Expo_Fact-Sheet.pdf. Retail sales from EIA-861 used to calculate incremental annual savings as a percent of retail sales.

Figure 9
Ohio's Annual Energy Efficiency Savings and Ramp Rates
2006 – 2012

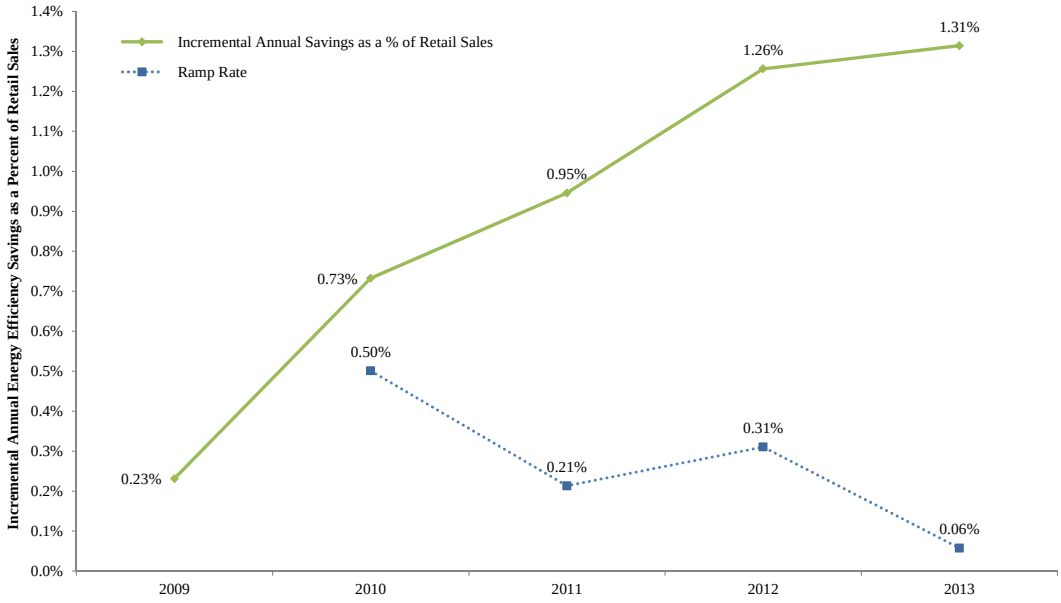


Notes & Sources:
[1] Savings data for 2006 to 2008 as reported in ACEEE State Energy Efficiency Scorecards, 2008-2010. Savings data for 2009 to 2012 as reported in "Benefits of Energy Efficiency in Ohio," Midwest Energy Efficiency Alliance, available at http://www.mwalliance.org/sites/default/files/uploads/MEEA_2014_Ohio-EE-Expo_Fact-Sheet.pdf.
[2] Retail sales from EIA-861 used to calculate incremental annual savings as a percent of retail sales.

Behind these aggregate state-wide energy efficiency savings, individual utilities achieved significant savings after the adoption of the EERS policy. In particular, American Electric Power Ohio (AEP) (who provides service to approximately 1.5 million customers in Ohio and is located in 61 of the 88 counties in the state[49]) dramatically increased annual savings from its energy efficiency programs beginning in 2009. **Figure 10** illustrates AEP's annual EE savings as a percentage of its annual retail sales, and the change in percentage savings, from 2009 through 2013. AEP tripled annual EE savings from 106 GWh to 333 GWh between 2009 and 2010, which corresponds to a ramp rate of 0.5 percent for this period. Between 2009 and 2012 the average increase in ramp rate was 0.34 percent. This upward trend continued through 2013, where incremental annual savings reached 1.31 percent of annual retail sales.

[49] "About AEP Ohio," American Electric Power Ohio, accessed November 19, 2014, available at https://www.aepohio.com/info/facts/.

Figure 10
AEP Ohio's Annual Energy Efficiency Savings and Ramp Rates
2009 – 2013

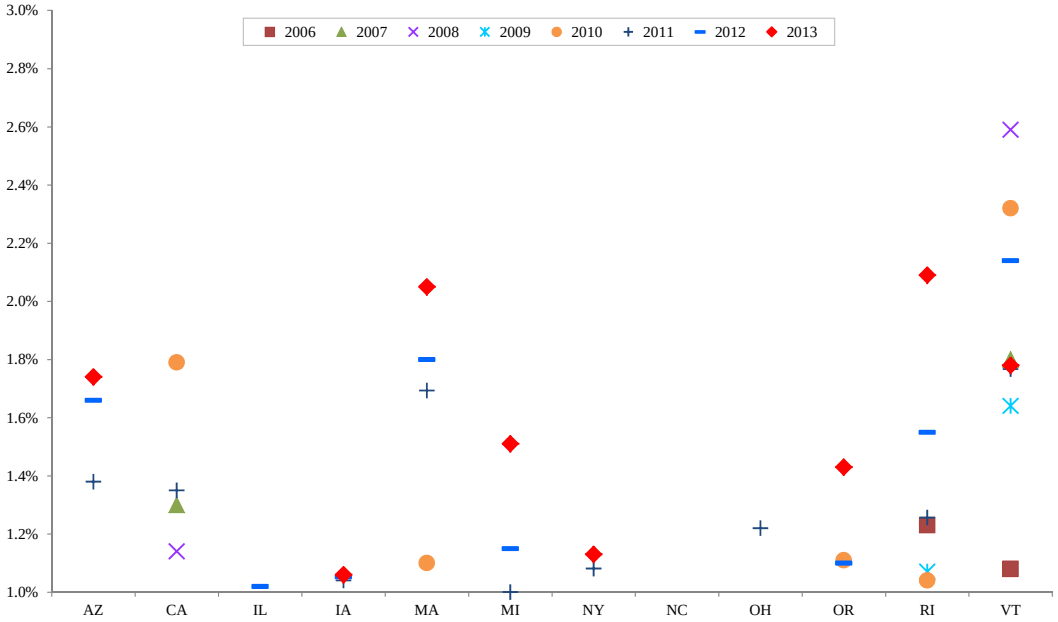


Notes & Sources:
[1] Annual energy efficiency savings as a percentage of retail sales is calculated as the incremental savings divided by baseline sales for a given year. Savings exclude self-direct program savings. Data are from AEP's portfolio status reports. See 2009 Portfolio Status Report of Energy Efficiency and Peak Demand Response Programs, Volume 1, March 15, 2010; 2010 Portfolio Status Report of Energy Efficiency and Peak Demand Response Programs, Volume 1, March 15, 2011; 2011 Portfolio Status Report of Energy Efficiency and Peak Demand Response Programs, Volume 1, May 15, 2012; 2012 Portfolio Status Report of Energy Efficiency and Peak Demand Response Programs, Volume 1, May 15, 2013; and 2013 Portfolio Status Report of Energy Efficiency and Peak Demand Response Programs, Volume 1, May 15, 2014.
[2] Ramp rate is calculated as the change in percentage savings between two years.

6. STATE & UTILITY EXPERIENCE WITH SAVINGS FROM ENERGY EFFICIENCY PROGRAMS

EPA's fourth building block assumes that states can scale their energy efficiency programs at a rate of 0.2 percent of electric retail sales until that state achieves a savings rate of 1.5 percent of electric retail sales in that year. States are then assumed to maintain this 1.5 percent savings level through the compliance period. Based on the methodology described in Section 2, Analysis Group assessed the reasonableness of EPA's sustained savings level assumption by evaluating the actual historical experience of states and program administrators in capturing savings from energy efficiency, and found that numerous examples exist of states and utilities that achieved relatively high levels (1.0 percent of retail sales or greater) of energy efficiency savings over time (see **Figure 11** below).

Figure 11
Annual Energy Efficiency Savings Expressed as a Percentage of Retail Sales
2006 – 2013



Notes & Sources:
Sources for savings vary by year. Savings data for 2013 are from the 2014 ACEEE State Scorecard when available. For 2012, sustained savings figures are from NEEP when available, otherwise savings are from Appendix H of the 2013 ACEEE State Scorecard. When neither NEEP nor ACEEE data are available for 2012, EIA Form 861 data are used. For 2011, sustained savings figures are from NEEP when available, otherwise savings are from the 2012 ACEEE State Scorecard. For the years 2006 to 2010, sustained savings are from the 2008 – 2011 ACEEE State Scorecards. Prior to 2010, incremental energy efficiency savings from the EIA are reported at a NERC region level. Savings are mapped to states for these years, first, by mapping utilities to states using EIA data from 2010 to 2012, and remaining savings were mapped using sales data for a given year.

Similar to our findings in Section 5, relatively high energy efficiency savings levels tend to follow changes in state level policies requiring or otherwise increasing annual spending on energy efficiency programs. This is significant because it indicates the ability of utility-driven efficiency programs to react quickly to changes in policy by aggressive ramping and sustained savings levels, analogous to the potential impact on EE providers that may flow from expanded opportunities associated with Clean Power Plan compliance activities.

Below we provide a number of illustrative examples of states that have achieved relatively high levels (1.0 percent of retail sales or greater) of energy efficiency savings, and sustained these levels over time.

California

California has been one of the leaders in energy efficiency investments for decades. Certain energy efficiency programs in the state date back to the 1970s, and the number and types of programs offered continue to evolve. Selected policies that have driven energy efficiency program activity in California include energy savings goals; legal requirements that utilities acquire all cost-effective energy efficiency; a system benefit charge; and resource planning that includes consideration of a broad range of resource

options, including meeting demand for electricity and natural gas through energy efficiency resources before purchasing any other source of electricity.[50]

California was one of the first states to adopt a "Loading Order" policy in 2003 under the Energy Action Plan. The 2003 Energy Action Plan was a collaborative effort between a number of different state energy agencies with the purpose of identifying specific goals and actions to "eliminate energy outages and excessive price spikes in electricity or natural gas."[51] The Plan laid out a loading order of energy resources to meet future load growth as follows:

1. First, increase conservation and energy efficiency to minimize increases in electricity and natural gas demand;
2. Second, use renewable energy resources and then distributed generation to meet new demand; and
3. Third, add clean, fossil fuel, central-station generation while improving the transmission grid and distribution facility infrastructure.

