Synapse
Energy Economics, Inc.

South Dakota Energy Efficiency Potential Study Report

PREPARED BY SYNAPSE ENERGY ECONOMICS ON BEHALF OF PLAINS JUSTICE

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1. Introduction

South Dakota's high electricity consumption and absence of a sustained commitment to reduce it offer tremendous potential to lower consumers' electricity bills. Controlling electric energy consumption through energy efficiency programs also reduces the risk from exposure to higher bills and volatility due to fuel prices, and increases in bills caused by construction of new power plants. While its electricity rates are among the lowest in the United States, South Dakota electric customers' bills are similar to those paid by customers in states with higher energy costs. The average residential electric bill for South Dakota was about $80 in 2007 (Table 1), while the average bill in California and Vermont was about $84 per month. South Dakota electric bills also compare with those from Iowa and Minnesota, although the retail rates for these neighboring states are higher than those in South Dakota. A major reason for this similarity is that the amount of electricity consumed in South Dakota is significantly greater than that of residents in other states, even compared to states with similar climates, such as Minnesota. The average South Dakota customer consumes about 155 kWh more per month than the average Minnesota resident, so even though its electricity rate is lower than other states, South Dakota residents spend about the same percent of their annual income on electricity as residents of other states.

Table 1. Comparison of State Residential Electric Consumption Profiles

State	Retail average rate in 2007 (cents/kWh) [1]	Average monthly kWh per customer in 2007 [1]	Average Monthly Bill [2]	Degree Days [3] (range across state)	Annual Per Capita Income[4]	Percent of Annual Income Spent on Electricity
North Dakota	7.30	1077.8	$78.70	8,500-10,500	$36,082	2.62%
South Dakota	8.07	990.7	$80.00	7,000-8,500	$35,760	2.68%
Iowa	9.45	885.5	$83.60	6,500-8,000	$34,916	2.87%
Minnesota	9.18	832.4	$76.40	8,000-10,500	$41,105	2.23%
New York	17.10	603.9	$103.30	5,500-9,000	$46,364	2.67%
Vermont	14.15	592.2	$83.80	7,500-9,000	$37,483	2.68%
Wisconsin	10.87	724.8	$78.70	7,000-9,500	$36,272	2.61%
California	14.42	579.6	$83.60	1,500-7,000	$41,805	2.40%

Notes:

[1] EIA 2009. Current and Historical Monthly Retail Sales, Revenues and Average Revenue per Kilowatt hour by State and by Sector (Form EIA-826)

[2] Residential revenue divided by the number of residential customers in each state. The data are based on EIA 2009.

[3] http://lwf.ncdc.noaa.gov/img/documentlibrary/clim81supp3/annualheatingDD_hires.jpg

[4] U.S. Department of Commerce, Bureau of Economic Analysis. Local Area Personal Income, available at http://www.bea.gov/regional/reis/default.cfm?selTable=CA1-3&section=2

When consumers perceive that electricity is and will remain inexpensive they are encouraged to make decisions about their energy consumption based on the short-term economics—decisions which have long-term and expensive impacts. Inefficient buildings may have slightly lower construction costs, but they consume high amounts of energy, and this high rate of consumption lasts for as many decades as the building is used. Similar dynamics play out with everything from light bulbs to HVAC systems. This short-term perception, along with the many barriers consumers and businesses face in making efficient investments, exposes them to the variations in electric fuel prices and to the costs of new power plants that are much more expensive than investments in energy efficiency. New power plants often also have other negative impacts, such as increased air pollution, sending money out of state to purchase fuel and exposure to risk from future environmental regulations. The costs of high energy consumption are also borne by residents and businesses in a state whose per capita income is lower than the U.S. national average. On a per customer energy bill basis, South Dakota's energy costs are comparable to other states. If South Dakota took steps to reduce its energy consumption, it would save consumers money and avoid the risk of an electricity rate increase due to the need to construct need power plants and transmission lines.

Energy Efficiency Reduces Consumers' Bills, Improves Reliability and Improves Public Health and the Environment

A reasonable and achievable goal adopted by many states and utilities over the past decade and more has been to save energy each year at a rate of 1% of annual retail sales. The cost to save that amount of energy is a fraction of that required to construct an equivalent new power plant. Energy efficiency also defers the need to upgrade transmission and distribution lines.

While 1% per year is considered to be a good level of savings today, a growing number of states have started to or have already ramped up their energy efficiency programs to achieve even higher levels of energy savings. Actions by these states have helped to stabilize consumer energy bills, kept money in state by creating local jobs to install, service, and maintain energy efficiency measures, and improved their environment through lower water use and reduced emissions of air pollutants. Several states now aim to save energy at an annual rate of 2% or more of annual retail sales including New York, Massachusetts, Vermont, Maryland and California; these states are finding that this target is also cost-effective. Such progress has not been confined to the coastal states. The member states of the Midwestern Governors Association (MGA) also pledged to achieve 2% energy savings by 2015.[1] A recent study by the Energy Center for Wisconsin (ECW) and the American Council for Energy Efficient Economy (ACEEE) has reviewed numerous potential studies and concluded that a 2% goal is achievable for the Midwest.[2]

Taking all of these activities and studies into account, a 2% energy efficiency goal is achievable in South Dakota provided that South Dakota stakeholders and organizations commit to consistent and sustained actions. Experience has shown that certain policies will need to be adopted to support this level of savings. These policies include:

- Establishing and funding utility energy efficiency programs;
- Improving building energy codes;

[1] Energy Security and Climate Stewardship Platform for the Midwest 2007 (Proceedings from Energy Summit held November 14-15, 2007) http://www.midwesterngovernors.org/Publications/MGA_Platform2WebVersion.pdf
[2] ECW and ACEEE 2009. A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, available at http://www.ecw.org/ecwresults/247-1.pdf

- Adopting advanced appliance efficiency standards;
- Integrating the energy resource and capacity benefits of energy efficiency into state energy plans, and utility integrated resource plans;
- Including the benefits of energy efficiency in air quality improvement and greenhouse gas reduction plans; and
- Including the external benefits of energy efficiency into the costs that are avoided, and factoring the external costs imposed on society by existing fossil-fuel fired generation into planning.

How Energy Efficiency Can Benefit South Dakota

While all sectors—residential, commercial and industrial—in South Dakota have significant potential to save energy, the commercial sector has led electric growth over the last decade, and now represents 35.4% of South Dakota's retail electric sales, up from 27.8% in 1997. Many states have conducted studies that evaluate the potential to save energy across various sectors. While these studies conclude that substantial savings exist across all sectors, the commercial and industrial sectors normally have substantial and highly cost-effective potentials to save energy due to the size of their electricity demand and economies of scale. Multiples of the same measure-lighting, appliances, motors- can be installed at the same location, reducing energy consumption significantly. Based on this experience from other states, we would expect to also find significant and highly cost-effective measures to be available in South Dakota across all sectors, but particularly in the commercial and industrial sectors. Many of the efficiency measures commonly used to reduce energy consumption have payback periods of one or two years, meaning that businesses can reduce their energy bills substantially today by implementing these measures[3]. The Appendix to this report provides examples of the type of measures that could be implemented by the commercial sector.