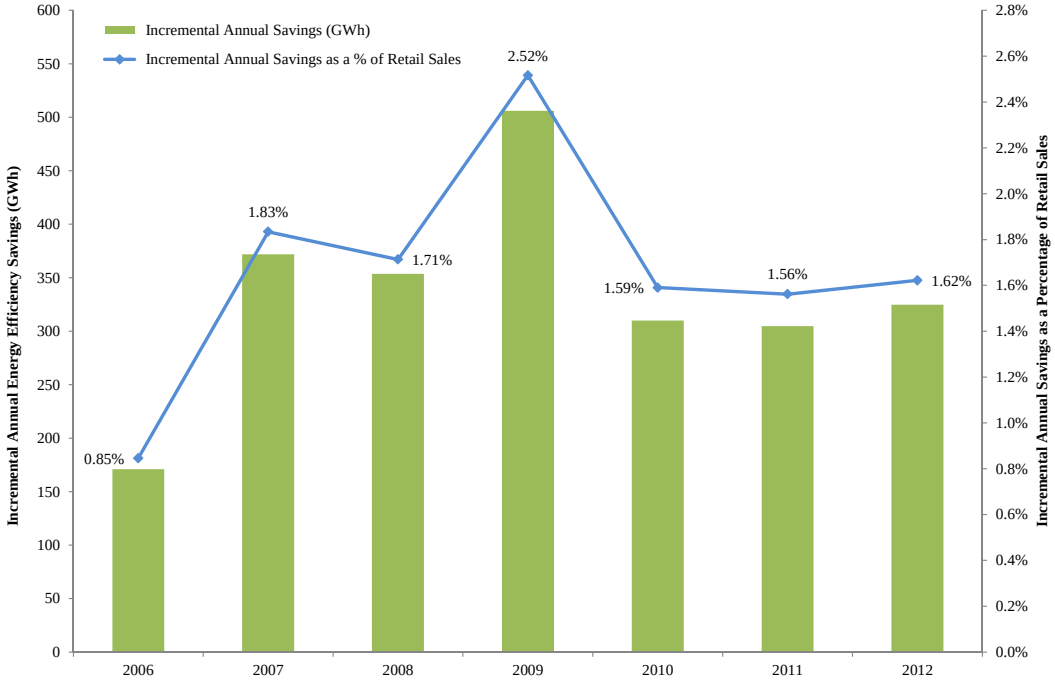
As a result of these driving policies and laws, electric and gas utilities in the state have achieved significant levels of savings through energy efficiency programs. For example, **Figure 12** illustrates energy efficiency savings from San Diego Gas & Electric (SDG&E), one of the "big three" electric IOUs in the state of California.[52] SDG&E has achieved annual incremental savings, measured as a percentage of their annual retail sales, from their EE program offerings exceeding 1.5 percent for each year between 2007 and 2012.

[50] "California Incentives/Policies for Renewables & Efficiency," DSIRE, accessed October 23, 2014, available at http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=CA.

[51] The Consumer Power and Conservation Financing Authority, Energy Resources Conservation and Development Commission, and Public Utilities Commission collaborated to produce the Energy Action Plan. Lynch, Loretta and Carl Wood, "Energy Action Plan," May 8, 2003, available at http://www.energy.ca.gov/energy_action_plan/.

[52] Annual savings are from SDG&E Annual Reports, 2006-2012, available at http://eestats.cpuc.ca.gov/Views/EEDataPortal.aspx. Retail sales come from EIA-861 data for 2006-2012.

Figure 12
San Diego Gas & Electric's Annual Energy Efficiency Savings
2006 – 2012



Notes & Sources:
[1] Annual savings are from SDG&E Annual Reports, 2006-2012, available at http://eestats.cpuc.ca.gov/Views/EEDataPortal.aspx.
[2] Retail sales come from EIA-861 data for 2006-2012.

Iowa

Iowa has dedicated spending to energy efficiency programs as far back as the early 1990s, which then dropped off during the late 1990s as Iowa considered utility restructuring. Beginning in the early 2000s, however, the state recommitted to energy efficiency programs.[53]

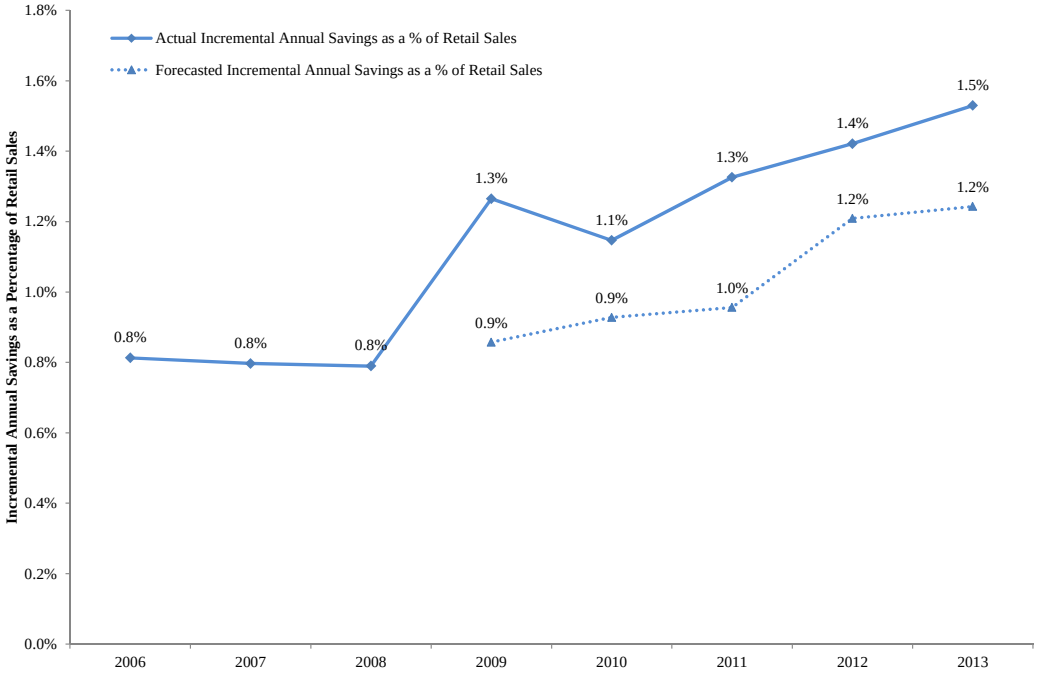
In 2008, the Iowa Senate passed Bill 2386, which requires the Iowa Utilities Board (IUB) to develop energy savings performance standards for each regulated electric and natural gas utility, who must file plans to meet those goals cost-effectively. Utilities that are not regulated (i.e., municipal utilities and rural cooperatives) are also required to set energy efficiency savings goals, but their plans are not reviewed or approved by the IUB.[54] In compliance with this law, the IUB established an EERS which required the state's IOUs to achieve an average 1.5 percent reduction in annual retail sales over the previous three years by the end of 2011. MidAmerican Energy Company achieved a 1.5 percent reduction in annual retail sales in 2010. **Figure 13** below compares the forecasted and actual energy savings for Interstate Power and Light Company (IP&L), after the IUB approved lower savings goals of

[53] "Iowa State Policy Database," ACEEE, accessed October 13, 2014, available at http://database.aceee.org/state/iowa.

[54] "Iowa State Policy Database," ACEEE, accessed October 13, 2014, available at http://database.aceee.org/state/iowa.

1-1.2 percent for IP&L.[55] **Figure 14** shows electricity savings resulting from energy efficiency programs across the state from 2000-2013, and illustrates Iowa's sustained upward trajectory over the past decade.

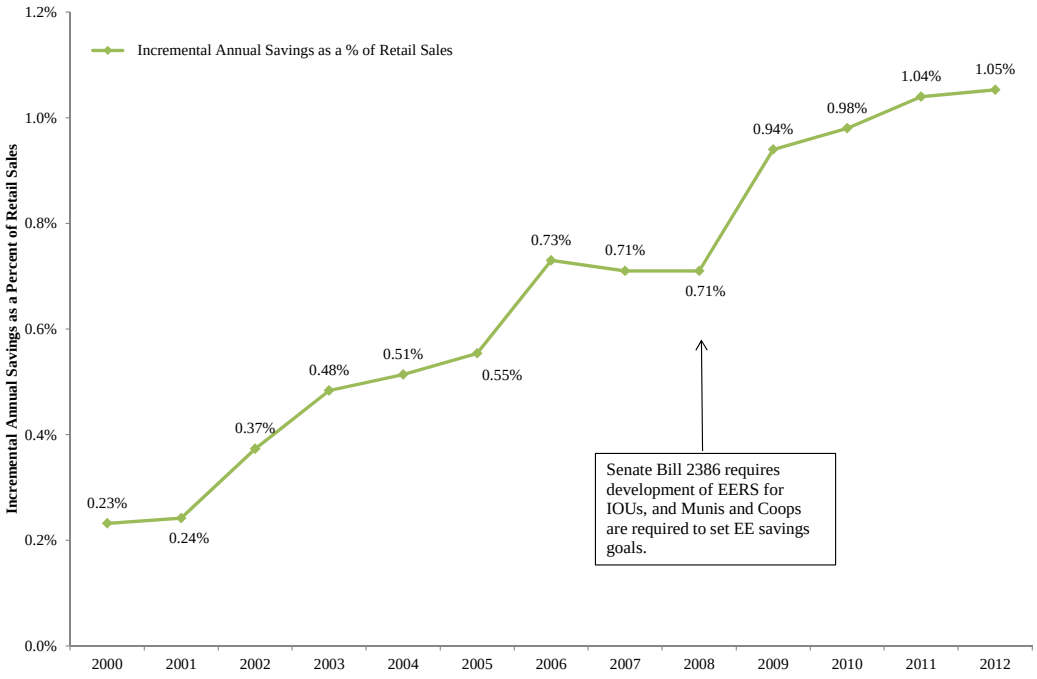
Figure 13
IP&L Forecasted Versus Actual Energy Efficiency Savings as a Percentage of Retail Sales
2006 – 2013



Notes & Sources:
[1] Forecasted and actual energy efficiency program savings are from IP&L Annual Reports, 2006-2013.
[2] Retail sales data for 2006-2008 from EIA-861. Retail sales data for 2009-2013 from IP&L Annual Reports, 2009-2013.

[55] "Iowa Incentives/Policies for Renewables & Efficiency: Energy Efficiency Standard," DSIRE, accessed October 13, 2014, available at http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=IA12R&re=0&ee=0.

Figure 14
Iowa's Annual Energy Efficiency Savings
Expressed as a Percentage of Retail Sales
2000 – 2012



Notes & Sources:
[1] Data for 2006-2012 from ACEEE State Scorecards, 2008-2013.
[2] Data for 2000-2005 from EIA form 861.

Municipal and cooperative electric utilities in the state have also been active in promoting energy efficiency and achieving meaningful savings. For example, 34 municipal and cooperative utilities were recipients of the U.S. Department of Energy's (DOE) Energy Efficiency Conservation Block Grants, which enabled utilities to implement energy efficiency initiatives including commercial and industrial energy audits and retrofits, lighting retrofits, water and wastewater treatment plant retrofits, LED street lighting and community weatherization projects. In another instance, seven municipal utilities joined the DOE's Smart Grid Innovation Grant, which provided funding for the installation of programmable communicating thermostats and load control switches for advanced metering infrastructure to bring technological innovation to municipal electric distribution systems. To date, over 2,000 thermostats, 300 switches, and 9,400 smart meters have been installed across the seven participating municipalities in Iowa as a result of this project.[56] Electric cooperatives were also successful with energy efficiency programs—Maquoketa Valley Electric Cooperative, for example, achieved savings of 1.45 percent and 1.87 percent of their sales in 2011 and 2012 respectively, while staying within budget and close to or above their energy savings targets (see **Table 1** below).[57]

[56] "2010-2012 Energy Efficiency Program Results and 2013-2015 Energy Efficiency Goals," Iowa Association of Municipal Utilities," December 31, 2013.