Energy consumption in the residential sector has also grown over the last decade, despite essentially no growth in the state's population.[4] Based on our experience, the cost of saving power by installing high efficiency lighting, typically the first measure adopted, would be about one-quarter of even South Dakota's low electric rates. In areas of the U.S. where energy efficiency competes on an equal footing with generation, energy efficiency is helping to drive down the costs to procure power. Energy efficiency also provides a prudent hedge against future fuel price increases and against their volatility.

Simple, commercially available and highly cost-effective measures such as lighting and improved building insulation and/or HVAC measures can reduce residential energy consumption by 10 to 20%. At these levels of energy savings, participating residential customers in South Dakota would reduce their energy bills by between $650 and $1,300 over 12 years (the average life of efficiency measures) after taking into account the cost of efficiency measures, and the average commercial customer would save between $3,390 and $6,780.

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[4] South Dakota: 1990: 696,004; 2000: 754,844; 2008 (est): 804,194. http://www.census.gov/

We commend South Dakota Governor Rounds for his signature on to the MGA commitment to increase the level of energy saved through energy efficiency. The MGA goal to save 2% of annual energy sales through energy efficiency will result in an estimated $390 million in savings to South Dakotans by 2020. Achieving this level of improved energy performance could also create an estimated 5,523 net new jobs in the state by 2020.

Aggressive efficiency programs in other states have provided opportunities to customers to reduce their energy bills to produce jurisdiction wide or state-wide energy savings of 1% to 2% per year. Energy efficiency programs that achieve annual energy savings of 1% per year are considered to be effective programs today. Assuming South Dakota would increase its annual energy savings to 1% of retail sales by 2012 and then continue at this level through 2020, (about 8.7% cumulatively by 2020) the state would save its ratepayers approximately $250 million. At the 1% efficiency scenario, about 3,680 net jobs would be created.

Investing in energy efficiency today, and increasing the amount of energy saved by South Dakota residents and businesses to levels consistent with neighboring states, will create substantial savings in energy costs.

2. "Why Energy Efficiency?" The Benefits of Energy Efficiency

A. What is Energy Efficiency?

Energy efficiency means providing the same or better level of service or production while reducing the energy consumption and costs to operate electric appliances, heating and cooling systems, or entire building envelopes. Energy efficiency programs and policies promote the techniques, measures and devices that provide equal or better service while using less energy than other measures. Consider the use of an efficient washing machine: the clothes get just as clean as when using a less efficient appliance, but the washing machine uses less energy and costs less to run. Energy efficiency can also mean achieving the same level of service through different means. Consider building design and industrial processes: building occupants require sufficient lighting, cooling, and heating to productively perform their duties in comfort. Reaching this level can be accomplished in several different ways, all with varying energy use. Buildings can have long rows of overhead lighting or they can have skylights to let in natural light. The latter requires less energy to accomplish the same goal and also increases worker productivity, as people work better with some natural daylight.[5] For heating and cooling needs, builders can choose boilers and air conditioners of varying degrees of efficiency. They can also constructed or modify buildings to take advantage of sunlight to help warm them in the winter in northern climates or to minimize such exposure in southern climates to help keep them cooler. In both examples, the building energy use is lower for the same amount of comfort. These buildings can also operate with much smaller and cheaper boilers and air conditioning systems, saving significant amounts of energy and money over their life.[6]

B. Benefits of Energy Efficiency

Many efficiency measures cost significantly less than generating, transmitting, and distributing electricity. Energy efficiency lowers system-wide electricity costs and reduces customers' electricity bills. Energy efficiency also offers a variety of benefits to utilities, their customers, and society. Energy Efficiency:

- *Reduces customer bills,* helping residents to increase their discretionary income, schools to purchase more books or hire more teachers, and businesses to improve their profit margin, and to maintain and increase their competitiveness.
- *Reduces the risks associated with fossil fuels* and their inherently unstable price and supply characteristics and costs of unanticipated increases in future fuel prices.
- *Increase energy independence*, by reducing the amount of fuels (coal, gas, oil, nuclear) and electricity imported from other regions or even from other countries.

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[5] Reviews of Technical Reports on Daylighting and Productivity, Peter Boyce, PhD, Lighting Research Center, Rensselaer Polytechnic Institute, Troy NY, 2004; http://www.lrc.rpi.edu/programs/daylighting/pdf/BoyceHMGReview.pdf (Iowa Energy Center was one of the funders for this report)

[6] Installing energy efficiency measures and smaller boilers and air conditioning systems can reduce consumption 25-50% using conventional, "off-the-shelf" technologies. Rocky Mountain Institute, Home Energy Brief #1, Building Envelope, December 2004, http://www.rmi.org

- *Improves the overall reliability* of the electricity system. Efficiency programs can have a substantial impact on peak demand, during those times when reliability is most at risk.[7] By slowing the rate of growth of electricity peak and energy demands, energy efficiency provides utilities and generation companies more time and flexibility to respond to changing market conditions, while moderating the "boom-and-bust" effect of competitive market forces on generation supply.[8]
- By reducing peak demand, *reduces the stress on local transmission and distribution* systems, deferring expensive T&D upgrades or mitigating local transmission congestion problems.
- *Offers significant benefits to the environment and reducing risks associated with environmental impact*. Every kWh saved through efficiency results in less electricity generation and, thus, less pollution.[9] Energy efficiency can delay or avoid the need for new power plants or transmission lines, thereby reducing the environmental impacts associated with new power plants or transmission lines.
- *Promotes local economic development and job creation* by increasing the disposable income of citizens and making businesses and industries more competitive, compared to importation of power plant equipment, fuel, or purchased power from outside the utility service territory. As an example, ACEEE estimated that the American Clean Energy and Security Act of 2009 passed by the House in June 2009 will save American consumers an average of $486 per household per year and create over 600,000 jobs by 2030.[10]

Energy efficiency programs create savings that accumulate over time. Energy efficiency measures that occur in the first year last for the entire life of the measures, measures that occur in the second year add to those from the first year, those that occur in the third year are added to the benefits from years one and two, and so forth. Energy efficiency measures can also be targeted to where the needs are: to a particular customer class, to peak or baseload times, and in quantities distributed throughout the state. This is different from a power plant, where the plant may be able to be quickly constructed, but consumers have to pay for the costs over the entire life of the plant (which can be 50 years or more), even during periods of changing electricity demand or fuel-price volatility that affects the number of hours that a plant operates.

Some power plant proposals are justified, in whole or in part, on projected exports to out-of-state customers. However, regional electricity markets are dynamic and a power plant built in South Dakota for export purposes can be affected by out-of-state events and policies, perhaps leaving South Dakotans to pay for the plant, even if it doesn't operate. As South Dakota's neighbors

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[7] ACEEE 2007. Examining the Peak Demand Impacts of Energy Efficiency: A Review of Program Experience and Industry Practices; ISO-New England, Second Regional Energy Efficiency Meeting, April 29, 2009. Almost 900 MW of energy efficiency was bid into, and cleared, the regional capacity market.

[8] Navigant Consulting 2009. Evaluation of Targeted Demand Side Management Program, Presented to Consolidated Edison Company of New York, Inc.; Regulatory Assistance Project 2001. Efficient Reliability: The Critical Role of Demand-Side Resources in Power Systems and Markets, prepared for the National Association of Regulatory Utility Commissioners, funded by the Energy Foundation, June.

[9] Unlike other pollution control measures – such as scrubbers or selective catalytic reduction, energy efficiency measures can reduce air emissions with a *net reduction* in costs. Thus, energy efficiency programs should be considered as one of the top priorities when investigating options for reducing air emissions and other environmental impacts from power plants.