[57] "Summary of 2011 and 2012 Energy Efficiency Programs," Maquoketa Valley Electric Cooperative, December 18, 2013.

Table 1
Maquoketa Valley Electric Cooperative
Annual Energy Efficiency Savings as a Percentage of Retail Sales
Along with Comparison to Projected Savings and Costs
2011 – 2012

	Savings as a Percent of Sales	Percent of Projected Savings	Percent of Projected Cost
2011	1.45%	92%	85%
2012	1.87%	110%	84%

Source:
[1] Maquoketa Valley Cooperative Energy Efficiency Program Results, 2011-2012.

Massachusetts

Massachusetts has a long history of enacting policies and regulations to promote the adoption of energy efficiency. **Figure 15** shows the incremental annual energy savings, expressed as percent of retail sales between 2000 and 2013, achieved by the state's utility program administrators. Since 2011, Massachusetts achieved savings from its energy efficiency programs in excess of 1.5 percent of retail sales. Additionally, during the 2008 to 2013 period, savings levels ramped by an average of 0.27 percent.

The recent increase in annual savings can be attributed to the passage of the Green Communities Act of 2008 (GCA), which specifies that "electric and natural gas resource needs shall first be met through all available energy efficiency and demand reduction resources that are cost effective or less expensive than supply."[58] In order to achieve this, the GCA requires that the state's utilities file joint three year energy efficiency program plans with the Department of Public Utilities, and it also established the Massachusetts Energy Efficiency Advisory Council (EEAC) to help provide oversight in meeting the GCA's requirements.[59] Funding for the state's energy efficiency programs comes from a number of different sources, including proceeds received by program administrators from the ISO-NE forward capacity market, as well as proceeds from the Regional Greenhouse Gas Initiative and the system benefits charge.[60]

[58] "An Act Relative to Green Communities," Chapter 169, The 188th General Court of the Commonwealth of Massachusetts, available at https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter169.

[59] "Massachusetts Energy Efficiency First Fuel Requirement (Gas and Electric)," DSIRE, accessed October 29, 2014, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA19R&re=0&ee=0.

[60] "Massachusetts Energy Efficiency First Fuel Requirement (Gas and Electric)," DSIRE, accessed October 29, 2014, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA19R&re=0&ee=0.

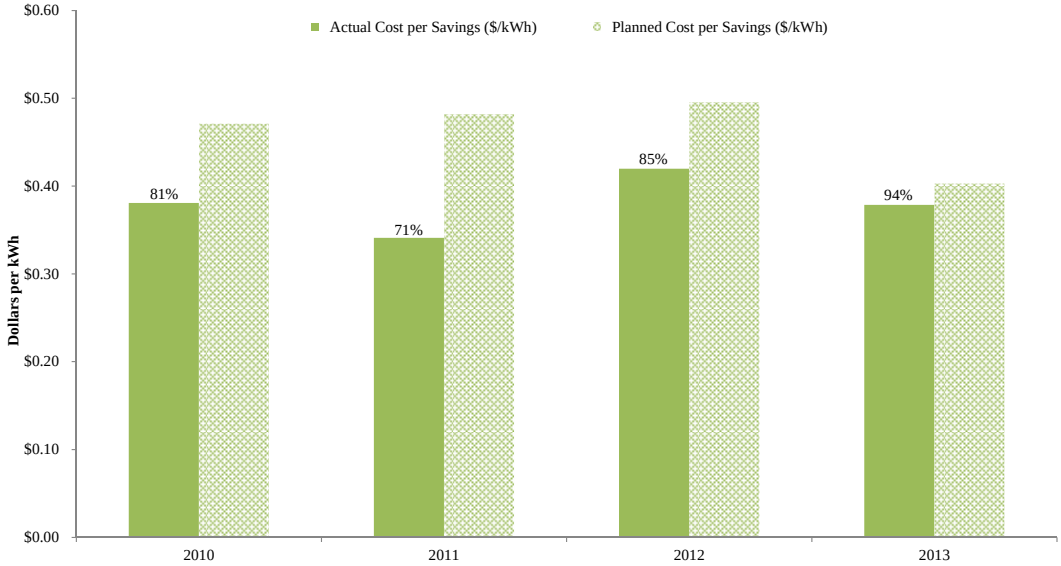
Figure 15
Massachusetts' Annual Energy Efficiency Savings
Expressed as a Percentage of Retail Sales
2000–2013

Notes & Sources:
[1] Sources for annual savings vary by year. For 2012 and 2011, data are from NEEP. For the years 2006 through 2010 and 2013, data are from ACEEE State Energy Efficiency Scorecards, 2008-2012, 2014. Data for 2000 through 2005 are from EIA-861. Prior to 2006, EIA Form 861 data are used. Prior to 2010, incremental energy efficiency savings from the EIA are reported at a NERC region level. Savings are mapped to states for these years, first, by mapping utilities to states using EIA data from 2010 to 2012, and remaining savings were mapped using sales data for a given year.

Since the passage of the GCA, Massachusetts' program administrators have also managed to keep actual energy efficiency program costs below their projected costs.[61] **Figure 16** compares the budgeted cost per kWh saved as projected in the program administrator's joint three-year plans with the actual cost per kWh saved between 2010 and 2013. As illustrated, program administrators have been able to achieve high levels of savings for a sustained period while also keeping costs low: between 2010 and 2013, the actual cost per savings in electricity was an average of 17 percent less than the projected cost on a per kWh basis, suggesting that there are many cost-effective energy efficiency measures that still remain available.

[61] Planned savings and costs are reported in "2010-2012 Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan," October 29, 2009, pp. 19-20, 78-82 and "2013-2015 Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan Electric and Gas Energy Efficiency Plan," November 2, 2012, p. 103. Actual savings and costs for 2010, 2012-2013 as reported in "Results & Reporting," MA Energy Efficiency Advisory Council, accessed October 23, 2014, available at http://ma-eeac.org/results-reporting/. For 2011, data are from "Strategic Investments Yield Energy, Economic, and Environmental Benefits, The 2011 Report of the Massachusetts Energy Efficiency Advisory Council," Massachusetts Energy Efficiency Advisory Council, September 2012, pp. 3, 19.

Figure 16
Planned Versus Actual Cost per Savings in Massachusetts
2010 – 2013



Notes & Sources:
[1] Planned savings and costs are reported in "2010-2012 Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan," October 29, 2009, pp. 19-20, 78-82 and "2013-2015 Massachusetts Joint Statewide Three-Year Electric Energy Efficiency Plan Electric and Gas Energy Efficiency Plan," November 2, 2012, p. 103.
[2] Actual savings and costs for 2010, 2012-2013 as reported in "Results & Reporting," MA Energy Efficiency Advisory Council, accessed October 23, 2014, available at http://ma-eeac.org/results-reporting/. For 2011, data are from "Strategic Investments Yield Energy, Economic, and Environmental Benefits, The 2011 Report of the Massachusetts Energy Efficiency Advisory Council," Massachusetts Energy Efficiency Advisory Council, September 2012, pp. 3, 19.
[3] Percentages indicate actual costs as a percentage of planned costs. Costs include residential, low-income, commercial & industrial, pilot programs,

New York

New York also has a long history of encouraging energy efficiency, beginning with the establishment of a system benefits charge (SBC) by the New York Public Service Commission (PSC), which collects charges from customers to fund energy efficiency programs in the state. Collections from the charge began in 1998 when the first framework was set for three years until 2001. In 2001, the SBC was renewed for 5 years, with an increase in funding and a focus on reducing peak load. In 2005, the PSC extended the SBC for a third time for a five year period until 2011, which included an annual funding level of $175 million, $25 million more annually than the second phase of the charge.[62] In 2008, the PSC established an Energy Efficiency Portfolio Standard (EEPS), with a goal of reducing New York energy usage by 15 percent by 2015. The EEPS increased funding from the system benefits charge from $175 million to $334 million annually during the third phase of the SBC.[63] The SBC is currently in its fourth cycle (approved by the PSC in 2011), and the current framework will last until the end of 2016, with

[62] "System Benefits Charge," New York State Public Service Commission, accessed October 20, 2014, available at http://www3.dps.ny.gov/W/PSCWeb.nsf/All/58290EDB9AE5A89085257687006F38D1?OpenDocument.

[63] "New York State Policy Database," ACEEE, accessed October 20, 2014, available at http://database.aceee.org/state/new-york.

approved funding of $98.8 million annually starting in January 2012 until the end of 2016.[64] Additionally, the majority of the EEPS programs were reauthorized by the NY PSC in 2011, increasing the total electric and gas efficiency program budget by $2.1 billion.[65]

Figure 17 illustrates the cumulative savings that resulted from the programs funded by the SBC and EEPS for the years 2001 to 2011, and highlights the continued upward progression of the state's energy efficiency program impacts. **Figure 18** shows the increase rapid increase in annual savings following the state's adoption of the EEPS. Between 2008 and 2013, incremental annual savings have increased 0.8 percent, reaching savings levels greater than 1 percent in both 2011 and 2013. For four of these years, the ramp rate of these programs was either above, or near, 0.2 percent.

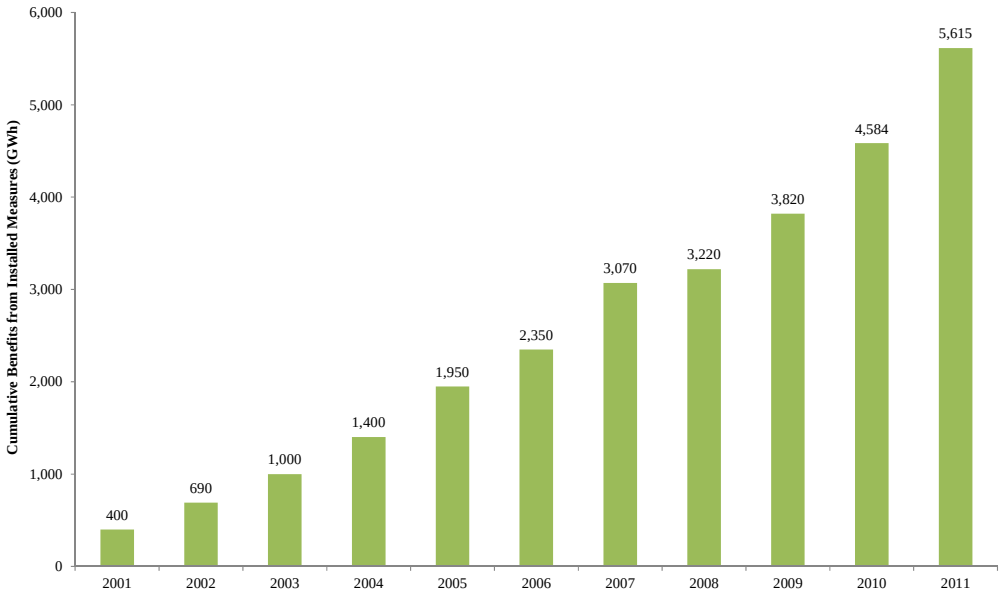
New York policymakers continue to refine the state's energy policy in order to improve upon the state's existing regulatory model for utilities. In April 2014, the NY PSC began its Reforming the Energy Vision initiative which seeks to "promote more efficient use of energy, deeper penetration of renewable energy resources such as wind and solar, wider deployment of 'distributed' energy resources, such as micro grids, on-site power supplies, and storage" and envisions efficiency programs as "one of the DER [distributed energy resource] tools at the utility's disposal" in the future. The PSC is also planning to "promote greater use of advanced energy management products to enhance demand elasticity and efficiencies," with the aim to "empower customers by allowing them more choice in how they manage and consume electric energy.[66]

[64] "System Benefits Charge," New York State Public Service Commission, accessed October 20, 2014, available at http://www3.dps.ny.gov/W/PSCWeb.nsf/All/58290EDB9AE5A89085257687006F38D1?OpenDocument.