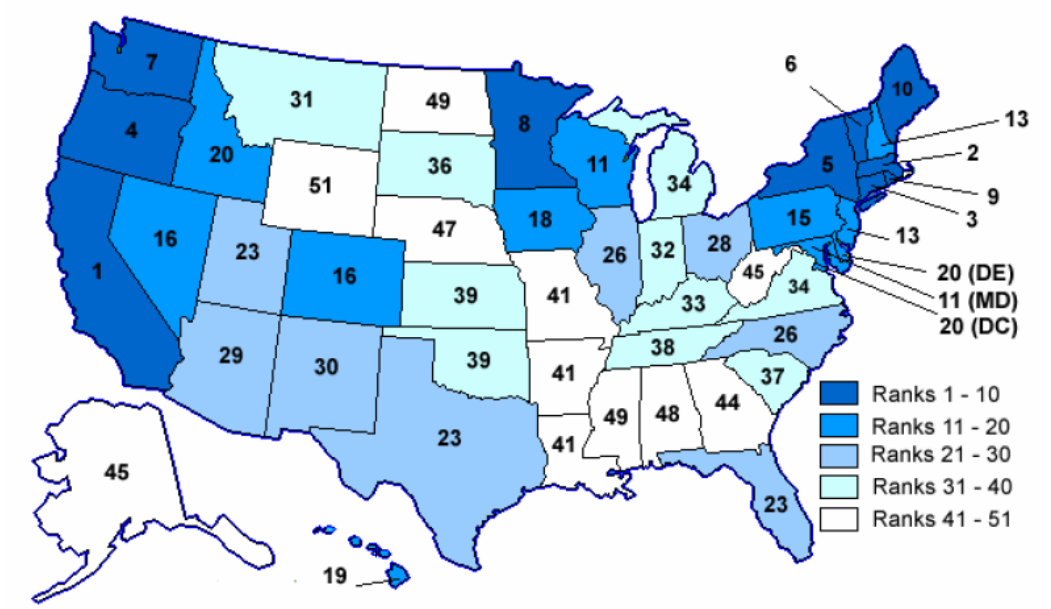
[10] ACEEE 2009a. Energy Efficiency in the American Clean Energy and Security Act of 2009: Impacts of Current Provisions and Opportunities to Enhance the Legislation, available at http://www.aceee.org/pubs/e096.htm

recognize the benefits of energy efficiency, and increase their level of energy savings each year, the need to build and operate new power plants to export electricity will decrease. Energy efficiency programs in Iowa and Minnesota will further reduce consumption there. New power plants have been recently cancelled in those states due to an inability to demonstrate the need for a new plant and to obtain financing given an uncertain future. South Dakotans can take charge of and plan for a more secure and cost-effective future through energy efficiency investments.

3. Energy Efficiency Programs in South Dakota and Other States

A. Level of Annual Savings by State and Utility

Electric energy efficiency activities in South Dakota are, and have been, very limited. Their scale and impact have been small compared to other states. According to the 2009 State Energy Efficiency Scorecard by the independent and not-for-profit ACEEE, South Dakota is ranked 36th out of 51 jurisdictions nationally for their policies and programs on energy efficiency (See Figure 1). That ranking summarizes ACEEE's scores for various types of energy efficiency activities including (1) utility and public benefit efficiency programs and policies, (2) transportation, (3) combined heat and power, (4) building codes, (5) appliance standards, (6) lead by examples, and (7) R&D.[11]



Note: Several states have the same score and are tied for the same ranking.

Figure 1. Rankings of State Energy Efficiency Policies for 2009

Source: ACEEE 2009 Scorecard[12]

In the category of utility and public benefit programs, the major policy mechanism for energy efficiency, South Dakota lags behind other states and the U.S. national average. South Dakota's ranking improved to 36th from 47th the previous year based on commitments to energy efficiency programs agreed to by Otter Tail Power (for a pilot scale program) and by MidAmerican Energy Company for a larger scale program. These initial efforts are encouraging; the scale of the

[11] ACEEE is a national non-profit research organization dedicated to promoting energy efficiency.
[12] Maggie Eldridge et al, The 2008 State Energy Efficiency Scorecard, October 2008, ACEEE Report Number E097, http://www.aceee.org/pubs/e097.htm

efficiency programs should be increased to achieve even greater savings in future years. According to ACEEE's 2009 State Scorecard, South Dakota's annual savings from utility efficiency programs are close to zero percent of annual electricity and natural gas sales.

In contrast, leading utilities and states are savings energy at about 1% to 3% per year. Table 2 below presents example from leading programs, including three from Minnesota and two from Iowa.

Table 2. Energy Savings by Leading Utilities and States[13]

Entity	Annual Savings (%)	Year(s)	Source
Pacific Gas & Electric (CA)	3.2	2008	CPUC 2009. Energy Efficiency and Conservation Programs: Progress Report to the Legislature, July 2009
Interstate Power & Light (MN)	2.6	2006	Garvey, E. 2007. "Minnesota's Demand Efficiency Program."
Efficiency Vermont (VT)	2.5	2008	Efficiency Vermont 2009. 2008 Highlights
Massachusetts Electric Co.(MA)	2.0	2006	EIA 861
San Diego Gas & Electric (CA)	1.9	2008	CPUC 2009
Southern California Edison (CA)	1.9	2008	CPUC 2009
Minnesota Power (MN)	1.9	2005	Garvey, E. 2007
Puget Sound Energy (WA)	1.4	2007	Data obtained from Northwest Power and Conservation Council (NWPCC)
Connecticut IOUs (CT)	1.3	2006	CT Energy Conservation Management Board 2007. Energy Efficiency: Investing in Connecticut's Future
Pacific Corp (ID & WA)	1.3	2007	Data obtained from NWPCC
Energy Trust of Oregon (OR)	1.3	2005	Data obtained from NWPCC
Avista Corp (ID, WA, MT)	1.1	2005	Data obtained from NWPCC
Idaho Power Co (ID)	1.1	2007	Data obtained from NWPCC
PUD No 1 of Snohomish (WA)	1.0	2007	Data obtained from NWPCC
Otter Tail (MN)	0.9	2005	Garvey, E. 2007. "Minnesota's Demand Efficiency Program."
Seattle City Light (WA)	0.9	2007	Northwest Power and Conservation Council
MidAmerican (IA)	0.9	2006	Iowa Utilities Board 2009. The Status of Energy Efficiency Programs in Iowa
Interstate Power & Light (IPL) (IA)	0.8	2006	Iowa Utilities Board 2009

Note: the numbers show the best performance by each entity in recent years.

[13] Some of the energy savings results may be still subject to verification process by independent parties. Most notably the estimates for California utilities are such a case. Sales data are obtained from EIA Form 861.

A growing number of states are starting new efficiency programs or expanding existing programs by requiring utilities to procure all cost-effective energy efficiency; others are expanding efficiency program requirements to non-investor owned utilities, such as municipal utilities and cooperatives, and to natural gas utilities. Table 3 provides some of the most aggressive energy efficiency targets in the United States (a map of state energy efficiency goals are attached in the Appendix, Figure A1).[14] While the Atlantic or Pacific coasts have had a long history of progressive energy efficiency programs, more recent progress has also occurred in states that have not had a program or which have lagged behind those of other states. Idaho is one such example. While its 2009 ACEEE ranking slipped to 20th, from 13th the previous year, Idaho has developed a comprehensive policy structure that requires energy efficiency to be a priority in utility resource planning and a pilot scale decoupling proceeding to allow utilities to recover infrastructure costs, such as those to maintain the transmission and distribution system that exist regardless of the quantity of electricity sold each year. A sustained implementation of the comprehensive policies could make Idaho a leading state to promote good energy efficiency programs.

Table 3. Examples of State Energy Savings Targets[15]

State	Target
Minnesota	1.5% annual savings based on prior-3 years average, to 2015
Iowa	5.4% energy savings by 2020 - 1.5% annually by 2011
Michigan	1% annual energy savings as a percent of from prior year's sales
Illinois	reduce energy use 2% per year by 2015 and peak 0.1% from prior year
Ohio	22% energy savings by 2025 (from 2009); reduce peak 8% by 2018
Vermont	11% energy reductions by 2011 (2% annual)
Massachusetts	25% of electric load from DSR, EE by 2020: capacity and energy
New York	reduce electric use 15% by 2015 from levels projected in 2008
Delaware	Sustainable Energy Utility charged with 30% energy reduction by 2015
Maryland	reduce per capita electricity use and peak 15% by 2015 from 2007
Washington	pursue all cost-effective conservation: ~ 10% by 2025
California	8% energy savings; 4,885 MW peak reduction by 2013 (from a 2004 base)

The Midwestern Governors Association (MGA) has set out aggressive energy efficiency goals for the region in its Energy Security and Climate Stewardship Platform for the Midwest established in 2007.[16] According to the Platform:

[14] Among the states that have statutes requiring all cost-effective energy efficiency are: California, Connecticut, Delaware, Maine, Maryland, Massachusetts, Rhode Island, and Vermont.
[15] Federal Energy Regulatory Commission 2009. Electric Market Overview: Energy Efficiency Resource Standards (EERS) and Goals, Updated July 8, 2009

> To implement the Energy Security and Climate Stewardship Platform, the governors and premier of Illinois, Indiana, Iowa, Kansas, Manitoba, Michigan, Minnesota, Ohio, South Dakota and Wisconsin endorse the following specific objectives and goals by which to measure progress, and offer a menu of policy options to reach our common goals. . . .Meet at least 2 percent of regional annual retail sales of natural gas and electricity through energy efficiency improvements by 2015, and continue to achieve an additional 2 percent in efficiency improvements every year thereafter.

B. Cost of Energy Efficiency Programs

Energy efficiency has been one of the most cost-effective energy resources across several states. The notion that efficiency is reliable and persistent is well established. Energy efficiency competes on an equal footing with coal-fired and other generation in electric capacity markets in the Northeast and Middle Atlantic states, and it has helped to drive down the costs to procure capacity in those regions. The Obama Administration recognizes efficiency as a cost-effective energy source and calls for aggressive energy savings in the President's "New Energy for America" plan:

> Deploy the Cheapest, Cleanest, Fastest Energy Source - Energy Efficiency. The Department of Energy (DOE) projects that demand for electricity will increase by 1.1 percent per year over the next few decades. Cutting this demand growth through efficiency is both possible and economically sound. Barack Obama will set an aggressive energy efficiency goal—to reduce electricity demand 15 percent from DOE's projected levels by 2020. Implementing this program will save consumers a total of $130 billion, reduce carbon dioxide emissions by more than 5 billion tons through 2030, and create jobs. A portion of this goal would be met by setting annual demand reduction targets that utilities would need to meet. The rest would come from more stringent building and appliance standards.[17]

The cost of saved energy (CSE) from energy efficiency programs is one-half that of South Dakota's retail residential electricity rates, and one-third that of new power plant construction. (See Figure 2.) One review of state and utility efficiency programs in 2004 found that the utility CSE ranged from $0.023 to $0.044 per kWh saved, with a median value of 3.0 cents per kWh saved.[18,19] ACEEE updated their 2004 study in 2009, concluding that the average program costs over multiple years and states ranged from 1.5 to 3.4 cents per kWh, with a median value of 2.7 cents/kWh and an average value of 2.5 cents/kWh. ACEEE notes that "recent conventional

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[16] Midwestern Governors Association, 2007, *Ibid*
[17] http://www.barackobama.com/pdf/factsheet_energy_speech_080308.pdf

[18] ACEEE 2004. Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies. Kushler, York & Witte, 2004

[19] The utility cost of saved energy through energy efficiency programs represents the costs incurred by a utility or efficiency program administrator. The utility cost typically includes the costs associated with program administration, marketing, measurement and evaluation, and participant incentives and rebates, while it excludes participants' costs, which is the cost participants pay minus the amount of utility incentives.

energy supply-side options have typically cost between $0.07 and $0.15 per kWh — about three to four times the cost of energy efficiency investments. [20,21]

Nearby states of Iowa and Minnesota operate energy efficiency programs that have costs that are even lower than the national average: 1.8 cents/kWh for Iowa and 2.3 cents/kWh for Minnesota.

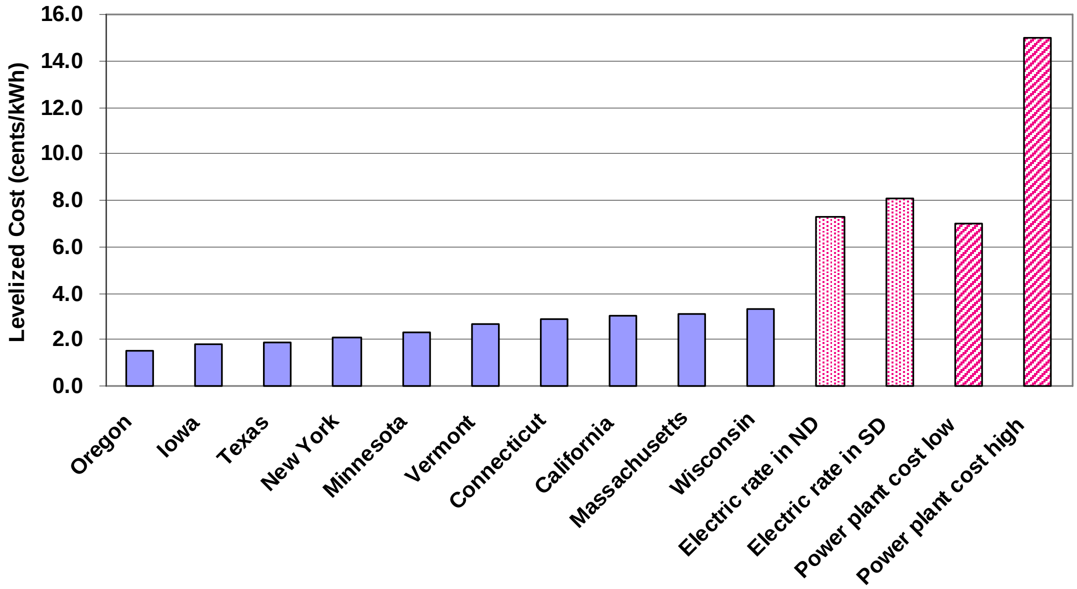

Figure 2. Comparison of Utility Cost of Energy Efficiency, Retail Rates, and Power Plant Cost

A study by Synapse Energy Economics evaluated historical trends in CSE and reported that the CSE even decreased when program scale and impact were expanded. (Details are provided in the Appendix to this report.)[22]

Finally, it is important to mention that states have rigorously evaluated the cost-effectiveness of energy efficiency programs and have consistently found that benefits from efficiency programs are over twice to nearly four times the cost of energy efficiency (as shown in the Appendix).