[65] "New York State Policy Database," ACEEE, accessed October 20, 2014, available at http://database.aceee.org/state/new-york.

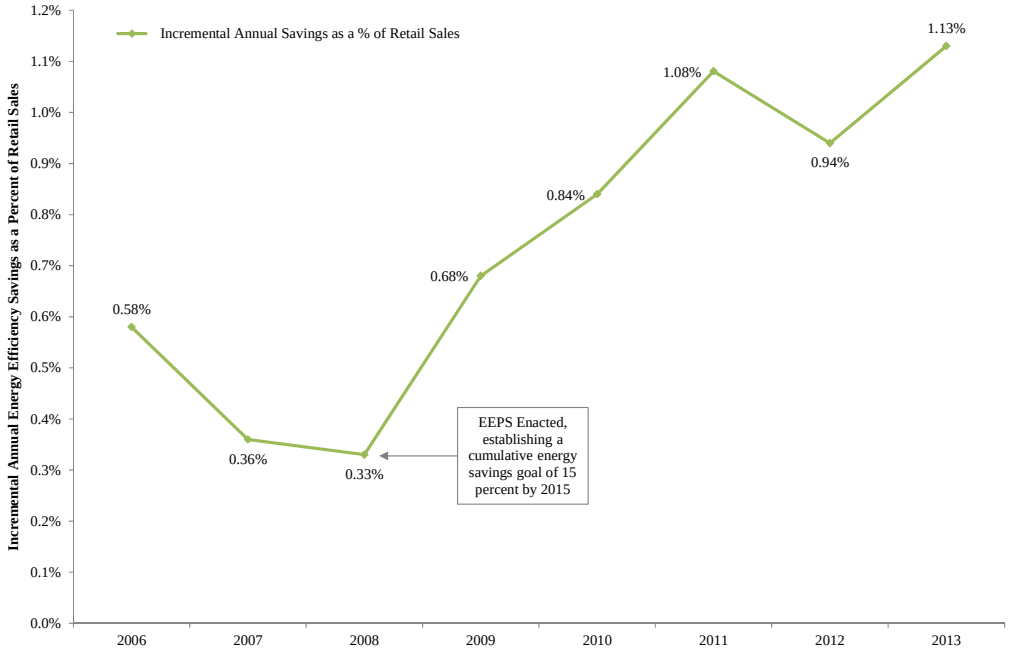
[66] http://www3.dps.ny.gov/W/PSCWeb.nsf/All/26BE8A93967E604785257CC40066B91A?OpenDocument and CASE 14-M-0101 - Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, April 25, 2014.

Figure 17
New York Cumulative Program Benefits from Installed Measures
2001 – 2011



Notes & Sources:
[1] Data represent cumulative program benefits from installed measures in New York.
[2] Figures for 2001-2003 are from "New York Energy $mart Program Evaluation and Status Report," May 2004, New York State Energy Research and Development Authority. Data for 2004-2006 are from "New York Energy $mart Program Evaluation and Status Report Year Ending December 31, 2007," March 2008, New York State Energy Research and Development Authority. Figures for 2007-2011 represent cumulative benefits from both the SBC and EEPS in New York, as reported in "New York's System Benefits Charge Programs Evaluation and Status Report, Year Ending December 31, 2011 Report to the Public Service Commission" New York State Energy Research and Development Authority, March 2012.

Figure 18
New York Annual Energy Efficiency Savings
2006 – 2013



Notes & Sources:
[1] Incremental annual energy efficiency savings as a percentage of retail sales from ACEEE State Energy Efficiency Scorecards, 2008 – 2014.
[2] Ramp rate calculated as the difference between incremental savings between two years.

North Carolina

In 2008, North Carolina adopted a Renewable Energy and Energy Efficiency Portfolio Standard (REPS) under Senate Bill 3. The REPS established both renewable energy and energy efficiency savings targets for the state. Beginning in 2012, public utilities were required to reach savings of 3 percent of 2011 retail sales from renewable energy and energy efficiency. The standard sets cumulative savings targets at 6 percent in 2015, 10 percent in 2018 and 12.5 percent in 2021 and thereafter. For these targets, the amount of savings that can come from energy efficiency is capped at 25 percent of the 2012-2018 targets and at 40 percent of the 2021 target.

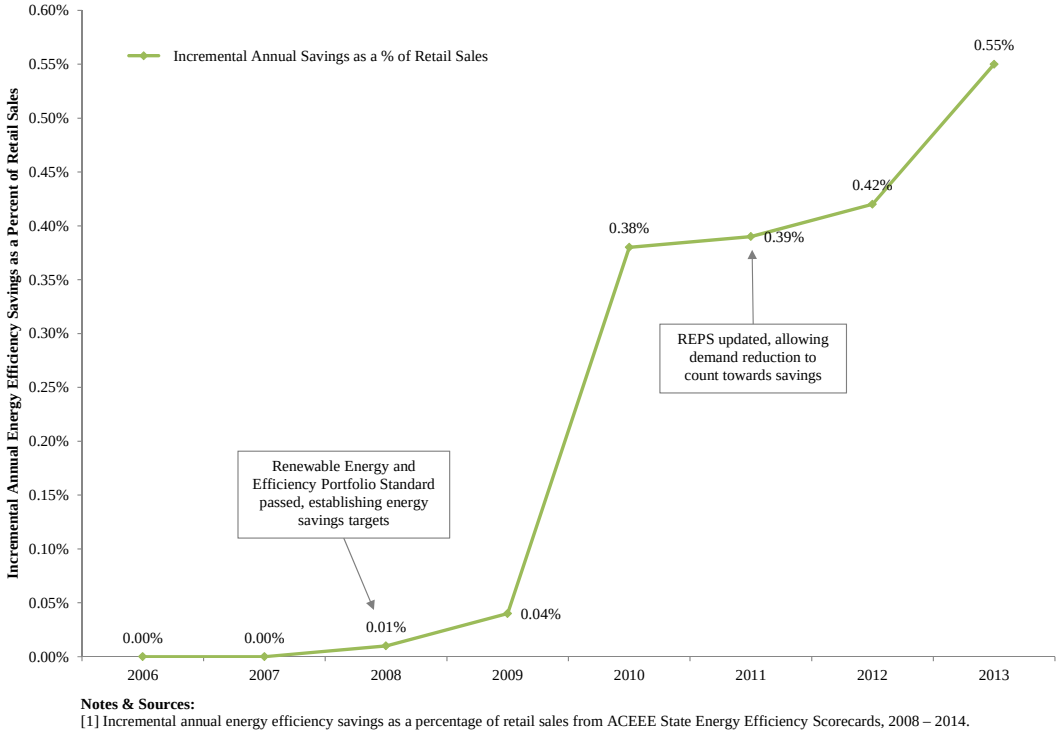
North Carolina's municipal and cooperative electric utilities are also required to reach 10 percent of retail sales in 2018 from renewable energy and energy efficiency, however there is not a cap on energy efficiency, enabling them to satisfy their entire savings target with energy efficiency, excluding small set-asides for solar and other resources.[67] An update to the REPS under Senate Bill 75 in 2011 allows demand reduction to be counted towards the standard.[68]

Figure 19 illustrates the increase in energy efficiency savings that followed the enactment of North Carolina's REPS. Between 2009 and 2010, incremental savings increased by 0.34 percent. Following an update to the REPS in 2011, annual savings reached 0.55 percent of retail sales in 2013.

[67] "North Carolina State Policy Database," ACEEE, accessed October 30, 2014, available at http://database.aceee.org/state/north-carolina; and North Carolina Renewable Energy and Energy Efficiency Portfolio Standard," DSIRE, accessed October 30, 2014, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC09R&re=0&ee=0.

[68] "North Carolina Renewable Energy and Energy Efficiency Portfolio Standard," DSIRE, accessed October 30, 2014, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC09R&re=0&ee=0.

Figure 19
North Carolina's Annual Energy Efficiency Savings
2006 – 2013



Notes & Sources:
[1] Incremental annual energy efficiency savings as a percentage of retail sales from ACEEE State Energy Efficiency Scorecards, 2008 – 2014.

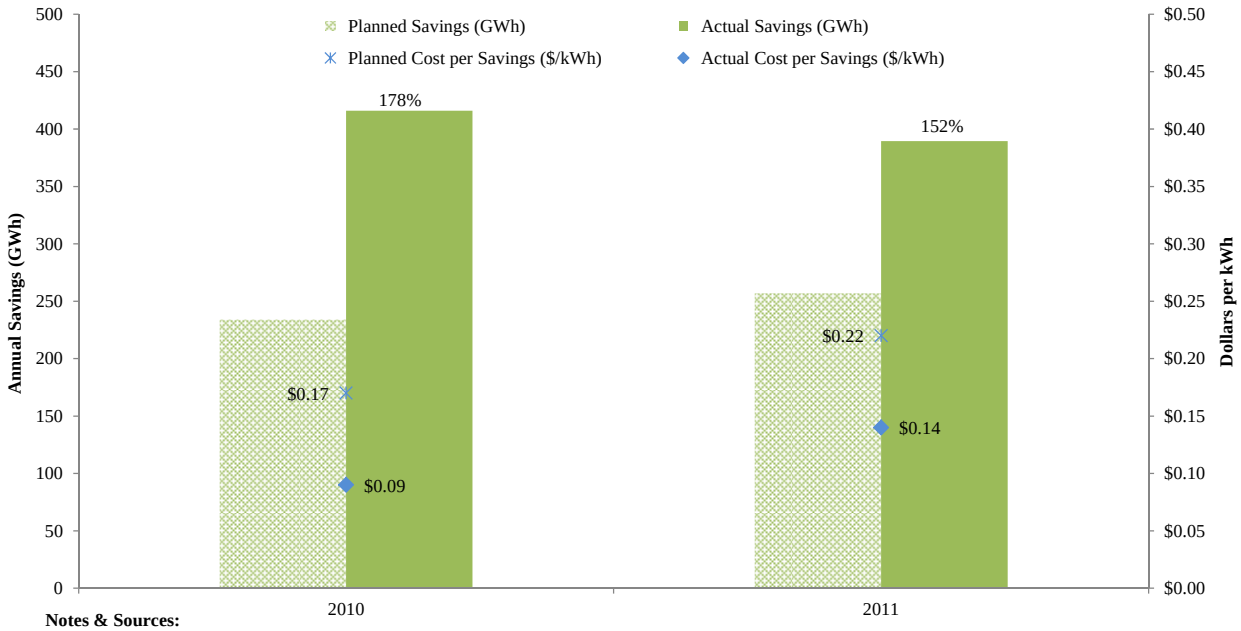
Beyond the REPS, certain utilities have pledged additional capture of energy efficiency savings. For example, as part of its 2011 merger settlement agreement, Duke Energy Progress has pledged an annual energy efficiency savings goal of 1 percent of its retail sales starting in 2015, with a cumulative goal of 7 percent captured between 2014 and 2018.[69] And, in 2009, the North Carolina Utilities Commission approved a three year pilot of Duke Energy's Save-A-Watt program, which established energy efficiency goals and rate recovery for the utility until the end of 2013, at which point a refined cost recovery mechanism was approved for future years.[70] The first two years of Duke's Save-a-Watt program demonstrated the utility's ability to exceed planned savings targets with significantly less cost than projected: Duke captured 178 percent and 152 percent of its 2010 and 2011 savings targets respectively, at a cost of 53 percent and 64 percent of its original projections (see **Figure 20**). These savings levels equated to 0.72 percent and 0.70 percent of Duke's retail sales in North Carolina 2010 and 2011, respectively.[71]

[69] "North Carolina State Policy Database," ACEEE, accessed October 30, 2014, available at http://database.aceee.org/state/north-carolina.

[70] "North Carolina State Policy Database," ACEEE, accessed October 30, 2014, available at http://database.aceee.org/state/north-carolina.

[71] Actual savings estimates are based on the proportion of Duke Energy Carolina's actual retail sales in North Carolina vs. South Carolina from EIA-861. Savings and retail sales are from Duke Energy Carolinas Application for Approval of Vintage 3 Rider EE, Direct Testimony of Timothy Duff, Exhibit 1, North Carolina Utilities Commission, Docket E-7, Sub 979, March 23, 2011. 2010 savings contain data from June 2009-December 2010.

Figure 20
Duke Energy Carolinas Planned Versus Actual Savings and Costs in North Carolina
2010 – 2011



Notes & Sources:
[1] Actual savings estimated based on proportion of Duke Energy Carolina's actual retail sales in North Carolina vs. South Carolina from EIA-861. 2010 savings includes savings from June 2009 through December 2009.
[2] Actual savings are from Duke Energy Carolinas Application for Approval of Vintage 3 Rider EE, Direct Testimony of Timothy Duff, Exhibit 1, North Carolina Utilities Commission, Docket E-7, Sub 979, March 23, 2011. Planned savings are reported in "Agreement and Joint Stipulation of Settlement, In Re: Application of Duke Energy Carolinas, LLC for Approval of Save-a-Watt Approach," North Carolina Utilities Commission, Docket E-7, Sub 831, June 12, 2009.
[3] Planned Save-a-Watt costs are from "Notice to Customers" sent to Duke Energy's North Carolina Customers Reflecting New EE Rider Surcharges, for the years 2010 through 2013 and Biennial Report of the NCUC to the Governor of NC and the Joint Legislative Commission on Governmental Operations Regarding the Results of Cost Allocations for Electric Utilities Involving: Renewable Energy and Energy Efficiency, Demand-Side Management and Energy Efficiency Programs and Costs, and Certain Fuel and Fuel-Related Costs, September 28, 2011. Actual Save-a-Watt costs are from "Agreement and Joint Stipulation of Settlement, In Re: Application of Duke Energy Carolinas, LLC for Approval of Save-a-Watt Approach," North Carolina Utilities Commission, Docket E-7, Sub 831, June 12, 2009.

Oregon

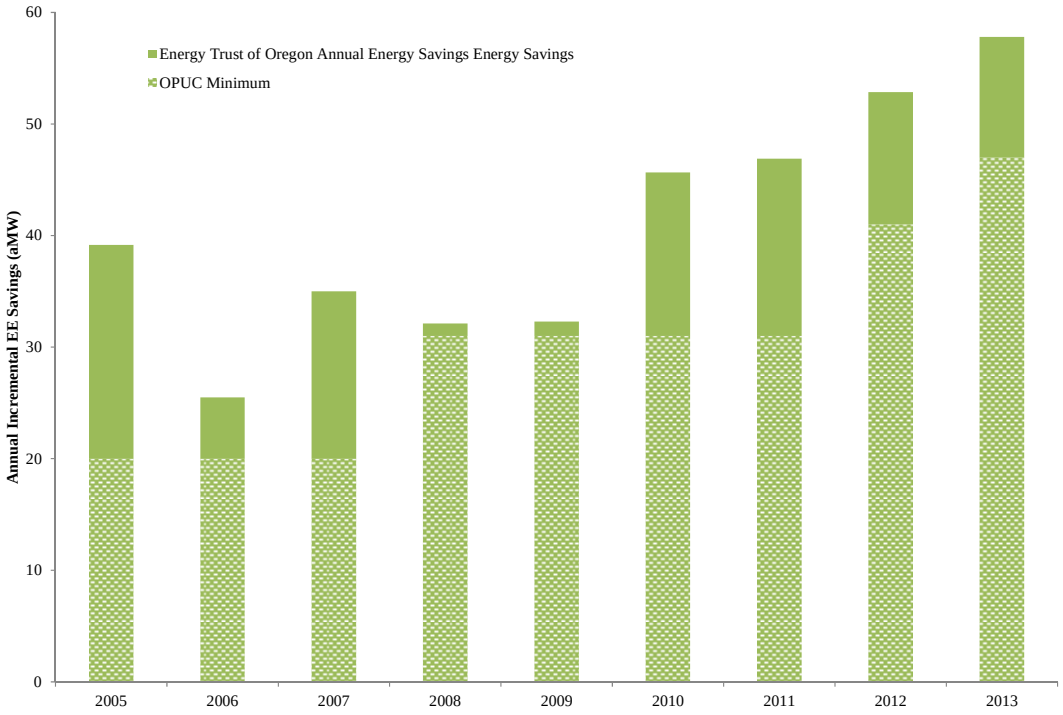
In 1999, Oregon law SB 1149 created a public purchase charge designed to support energy efficiency, renewable energy, and low-income electric programs. SB 1149 also specified that the charge be managed by a separate entity that could focus exclusively on energy efficiency and renewable energy programs while keeping ratepayers' best interests in mind. As a result, the Energy Trust of Oregon (ETO) was established in 2002 to administer the energy efficiency funds. The ETO currently administers electric energy efficiency programs for Portland General Electric (PGE) and Pacificorp, the state's two electric IOUs, as well as for the natural gas IOUs in the state, covering in total 73 percent of the state's energy consumers.[72]

In September 2004, the Oregon PUC set minimum performance measures for ETO in a variety of categories, including minimum savings and maximum costs. ETO has delivered savings in excess of

[72] "Oregon State Policy Database," ACEEE, accessed September 2, 2014, available at http://database.aceee.org/state/oregon.

OPUC's minimum in every year since 2005 (see **Figure 21),** and at a cost well below OPUC's maximum **(**see **Figure 22**).[73] Expressing these savings as a percentage of PGE and Pacificorp's total annual retail sales shows that the ETO has generally captured increasing amounts of energy efficiency compared to electric sales, with the equivalent of 1.44 percent of retail sales saved in 2012 (see **Figure 23** below).

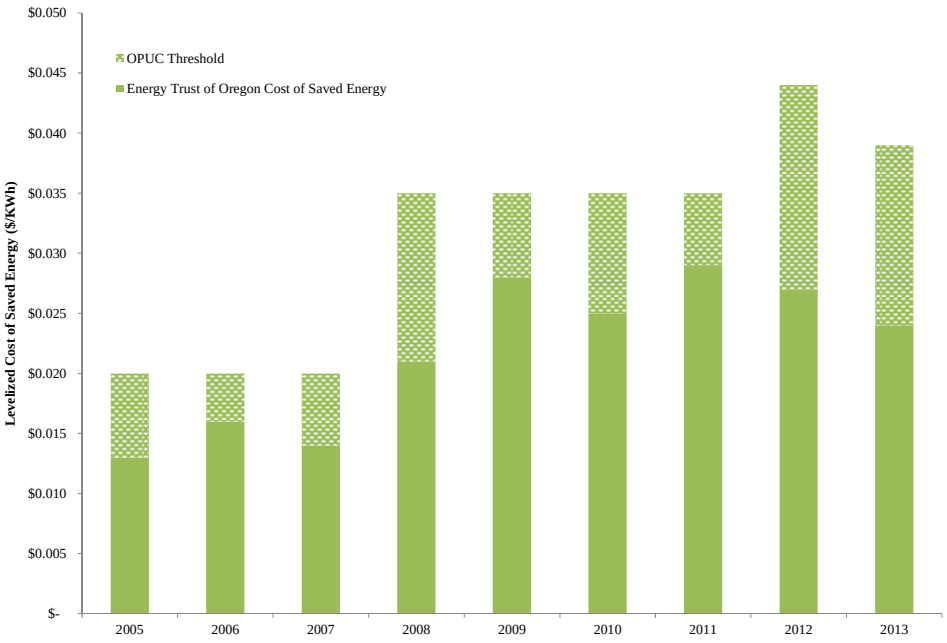
Figure 21
Energy Trust of Oregon Annual Energy Savings and OPUC Requirements
2005 – 2013



Source:
[1] ETO Annual Reports, 2005-2013.