C. Potential for Energy Efficiency in States, Based on Recent Studies and Program Approvals

No recent studies have been completed to assess the potential of energy efficiency in South Dakota. However, several existing potential studies conducted across the nation including for neighboring states provide useful insight for South Dakota's energy efficiency potential. The Energy Center of Wisconsin (ECW) and ACEEE have recently conducted a comprehensive study

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[20] ACEEE 2009b. Savings Energy Cost-Effectively: A National Review of the Cost of Energy Saved Through Utility-Sector Energy Efficiency Programs

[21] ACEEE 2009b, page 15 In 2008, power from pulverized coal plants cost between $0.07 and $0.14 per kWh, power from combined-cycle natural gas cost between $0.07 and $0.10 per kWh, and wind cost between $0.04 and $0.09 per kWh."

[22] Synapse Energy Economics 2008. Cost and Benefits of Electric Utility Energy Efficiency in Massachusetts, available at http://www.synapse-energy.com/Downloads/SynapseReport.2008-08.0.MA-Electric-Utility-Energy-Efficiency.08-075.pdf.

to review and analyze a number of such existing energy efficiency potential studies. The study concluded that it is possible to achieve 2% per year energy efficiency savings in the Midwest.

The study also found that those estimates had significant limitations and were quite conservative. The reasons for this conservatism are:[23]

- Avoided costs used in existing studies are much lower than either present or projected generation costs even without considering a cost of carbon;
- Existing studies emphasize incremental changes and improvements and exclude greater savings opportunities through integrated, synergistic effects of comprehensive packages of measures;
- They do not include more advanced measures such as net zero energy buildings;
- Existing studies do not account for emerging technologies, continued improvements of technologies and cost reductions of such technologies over time;
- Existing studies ignore on-energy benefits such as increased thermal comfort, increased productivity, and environmental benefits; and
- Additional conservatism is typically built into each key assumption (particularly customer participation realization rates).

Despite the limitations and conservatism built into the existing potential studies, several studies project annual achievable savings near or above 2% of annual sales, as presented above. While existing, limited studies for Midwestern states are projecting potential energy savings of less than 2% per year, ECW and ACEEE concluded that the 2% annual savings goal of MGA's Energy Security and Climate Stewardship is achievable because the existing studies contain significant limitations and conservatisms as described above. But the study also emphasizes that in order to achieve the 2% goal, states have to engage in significant concerted efforts that involve emulating or continuing existing successful efficiency programs along with new initiatives, more timely adoption of codes and standards, use of combined heat and power, and governments leading by examples.

[23] ECW and ACEEE 2009.

4. Potential of Energy Efficiency in South Dakota

A. Energy Efficiency Potential for Customers

Customers participating in state or utility energy efficiency programs can save significant amounts of energy and lower their energy bills. The level of savings will depend on the energy efficiency savings goals and the measures included in a program. Replacing CFLs, one of the most popular energy efficiency measures, will save a sizable amount of energy if multiple incandescent lamps are removed. A value of 10 to 20% energy savings was used as a proxy for a typical, but comprehensive efficiency program. To reach the 10-20% savings levels energy efficiency programs should include:

- Lighting measures plus replacement of inefficient appliances (e.g., refrigerators, building chillers and motors);
- Retrofitting the building envelope (such as efficient windows and insulation);
- Lost opportunities programs focused on new building construction, and;
- Whole building approaches that evaluate how energy is used throughout the entire building, including boilers and furnaces.

In 2008, residential customers participating in Efficiency Vermont's programs (one of the most successful efficiency programs in the nation) saved an average 1,400 kWh, which is about 20% of Vermont's total consumption.[24] California investor owned utilities are now aiming to save at least 20% of energy for up to 130,000 homes by 2012.[25]. As Figure A2 in the Appendix shows, the cost of saved energy decreases as the quantity of energy savings increases. Efficiency becomes more cost effective in more aggressive programs because of economies of scale (more energy efficient devices and products are being delivered, thus lowering the per unit cost to market and install a product), but also because many costs, including administration and advertising, are fixed regardless of the size of the energy efficiency program, its comprehensiveness, or its goals.

In the case of South Dakota, we estimate how much energy costs residential and commercial customers will save if they participate in comprehensive energy efficiency programs, and if those programs aim to reduce participants' consumption at 10% or 20% of annual consumption on average. The results of this analysis are presented in Tables 4 and 5. Table 4 presents energy bill savings over 12 years (the average life of a portfolio of efficiency measures) as well as annual bill savings. Table 5 shows net bill savings, taking into account the participants' share of the cost of energy efficiency installations.[26] Note that the savings shown in Tables 4 and 5 do not include any

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[24] Efficiency Vermont 2009. Year 2008 Preliminary Savings Claim.

[25] RestructuringToday "California PUC OKs $3 billion for statewide energy efficiency" issued on September 28, 2009.

[26] In these calculations, the savings are estimated relative to the consumption levels by typical residential and commercial customers according to U.S. EIA 861 data files (77.2 MWh per year for commercial and 12.9 MWh per year for residential). Also it is assumed that participating customers would save the average retail residential and commercial rates in 2007 for every kWh of efficiency savings. The rates are 7.3 cents/kWh (in 2007 real dollar) for residential and 6.6 cents/kWh (in 2007 real dollar) for commercial. For the purpose of this analysis, these rates are kept constant on a real term given that EIA AEO 2009 forecast assumes almost a zero fuel cost escalation rate for coal which accounts for the majority of generation fuel source in this region. For the estimate of net energy bills,

assumptions to escalate retail electricity rates. The values shown are therefore conservative, since it is probable that retail rates will increase in South Dakota between now and 2020.

Table 4. Energy Bill Savings for Typical Residential and Commercial Customers in South Dakota

	Total Bill Savings Over 12 years (PV)		Average Annual Bill Savings (PV)	
	10% savings	20% savings	10% savings	20% savings
Typical Residential	$837	$1,675	$70	$140
Typical Commercial	$4,509	$9,018	$376	$752

Table 5. Net Energy Bill Savings for Typical Residential and Commercial Customers in South Dakota

	Total Bill Savings Over 12 Years (PV)		Average Annual Bill Savings (PV)	
	10% savings	20% savings	10% savings	20% savings
Typical Residential	$650	$1,300	$54	$108
Typical Commercial	$3,389	$6,777	$282	$565

These results do not reflect costs and benefits associated with potential federal carbon legislation or public health benefits from reducing consumption of fossil fuel. Federal legislation would include the costs of greenhouse gas emissions in the electricity that is generated by plants that emit such gases, as a function of the quantity emitted. Coal-fired power plants which produce more greenhouse gases per MWh of generation would have higher costs than those plants which produce electricity with natural gas, while plants that produce electricity through renewable sources, such as hydroelectric or wind, would have no additional costs. Fossil-fueled power plants, especially coal plants, also impose substantial external costs which are not included in their operating costs. A recent report completed by the National Academy of Sciences concludes that, on average, each coal-fired power plant imposes public health costs of $156 million (or 3.2

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costs of energy efficiency borne by program participants is assumed to be 1.6 cents/kWh (in 2007 real dollar). This is about 45% of total energy efficiency costs, assuming that utility programs cost about 2 cents/kWh, which is about 55% of the total cost. These ratios are based on ACEEE 2009b. Savings Energy Cost-Effectively: A National Review of the Cost of Energy Saved Through Utility-Sector Energy Efficiency Programs. The utility cost of efficiency program is based on the experience from efficiency programs in Iowa and Minnesota. The present value calculation uses a 5% real discount rate.

cents/kWh), compared to an average of $1.49 million (or 0.16 cents/kWh) for natural gas-fired plants.[27] South Dakota customers who install energy efficiency measures and appliances will enjoy even greater dollar savings in the future if carbon costs are included in electricity bills. As an example, if assumed carbon costs of $15 per ton starting in 2015 and increased to $30 per ton by 2020 are included in the operating costs of power plants in the region, that the electricity produced by these plants will increase by 19% - 21%.[28] Improving energy performance through energy efficiency and increased use of electricity produced by renewable energy sources will avoid these cost increases and reduce the public health impacts and costs that presently occur from coal-fired generation.