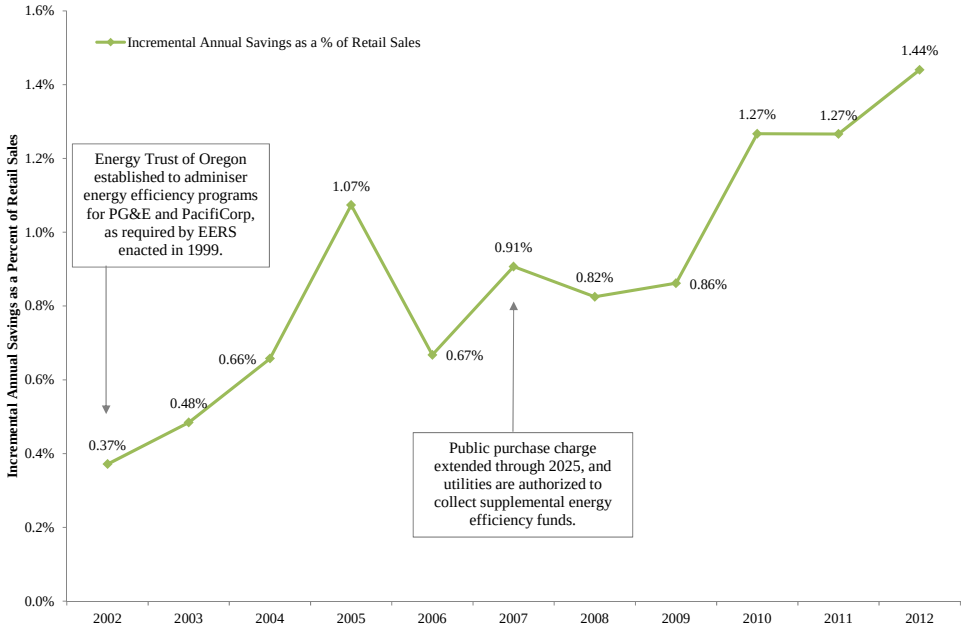
[73] Energy Trust of Oregon Annual Reports, 2002-2013.

Figure 22
Energy Trust of Oregon Annual Levelized Cost of Saved Energy and OPUC Requirements
2005 – 2013



Source:
[1] ETO Annual Reports, 2005-2013.

Figure 23
PacifiCorp and PGE Annual Energy Efficiency Savings
As Administered by Energy Trust of Oregon
2002-2012



Notes & Sources:
[1] Savings numbers from ETO Annual Reports, 2002–2012.
[2] Retail sales from EIA Form 861, 2002–2012.

Energy efficiency success in Oregon is not limited to just those customers served by the ETO; many customers are served energy efficiency by utilities directly, and regional energy efficiency organizations like the Bonneville Power Administration, the Northwest Energy Efficiency Alliance, and the Northwest Power and Conservation Council provide additional support for energy efficiency programs.[74]

Rhode Island

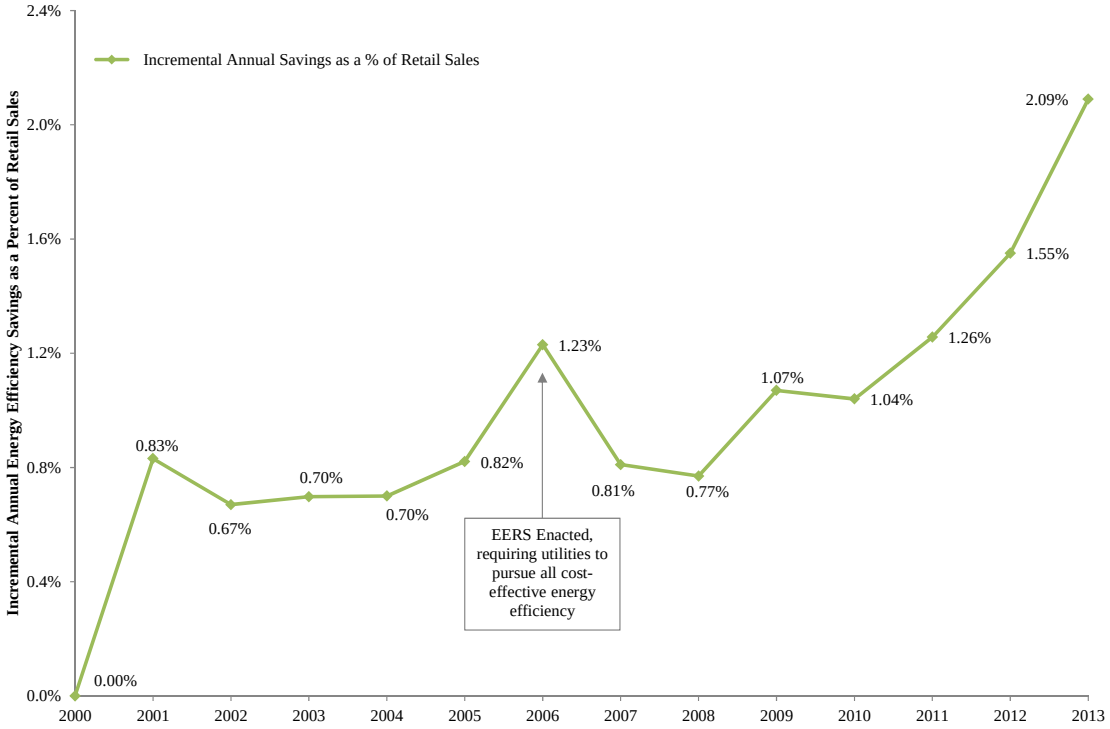
Rhode Island has over a decade of experience administering energy efficiency programs. The state's primary administrator of energy efficiency programs is the Narragansett Electric Company (doing business as National Grid), who services 99 percent of the state's electric customers. National Grid is subject to the state's 2006 EERS that was established under the Comprehensive Energy Conservation, Efficiency and Affordability Act. Under this mandate, National Grid must submit three-year and annual energy procurement plans to the Rhode Island Public Utilities Commission. In these plans, National Grid lays out its spending and savings goals and progress associated with pursuing the state's mandate of capturing all cost-effective energy efficiency measures. Savings targets for 2012 were 1.7 percent of National Grid's total retail sales, and 2.1 percent for 2013, with National Grid actually achieving 1.55 and 2.09 percent savings in these years, as shown in **Figure 24**.[75] National Grid has also achieved strong ramp rates for its programs in recent years, with an average ramp rate of 0.26 percent from 2008 through 2013.[76]

[74] "Oregon State Policy Database," ACEEE, accessed September 2, 2014, available at http://database.aceee.org/state/oregon.

[75] "Rhode Island State Policy Database," ACEEE, accessed October 14, 2014, available at http://www.aceee.org/sector/state-policy/rhode-island.

[76] ACEEE State Scorecards, 2010-2014.

Figure 24
National Grid's Annual Energy Efficiency Savings
2000–2013



Notes & Sources:
[1] Data for 2006-2013 from ACEEE State Energy Efficiency Scorecards, 2008-2014.
[2] Data for 2000-2005 from EIA Form 861.

Vermont

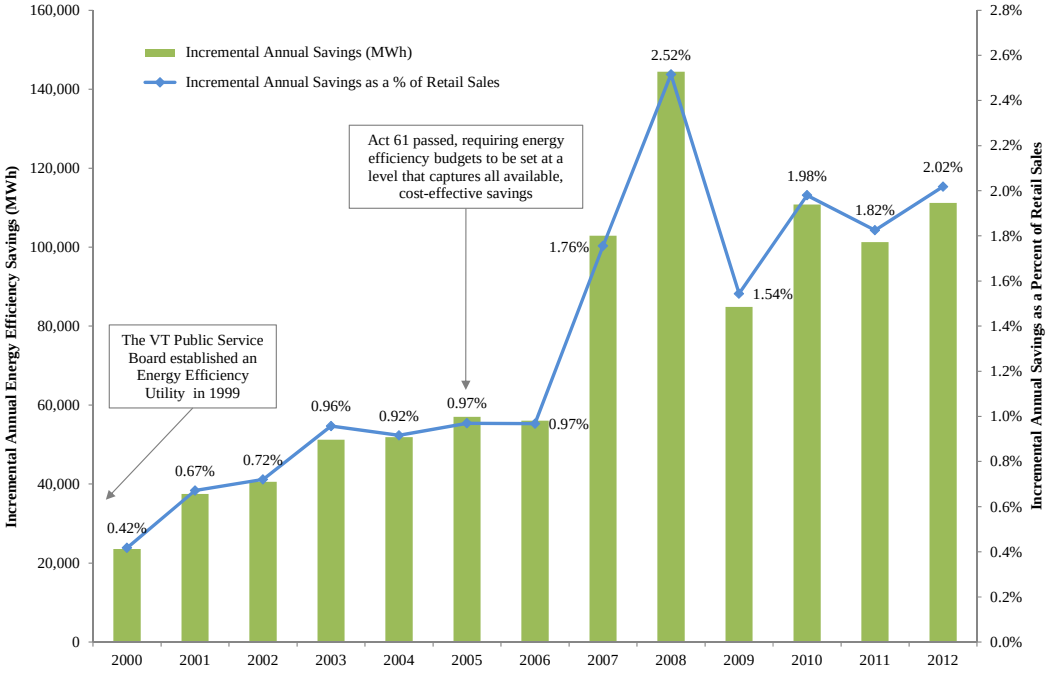
Vermont has a long history with energy efficiency programs. These programs were originally administered by the investor-owned electric utilities within the state, but state officials later determined that electric customers could benefit from programs with oversight by a single party. In 1999, the Vermont Public Service Board established an Energy Efficiency Utility (EEU) which would administer and deliver energy efficiency programs across the state. There are currently two EEUs in the state: Efficiency Vermont and Burlington Electric Department (BED). Funding for the programs that these EEUs oversee come from the Energy Efficiency Charge, a volumetric charge on customers' bills. All funding goes to fund Efficiency Vermont's programs (currently operated the Vermont Energy Investment Corporation, acting as an independent third party administrator), with the exception of BED's customers, whose bills pay for the energy efficiency programs BED offers.[77] Vermont law passed in 2005 (Act 61)

[77] "Energy Efficiency Utility Creation and Structure," State of Vermont Public Service Board, accessed October 24, 2014, available at http://psb.vermont.gov/utilityindustries/eeu/generalinfo/creationandstructure.

requires that energy efficiency program budgets be set at a level that would realize "all reasonably available, cost-effective energy efficiency savings."[78]

Since the establishment of the EEUs and the passage of Act 61, energy savings in Vermont have increased dramatically. **Figure 25** illustrates savings as reported by Efficiency Vermont for the 2000 to 2012 period.[79] For all years between and including 2007 and 2012, Vermont has achieved incremental annual savings from its energy efficiency programs greater than 1.5 percent of retail sales. During this same period, the ramp rate between years has been greater than 0.2 percent for four years.

Figure 25
Efficiency Vermont's Annual Energy Efficiency Savings
2000–2012



Notes & Sources:
[1] Annual savings come from Efficiency Vermont Annual Reports, 2005-2012, available at https://www.efficiencyvermont.com/About-Us/Oversight-Reports-Plans/Annual-Reports-amp-Plans.
[2] Retail sales come from EIA-861 data for 2000-2012.

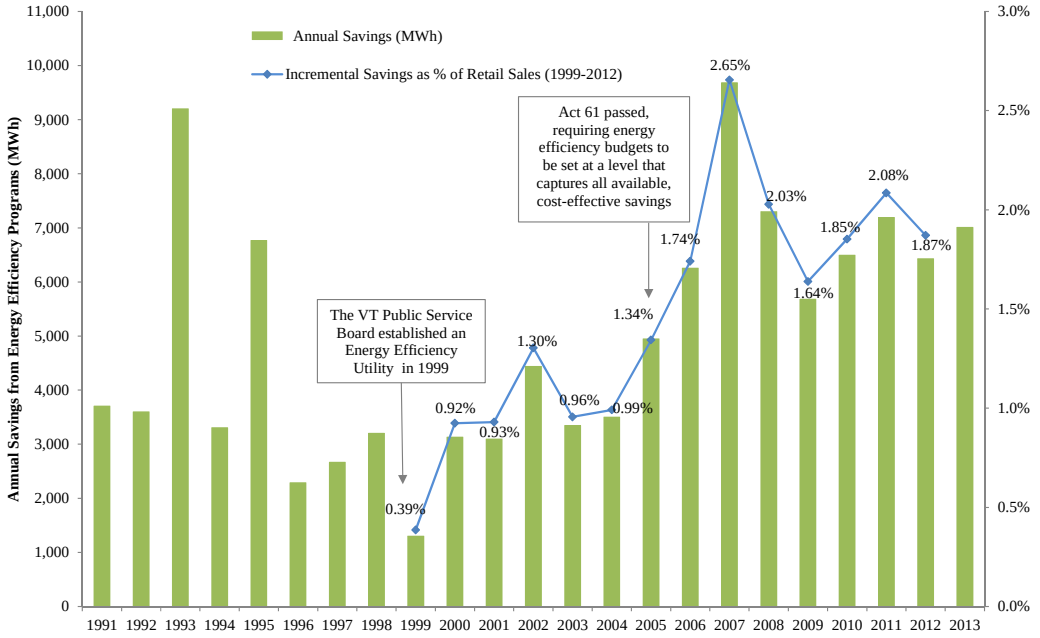
In addition to the energy efficiency programs administered by Efficiency Vermont, the municipally-owned electric utility BED implements a number of energy efficiency programs in the city of Burlington. BED's energy efficiency programs have been in place since 1991 and have managed to hold Burlington's

[78] Act of the General Assembly 2005-2006, No. 61 An Act Relating to Renewable Energy, Efficiency, Transmission, and Vermont's Energy Future, Vermont Public Service Board, available at http://psb.vermont.gov/docketsandprojects/eeu/act61text.

[79] Annual savings come from Efficiency Vermont Annual Reports, 2005-2012, available at https://www.efficiencyvermont.com/About-Us/Oversight-Reports-Plans/Annual-Reports-amp-Plans. Retail sales come from EIA-861 data for 2000-2012.

total annual electric consumption below 1989 levels.[80] The benefits from BED's programs for business and residential customers since 1991 are depicted below in **Figure 26**.[81]

Figure 26
Burlington Electric Department's Annual Energy Efficiency Savings
1991 – 2013



Notes & Sources:
[1] Savings reported in "2013 Energy Efficiency Annual Report," Burlington Electric Department. Savings include all business and residential demand-side management savings and costs.
[2] Incremental savings as a percentage of retail sales is calculated using Burlington Electric Retail Sales data for 1999-2012 from EIA form 861.

7. ENERGY EFFICIENCY AS A SUSTAINABLE RESOURCE

EPA makes two fundamental assumptions in its analysis. First, it assumes that EE providers (whether utilities, municipals, cooperatives, or third-party providers) can ramp up EE programs that increase savings by at least 0.2 percent per year. Second, EPA assumes that once reaching an annual savings amount of 1.5 percent of retail load, can maintain that level of savings for at least the remaining years of their analysis. The ability to sustain a level of EE savings over time depends, in part, on how sustainable EE is as a resource.

Analysis Group reviewed the available literature to determine the extent to which, based on past state experience, states can sustain moderate levels of energy efficiency programs before available cost-effective energy efficiency potential is depleted. Part of the answer is found in our analysis of state-

[80] "2013 Energy Efficiency Annual Report," Burlington Electric Department, p.1.

[81] Savings and program expenditures reported in "2013 Energy Efficiency Annual Report," Burlington Electric Department. Savings and expenditures include all business and residential demand-side management savings and costs.

driven EE programs, summarized above. For at least several years in leading states – including states that have implemented EE for over a decade – states continue to be able to achieve high levels of annual energy efficiency savings as programs grow. While it cannot be assumed that continued savings are inexhaustible, it is clear that achieving savings at the rate assumed by EPA can be sustained for many years. This suggests, in part, that as technological innovation advances and the cost of new technologies falls, more cost-effective energy efficiency potential becomes available and in some sense continuously building the resource of EE potential.

For example, improvements in lighting technology for light-emitting diode (LED) bulbs have increased lighting efficiency as well as color quality in recent years. When first introduced, LED bulbs were far more expensive than other bulbs, but their costs have since come down dramatically, falling 24 percent between 2010 and 2012 and by more than 85 percent since 2008. Even now, however, they are often the most expensive bulbs on the shelf, but their much longer lifespans (lasting up to 25 times as long as incandescent light bulbs) and lower power draw can economically justify the higher initial cost.[82]

A 2013 study of energy efficiency potential in New Hampshire conducted by VEIC also supports this concept of EE as a sustainable resource; the study estimates that the potential for cost-effective energy efficiency in New Hampshire's buildings is equivalent to 715.4 million kWh per year, representing more than 10 times the savings being achieved through the energy efficiency programs currently in place in the state. The report notes that "the fact that 10 times the amount of cost-effective energy efficiency is still available in New Hampshire than has been achieved after more than a decade of energy efficiency programs suggests that continuation of business-as-usual is not sufficient." [83]

A 2014 study from NYSERDA estimates achievable energy efficiency potential for the state of New York and finds that capturing the achievable potential in the state could generate $30 billion in net benefits. Additionally, the study suggests that EE can capture savings well beyond the state's current targets. The study finds that "the achievable potential is considerably higher than the savings targets for New York State's current programs, indicating that current and new programs will have ample opportunity to continue generating cost-effective efficiency savings and economic benefits for the State."[84]

Most importantly, Analysis Group's review of these factors demonstrates that leading states – including states that have implemented EE for over a decade – continue to be able to achieve high levels of annual energy efficiency savings as programs grow. For example, electric utilities in the Southwest have implemented a set of strategies to continue to meet energy savings goals that include encouraging behavior change, integrating demand response and energy efficiency efforts, adding financing to energy efficiency programs and supporting building energy code adoption and implementation, among other things.[85] Similarly, because EE potential studies are done at points in time and only consider the known

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[82] See http://www.eia.gov/todayinenergy/detail.cfm?id=18671; http://www.greentechmedia.com/articles/read/LED-Fixture-Prices-Fall-24-in-Two-Years-How-Much-Lower-Can-They-Go; http://www.rtcc.org/2014/03/20/led-costs-to-halve-as-efficiency-doubles-by-2020-us-dept-of-energy/; and Pogue, David. "New Reasons to Change Light Bulbs," *The New York Times*, March 20, 2013.

[83] Vermont Energy Investment Corp. "Increasing Energy Efficiency in New Hampshire: Realizing our Potential," November 15, 2013.

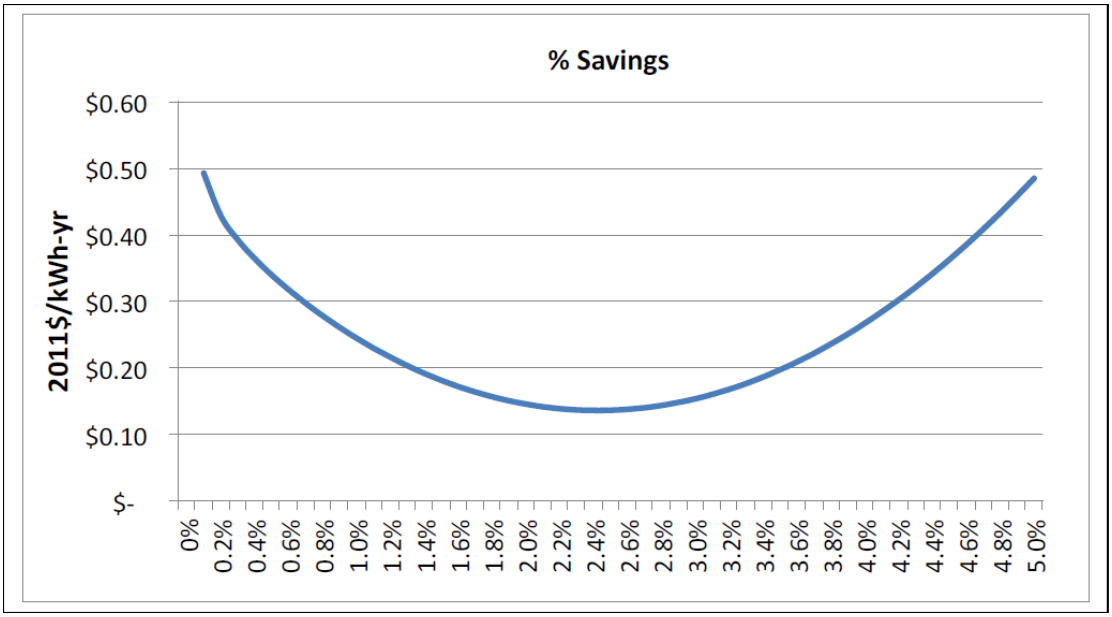
[84] NYSERDA, "Energy Efficiency and Renewable Energy Potential Study of New York State," Final Report, Report Number 14-19, April 2014, p. ES-4.

[85] Geller, Howard, et. al., "Maintaining High Levels of Energy Savings from Utility Energy Efficiency Programs: Strategies from the Southwest," SWEEP, ACEEE, 2014.

technology at that moment, updated studies in subsequent years continue to uncover more energy efficiency potential.[86] While it cannot be assumed that continued savings are inexhaustible, it is clear that achieving savings at the rate assumed by EPA can be sustained throughout the Clean Power Plan's compliance period.

Similarly, a study presented at the 2012 ACEEE's Summer Study on Energy Efficiency in Buildings estimated the cost of energy efficiency resource acquisition using actual and planned annual electric energy savings and spending by over 30 program administrators in the U.S. and Canada. The results of their regression analysis using these data indicated that the cost per kWh-year of energy avoided (expressed in $2011) falls as savings increase, until approximately 2.5 percent of annual energy savings are achieved, as shown in **Figure 27** below.[87] Notably, the Clean Power Plan's fourth building block assumes that states could scale their energy efficiency programs until they achieve and maintain annual energy savings of 1.5 percent of retail sales – only sixty percent of the level of annual energy savings at which the study suggests an inflection in the cost of maintaining annual savings levels.

Figure 27
Percentage Savings Effect on Costs of Savings



Source: John Plunkett, Theodore Love, and Francis Wyatt, Green Energy Economics Group, Inc., "An Empirical Model for Predicting Electric Energy Efficiency Resource Acquisition Costs in North America: Analysis and Application," 2012 ACEEE Summer Study on Energy Efficiency in Buildings.

More recently, ACEEE published a comprehensive meta-analysis of EE potential studies in August 2014 in which it reviewed 45 publicly available electric and natural gas energy potential studies published

[86] See, for example, New York studies in 1989 and 2003 found similar levels of available energy efficiency potential. The National Academy of Sciences, "Real Prospects for Energy Efficiency in the United States," 2010, p. 58.