B. Energy Efficiency Potential for South Dakota

Based on our research on existing and proposed energy efficiency programs (discussed above), we also analyzed the potential impact of two policy scenarios for aggressive energy efficiency for the entire state of South Dakota.

- Scenario A involves ramping up the state's efficiency programs to 1% of annual sales by 2012 and maintaining programs at this level thereafter;
- Scenario B entails ramping up the state's efficiency programs to 2% of annual sales by 2015 to meet the goals of the Midwestern Governors' Association, and maintaining programs at this level thereafter.[29]

Under Scenario A, we estimate that by 2020, consumers would save over 6,400 GWh of energy (equivalent to more than twice the annual output from the 457 MW Otter Tail Power Big Stone generating plant), resulting in about a $250 million net benefit to the state by 2020. Under Scenario B, we estimate that by 2020, consumers would save nearly 9,600 GWh of energy, (equal to three times the annual output from the 457 MW Big Stone plant plus six times the annual output from the 135 MW Black Hill Ben French generating plant [30]) resulting in an approximately $400 million net benefit to the state by 2020. (See Table 6 below.) To estimate the economic benefits, we assumed energy efficiency would avoid generation from existing coal power plants until 2014 and then avoid or defer the construction of new combined cycle gas turbines thereafter until 2020. The avoided cost starts at 2.7 cents/kWh in 2010 and increases to

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[27] National Research Council, Hidden Costs of Energy, 2009 http://www.nap.edu/catalog.php?record_id=12794#toc

[28] This estimate is based on the current average emission rate in the region from U.S.EPA and on the mid-case CO_2 price forecast from a recent Synapse assessment of numerous studies on carbon regulation and policies. A recent study conducted by ECW estimated the potential of energy efficiency for Wisconsin also used Synapse mid-case CO_2 price forecast to assess the potential of energy efficiency opportunities. There are many studies that forecast future potential carbon prices based on proposed federal legislation on carbon regulation. Synapse Energy Economics (2008) prepared carbon price forecasts based on such studies in an attempt to present an appropriate level of financial risk associated with greenhouse gas emissions to be used for utility resource planning and other decision making.

[29] In our baseline scenario that does not include energy efficiency programs, the load is assumed to increase by 1.8% on average, which is the average of the load growth rates over the 2009 to 2020 period estimated by Otter Tail Power Company and Montana-Dakota Utilities Company. The data are found in the most recent integrated resource planning documents by these utilities. This average value is based on the average load growth rates between those time periods for the two utilities' jurisdictions. Otter Tail covers Minnesota, North Dakota, and South Dakota. Montana-Dakota Utilities covers Montana, North Dakota, and South Dakota.

[30] Based upon actual operating data from EPA eGrid for both power plants referenced.

8.2 cents/kWh by 2020 as the avoided resource shifts to natural gas power plants from existing generation.[31]

Table 6. Energy Efficiency Potential for South Dakota by 2020 (Cumulative over 11 year period 2009 to 2020)

	Energy Savings (GWh)	Economic Savings to Ratepayers in $ Million	Net Jobs
1% Scenario	6,396	$220	3,198
2% Scenario	9,604	$341	4,802

These energy and economic benefits also include the creation of new jobs in South Dakota.[32] South Dakota could create 3,198 net jobs at 1% efficiency level or 4,802 net jobs at 2% efficiency level by 2020, assuming it would create jobs at the average rate per energy savings based on 48 studies across the nation. [33] It is important to understand here that "net" job means that additional jobs to the state take into account any job loss due to reduced electric production. Also note that these job estimates are indicative.

[31] The average of the load growth rates over the 2009 to 2020 period estimated by Otter Tail Power Company and Montana-Dakota Utilities Company. The data are found in the most recent IRPs by these utilities.

[32] Cite ACEEE study and methodology used

[33] Our job impact estimate is based on ACEEE 2008. Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments. In this study, ACEEE reviewed over 48 studies on energy efficiency and its job impacts and estimated a range of job impacts. Our estimate is based on 49 net job gained per TBTU efficiency gains (or 0.5 jobs per GWh efficiency gain), the average job impact that ACEEE found in the study. The study found the job impact ranges from 9 to 95 net jobs per TBTU efficiency savings.

5. Conclusion

From one perspective, South Dakota's future may appear to be uncertain and exposed to risks. Rapid swings in fuel prices, uncertainty over the direction of national energy and environmental policies, and flat growth in per capita income could impact the state. While fuel price volatility and shifts in the direction and extent of national or global policies are likely to occur, their consequences to South Dakota can be minimized, and even capitalized upon by South Dakota and its citizens. The state's comparatively high rates of electricity consumption help to make create terrific opportunity. Reducing per capita energy consumption to that of the United States average, a cut of about 20%, over a 12-year period would produce hundreds of millions of dollars in savings to South Dakota consumers, create thousands of local jobs, reduce exposure to fuel price volatility, avoid the need to build or upgrade new transmission lines, and improve public health. Planning for an energy efficient future today also better prepares South Dakota to avoid the risks from increased emissions of greenhouse gases.

We recommend that South Dakota build upon the small scale energy efficiency programs that that have recently begun in order to achieve the level of annual energy savings agreed to by the Midwestern Governors Association. In a few years, South Dakota can achieve annual energy savings of 1% per year and can then increase the savings levels to achieve a goal of 2% per year thereafter. Doing so will enable consumers to enjoy lower energy bills, allow businesses to maintain and improve their competitiveness, and build cumulative energy savings that over the long-term will avoid the need to build new transmission lines or to construct new power plants.

Appendix

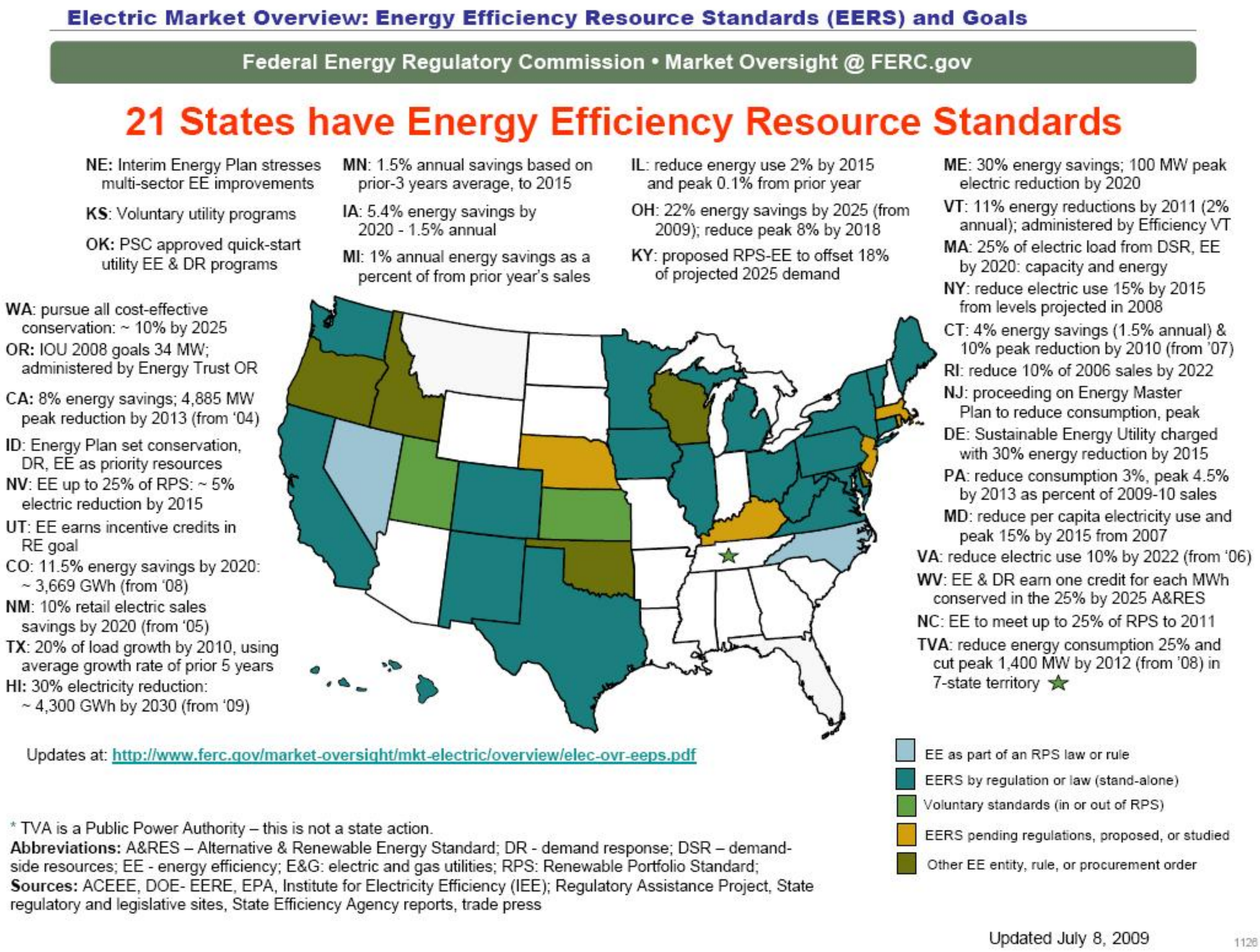

Figure A1

Cost of Energy Efficiency Trends

Synapse Energy Economics conducted an extensive review of numerous cost of saved energy (CSE) data for a number of energy efficiency programs for multiple years since 2000. A total of 15 datasets representing individual utilities, groups of utilities, or individual states are presented in Figure A2 below. We found that the CSE range from slightly above 1 cent to close to 7 cents per kWh saved, with an average value of 2.5 cents/kWh and a median value of 3 cents/kWh saved based on 71 data points. Each data point represents a result of efficiency program activities in one year by one utility or third party administrator or a group of utilities. The main finding is that each dataset shows a declining trend curve which means that the CSE decreases as energy savings increase relative to annual sales. Some argue for setting modest program goals by claiming that the CSE would increase if the amount of energy savings were increased. However, this effect was not observed, rather the analysis found an opposite trend. While there exists a possibility that the CSE might begin to increase at much higher levels of EE program savings than yet experienced, this evidence suggests that current program savings levels have not yet approached any such point.[34]

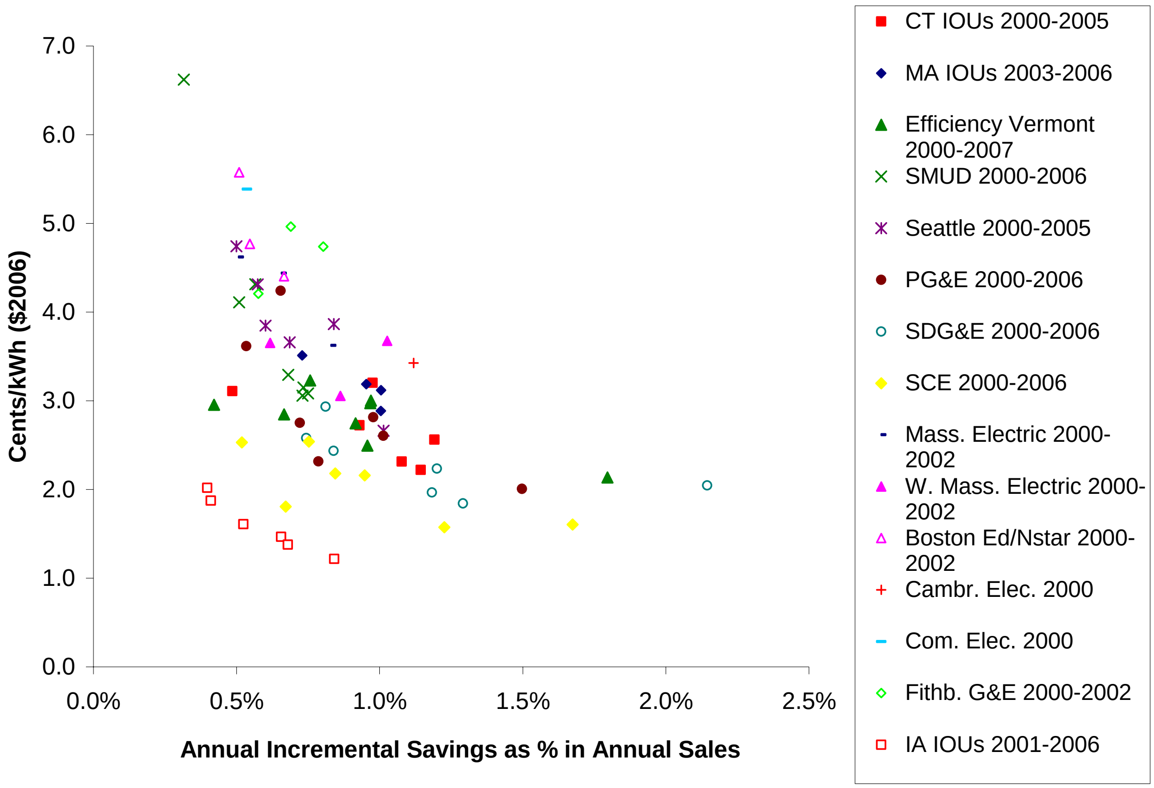

Figure A.2. Utility CSE vs. Annual Savings as % of Annual Sales

The lessons for energy efficiency programs is that as energy savings increase, the costs to save that energy decrease. There are several reasons for this phenomenon. Economies of scale, more units of an efficient product are produced and their unit costs decrease. Technology rises to meet demands, especially those established by certainty. Regulations and standards provide this certainty, and send long-term signals that help to procure the technology needed to meet that demand, and at a lower cost than if no standards or regulations existed. As the level of savings is increased, this encourages energy efficiency program administrators to look for and find deeper savings, such as those associated with entire buildings, the ability to retrofit buildings with smaller boilers and air conditioners, and so forth. Finally, deeper savings promote local economic

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[34] Synapse Energy Economics 2008. Cost and Benefits of Electric Utility Energy Efficiency in Massachusetts, available at http://www.synapse-energy.com/Downloads/SynapseReport.2008-08.0.MA-Electric-Utility-Energy-Efficiency.08-075.pdf. For references and other information related to this analysis, contact Kenji Takahashi at Synapse Energy Economics (ktakahashi@synapse-energy.com)

development through building a network of service providers and equipment manufacturers, avoiding the need to import goods and services from other states or even other countries.