[87] John Plunkett, Theodore Love, and Francis Wyatt, Green Energy Economics Group, Inc., "An Empirical Model for Predicting Electric Energy Efficiency Resource Acquisition Costs in North America: Analysis and Application," 2012 ACEEE Summer Study on Energy Efficiency in Buildings.

between 2009 and 2014 that cover a myriad of sources and geographic regions. The results include a quantitative summary of the EE potential as well as a qualitative deep dive on ten of the studies to fully vet the underlying methodology and assumptions. In evaluating these energy efficiency studies, ACEEE compared its results to a 2004 meta-analysis and found "median estimates of energy efficiency savings potential have not changed noticeably over the past decade or more, despite a major recession, a precipitous drop in natural gas prices, and the impacts of codes and standards.…It is clear that, for all the differences in study methodologies and assumptions, states and utilities are still finding a considerable amount of cost-effective energy efficiency savings potential after more than ten years."[88]

The role of technological innovation and falling costs in the sustained availability of cost-effective energy efficiency can be illustrated using the experience of the Northwest Power & Conservation Council ("NPCC") – a regional organization that develops and maintains a regional power plan that aggressively targets energy efficiency. NPCC updates its 20-year electric power plan every five years, dating back as far as 1983, and these plans include estimates of achievable potential energy efficiency savings for all cost-effective energy efficiency measures. NPCC's estimate of available cost-effective energy efficiency potential more than doubled between its Fifth Power Plan (2005) and Sixth Power Plan (2010) in large part due to technological innovation. As explained by NPCC, "the amount of efficiency included in the Sixth Power Plan is significantly higher than in previous Council plans. For example, in the Fifth Power Plan cost-effective efficiency was 2,500 average megawatts compared to 5,900 megawatts in the sixth plan. To a large extent, this increase is the result of changing technology that has created new efficiency opportunities and reduced costs."[89] NPCC's changing estimates of the available cost-effective energy efficiency potential from compact florescent light bulbs ("CFLs") over time is an illustrative example of this effect: in the 22 years between the NPCC's First and Fifth Power Plans, CLFs became the largest available residential conservation resource, with an estimated 625 MW available. "The shift from scant mention to the most valuable resource happened suddenly and recently due to technological improvements and decreasing costs."[90] **Table 2** below shows the dramatic increase in savings over time attributable to CFLs.

[88] Neubauer, Max, "Cracking the TEAPOT: Technical, Economic, and Achievable Energy Efficiency Potential Studies," ACEEE, Report U1407, August 2014.

[89] "Sixth Northwest Conservation and Electric Power Plan," Northwest Power and Conservation Council, February 2010, p. 10-4.

[90] Gordon, Fred, Lakin Garth, Tom Eckman, and Charles Grist, "Beyond Supply Curves," Proceedings of 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 17, 2008.

Table 2
Estimates of Residential CFL Savings
for 20-Year Periods in NPCC Power Plans

Plan	Year	Achievable Savings (MWa)	Assumed Cost Per Bulb
Plan 1	1983	105	-
Plan 2	1986	Not included	-
Plan 3	1991	24	$12
Plan 4	1996	44	$10
Plan 5	2005	625	$3

Source:
[1] Gordon, Fred, Lakin Garth, Tom Eckman, and Charles Grist, "Beyond Supply Curves," Proceedings of 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 17, 2008.

Lastly, improvements and innovations in EE program design and implementation can enable customers to capture a greater share of the available EE resource base, even absent technological improvements or reductions in technology cost. For example, recent innovative programs such as Property Assessed Clean Energy (PACE) financing have enabled more customers to invest in EE improvements. PACE financing effectively allows property owners to borrow money from a local government to pay for renewable-energy systems and/or EE improvements. The amount borrowed is typically repaid via a special assessment on property taxes, or another locally-collected tax or bill, such as a utility bill. Only property owners within a local jurisdiction that opt in to a PACE program may receive financing; local PACE programs are currently operating in at least nine states (California, Connecticut, Florida, Maine, Michigan, Minnesota, Missouri, New York and Wisconsin) and the District of Columbia.[91]

On-bill financing (OBF) is another innovative program that has been offered by some utilities and other EE program administrators to overcome the financial barrier faced by customers when investing in EE improvements that have a high upfront cost. OBF allows utility customers to invest in EE improvements and repay the funds through additional charges on their utility bills. If structured properly, an OBF program can substantially reduce the cost of and improve access to financing. In many cases, the product can be "bill-neutral," meaning that energy savings are sufficient to cover the monthly payments for the financing so that the total monthly charge on utility bills is less than or equal to the pre-investment amount. On-bill programs have been piloted as early as 1993 but have recently seen a surge in popularity. Currently, utilities in at least 23 states have implemented or are about to implement OBF programs, many of which (Illinois, Hawaii, Oregon, California, Kentucky, Georgia, South Carolina, Michigan, and New York) have legislation in place that supports adoption.[92]

[91] http://www.dsireusa.org/solar/solarpolicyguide/?id=26, accessed November 24, 2014.

[92] http://www.aceee.org/sector/state-policy/toolkit/on-bill-financing, accessed November 24, 2014.

8. CONCLUSION

EPA's draft Clean Power Plan, issued in the summer of 2014, sets state-specific standards for the amount of carbon dioxide allowed to be emitted per megawatt-hour of electricity produced at affected power generating facilities. In setting each state's standard, EPA considered *in part* the ability of states to reduce system-wide CO_2 emissions through investments in demand-side energy efficiency at the businesses and residences of the state. Based on an evaluation of historical experience with energy efficiency programs administered by utilities in leading states over the past several decades, EPA concluded that states could grow EE savings at a rate of increase of at least 0.2 percent per year, and over the initial term of the program, could sustain annual average savings of up to 1.5 percent of state retail electricity sales.

EPA's analysis keys in on the experience with energy efficiency investment/savings and the setting of energy efficiency standards in several key states in order to determine the potential impact of EE as a Clean Power Plan compliance mechanism, and help identify an adequately demonstrated Best System of Emission Reduction. Given the expanded set of EE compliance strategies that could occur under the Clean Power Plan, beyond traditional modes of EE investment, this may in the end represent a lower-bound estimate on what states are capable of, where EE is a cost-effective compliance alternative. Nevertheless, in this Report we comprehensively review state and utility experience with the implementation of EE programs over many years in order to evaluate EPA's assumed ramp rates and sustained savings levels, and determine whether they represent reasonable assumptions for the purpose of establishing state compliance standards.

Our assessment draws from the literature on EE program implementation and performance, publicly-available data sources, and state- and utility-specific documentation on EE policies and annual EE program budgets, savings rates and potential. Specifically, our analysis includes a literature review, quantitative analysis of historical ramp rates and savings levels at the state and utility level, and an analysis of the links between policy changes and periods of rapid EE uptake.

For this purpose, we only considered actual state/utility historical experience. We do not try to capture how EE could expand under the Clean Power Plan, how the incentives might change in response to new EE investment opportunities, or how the industry might expand with an increase in the magnitude and geographic scope of interest in EE measures and programs. Further, wherever possible, and absent more accurate sources, we calculated ramp rates and savings levels of energy efficiency programs using the state's aggregate reported savings from energy efficiency program administrators and the state's total electric retail sales in each year. For several reasons discussed in the Report, we believe our approach and observations based on the analysis may be overly-conservative – that is, our findings likely understate the potential ramp rate and sustained savings levels for energy efficiency investments on a going-forward basis.

Summary of Key Findings

There is a wealth of experience across the U.S. with implementation of energy efficiency programs, and a very wide range of efforts undertaken by individual states. Some states have sustained relatively high levels of energy efficiency investments over decades driven by prevailing high electricity prices and/or aggressive laws and regulations focused on energy and environmental policy. Other states are new to these efforts, only recently committing significant dollars for energy efficiency. And some – including in certain states with historically low energy prices – have pursued energy efficiency in only very limited ways.

Based on our review of an expanded set of data on states' experiences with EE implementation, we find that at the very least the potential for cost effective investment in energy efficiency – meaning cost effective from the perspective of avoiding utility/ratepayer costs – is likely to exceed the values for EE ramp-up activities and sustained savings levels adopted by EPA in its own assessment. In short, if anything we expect that as part of a Clean Power Plan compliance strategy states could achieve rates of growth in EE savings in excess of 0.2 percent per year, and could likely sustain levels of energy savings (and associated emission reductions) above 1.5 percent of state retail electricity sales throughout the Clean Power Plan's compliance period.

There is a substantial body of experience with utility-driven EE performance supporting this conclusion:

- Many states and/or individual utilities have demonstrated – in many years – the ability to achieve growth in energy savings through EE investments year-on-year at rates well in excess of 0.2 percent, including a number of states that achieved *double and triple that rate*. This includes states often considered first movers or leaders in EE programs, as well as states that do not fit that category.
- Many states and utilities have demonstrated the ability to rapidly change gears and increase the annual rate of savings quickly in response to changes in policy, indicating that rapid and major expansion of EE programs does not require a long lead time.
- States have demonstrated the ability to sustain high levels of EE savings over many years, in some cases at annual average savings rates over EPA's assumed 1.5 percent.
- The successful demonstration of states' ability to meet aggressive ramp rate and/or sustained savings levels holds true across a wide cross-section of states and delivery mechanisms, representing different electric industry structures; different electricity costs; different parts of the country with different climates and electricity needs; different mixes of residential, commercial, and industrial customers; and vastly different modes of EE program implementation (e.g., by utilities, compacts/associations, state agencies; and third-party contractors).
- Even though many customer-funded EE programs have historically been undertaken by regulated utilities responding to state policy mandates, highly successful implementation of energy efficiency has also been realized at municipal electric companies, electric cooperatives, and by private industries.
- Through continuous implementation of EE over multiple decades, it is becoming clear that EE is not a finite resource – that is, as states and utilities have implemented EE programs over many years, few if any have begun to see meaningful diminishing returns in EE investments. Huge energy efficiency potential remains even in states that have had sustained aggressive levels of EE investment. Evidence suggests that the point at which sustained annual savings from EE begin to experience increased unit costs would be at annual savings rates well above the levels EPA has assumed in its evaluation of sustainable savings levels.

Many states throughout the U.S. have realized that energy efficiency is and should be our "first fuel." Portfolio standards, loading order requirements, integrated resource planning standards, and the like all reflect a realization that there is a vast untapped and cost-effective EE potential remaining in all the states. In developing its proposed Clean Power Plan standards, EPA assumed that states can achieve a rate of increase in energy efficiency savings of at least 0.2 percent of annual electricity sales, and sustain a level of EE savings of 1.5 percent over the compliance period. Based on our review of primarily utility-driven EE programs and data on the results of implementation, we believe that EPA's numbers are on solid ground and, if anything, understate the potential to reach and sustain high levels of EE savings.