Cost Effectiveness of Efficiency Programs

Energy efficiency has been meeting consumers' energy demand at much lower costs than supply side resources, and avoiding unnecessary additions of energy infrastructure as well as harmful emissions. The best indicators of such benefits are the results of the cost-effectiveness tests for energy efficiency programs prepared by numerous utilities and states over many years.

ACEEE (2009) also provided information regarding the level of net benefits of efficiency programs by leading states.[35] Figure A3 below provides benefit cost (BC) ratios by 7 leading states on energy efficiency programs. The ratios are based on the Total Resource Cost test or Societal Cost, which represents the benefits and costs for the entire jurisdiction or society at large.[36] The BC ratios range from 2.2 for Wisconsin and Iowa to 3.6 for Massachusetts.

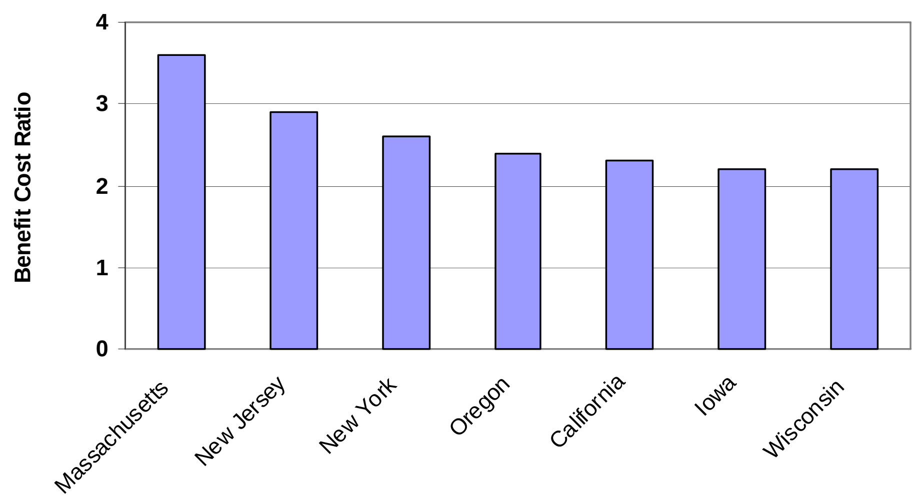

Figure A3. Cost-Effectiveness of Energy Efficiency Programs by the TRC or Societal Cost Test[37]

[37] ACEEE 2009. table 3.

Description of Energy Efficiency Potential Studies

The focus of the ECW and ACEEE study was on “achievable potential” of energy efficiency. Achievable potential is a subset of “economic potential” which refers to the amount of potential that includes identified energy efficiency measures and technologies whose energy savings benefits outweigh the cost of power supply (e.g., building new power plants, purchasing power, etc). Achievable potential further screens out measures that, for practical policy, infrastructure, funding and consumer response limitations, cannot be delivered. It is essentially “an estimate of the possible impacts that various policies and programs can have on influencing customer energy use through adoption and implementation of more energy-efficient technologies.”[38] But it is surely most subject to discretion on various subjects as to what is practical and achievable.

Examining achievable potential estimates of various studies, the study found a wide range of economic and achievable energy efficiency potential estimates as well as significant limitations and conservatism in those estimates. Table A2 below provides the estimates of the potential studies that provide achievable potential estimates, based on ECW and ACEEE 2009 study. As is shown in the table, the achievable potential estimates per year ranges widely from 0.7% to 1.6% for Midwest and 0.3% to 4% for non-Midwest regions.

Table A2. Summary of Electric Energy Efficiency Studies from ECW and ACEEE 2009 Study[39]

Region of Study	Economic Potential (% total savings)	Years	Achievable Potential (% savings/year)
Midwest			
Iowa, Municipal (2009)	22%	10	1.2%
Kansas (2008)	35%	20	1.1%
Wisconsin (2009)	18%	10	1.6%
Wisconsin (2005)		10	0.8%
Ontario (2005)	20%	20	0.7%

[38] Energy Center for Wisconsin (ECW) and ACEEE 2009. A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, page 11

[39] Energy Center for Wisconsin (ECW) and ACEEE 2009

Range	18% - 35%	10 - 20	0.7% - 1.6%
Non-Midwest			
U.S. (2000)		20	1.2%
California (Xenergy/EF 2002)	13%	10	1.0%
Southwest (SWEEP 2002)		17	1.9%
Puget (2003)	19%	20	0.6%
Vermont (2003)		10	3.1%
Quebec (Optimal 2004)		8	4.0%
New Jersey (Kema 2004)	17%	16	0.7%
New England (Optimal 2005)		10	2.3%
Northwest (NW Council 2005)	17%	20	0.6%
Georgia (ICF 2005)	20%	10	0.9%
California (Itron 2006)	17%	13	0.6%
North Carolina (GDS 2006)	20%	10	1.4%
Florida (ACEEE 2007)	25%	15	1.3%
Texas (ACEEE 2007)	30%	15	1.2%
Utah (SWEEP 2007)		15	1.7%
Vermont (GDS 2007)	22%	10	1.9%
EPRI (2009)		22	0.3%

Range	13% - 35%	8 - 20	0.3% - 4%

Examining potential estimates of various studies, the study found significant limitations and conservatism in those estimates. Some of the examples are:[40]

- Avoided costs used in existing studies are much lower than present and projected avoided costs and also do not include a cost of carbon;
- Existing studies emphasize incremental changes and improvements and exclude greater savings opportunities through integrated, synergistic effects of comprehensive packages of measures. (they do not include more advanced measures such as net zero energy buildings);
- Existing studies do not account for emerging technologies, continued improvements of technologies and cost reductions of such technologies over time;
- Existing studies ignore on-energy benefits such as increased thermal comfort, increased productivity, and environmental benefits; and
- Conservatism is built into each key assumption (particularly customer participation realization rates).

We also have some additional concerns with the existing studies. Within the time frame of 10 years, data on existing technologies are likely to become obsolete and emerging technologies start to dominate the market. Thus, potential estimates that claim to be valid over 10 years are subject to great uncertainty. This means that annual achievable potential estimates based on economic potential valid over 10 years are underestimating the actual annual achievable potential. Second, while the cutoff point to determine cost-effective efficiency measure is the most expensive technology below cost of power supply (i.e., experts call the marginal cost of technologies), the cost of energy efficiency programs often reported in public is the weighted average of all types of energy efficiency measures. This latter cost information is more important to consumers and the society. We need to have more emphasis on pursuing the level of energy efficiency measures that “collectively” cost less than cost of supply although we also want to make sure not too expensive measures are included.

[40] ECW and ACEEE 2009.