National Action Plan for Energy Efficiency

Vision for 2025:

A Framework for Change

A RESOURCE OF THE NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY

NOVEMBER 2008

Letter from the Co-Chairs of the National Action Plan for Energy Efficiency

November 2007

To all,

As you know, the National Action Plan for Energy Efficiency is playing a vital role in advancing the dialogue and the pursuit of energy efficiency in our homes, buildings, and industries—an important energy resource for the country.

With the commitment and leadership from more than 60 diverse organizations nationwide we have made great progress in a short time. We have:

- Developed five broad and meaningful recommendations for pursuing cost-effective energy efficiency.
- Brought together more than 100 organizations from 50 states around this common goal to take energy efficiency to the next level.

However, there is much more to do. We remain substantially underinvested in efficiency at a time when using energy wisely can help address rising energy costs, rising emissions of greenhouse gases, and our dependence on foreign fuel supplies.

We need a concerted, sustained effort to overcome what are truly surmountable hurdles to making energy efficiency a larger part of our supply picture. To continue our progress we need to move from our initial Action Plan to implementation. We need a vision for where we want to be and a path for getting there.

Commensurate with that goal, we are pleased to offer this 2025 Vision for the National Action Plan. This Vision outlines what our long-term goals should be if we are to truly achieve all cost-effective energy efficiency. This Vision outlines what we consider are ten key implementation goals as well as the steps we need to take to achieve them. It is a framework for changing our course on energy efficiency.

This Vision represents the thinking of many leading organizations nationwide. Importantly, we believe that this Vision is a living document that looks out to long-term needs and will be modified to reflect new information and changing conditions.

We thank the Leadership Group for its contribution to this document. It is a pleasure to work with this committed group to advance energy efficiency to address the critical energy and environmental issues facing the country.

Sincerely,

Marsha H. Smith
President, National Association
Regulatory Utility Commissioners
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James E. Rogers
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The Leadership Group of the National Action Plan for Energy Efficiency is committed to taking action to increase investment in cost-effective energy efficiency. The Vision for 2025 was developed under the guidance of and with input from the Leadership Group. The document does not necessarily represent a consensus view and does not represent an endorsement by the organizations of Leadership Group members.

The Vision is a product of the National Action Plan for Energy Efficiency Leadership Group and does not reflect the views, policies, or otherwise of the federal government. The role of U.S. DOE and U.S. EPA is limited to facilitation of the Action Plan.

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List of Abbreviations and Acronyms

A

ACEEE	American Council for an Energy-Efficient Economy
AMI	advanced metering infrastructure

B

Btu	British thermal unit

C

CEE	Consortium for Energy Efficiency
CHP	combined heat and power
CO_2	carbon dioxide

D

DOE	U.S. Department of Energy

E

EERE	U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
EM&V	evaluation, measurement, and verification
EPA	U.S. Environmental Protection Agency

F

FERC	Federal Energy Regulatory Commission

G

GJ/t	gigajoules per tonne
GW	gigawatt
GWh	gigawatt-hour

H

HVAC	heating, ventilation, and air conditioning

I

IECC	International Energy Conservation Code
ISO	independent system operator

K

kW	kilowatt
kWh	kilowatt-hour

L

LIHEAP	Low Income Home Energy Assistance Program

M

MEEA	Midwest Energy Efficiency Alliance
MMBtu	million British thermal units
MMcf	million cubic feet
MtC	metric tonnes of carbon
$MtCO_2e$	metric tonnes of carbon dioxide equivalent
MW	megawatt
MWh	megawatt-hour

N

NARUC	National Association of Regulatory Utility Commissioners
NEEA	Northwest Energy Efficiency Alliance
NEEP	Northeast Energy Efficiency Partnership
NYSERDA	New York State Energy Research and Development Authority

List of Abbreviations and Acronyms (continued)

P

ppm	parts per million units

R

R&D	research and development

S

SEEA	Southeast Energy Efficiency Alliance
SWEEP	Southwest Energy Efficiency Partnership

T

Tcf	trillion cubic feet
TRC	total resource cost test
TWh	terawatt-hour

W

WAP	Weatherization Assistance Program

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Executive Summary

This Vision for the National Action Plan for Energy Efficiency establishes a goal of achieving all cost-effective energy efficiency by 2025; presents ten implementation goals for states, utilities, and other stakeholders to consider to achieve this goal; describes what 2025 might look like if the goal is achieved; and provides a means for measuring progress. It is a framework for implementing the five policy recommendations of the Action Plan, announced in July 2006, which can be modified and improved over time.

Background

Through the Leadership Group of the National Action Plan for Energy Efficiency (Action Plan), more than 60 diverse leading organizations recognized the importance of bringing greater emphasis to the role that cost-effective energy efficiency[1] can and should play in supplying our future energy needs. Improving the energy efficiency of homes, businesses, schools, governments, and industries—which consume more than 70 percent of the natural gas and electricity used in the United States—is one of the most constructive, cost-effective ways to address the challenges of high energy prices, energy security and independence, air pollution, and global climate change in the near future. Energy efficiency can play a significant role in meeting our energy requirements, and it is a critical component of the overall modernization of utility energy systems worthy of the 21st century.

Despite the value that cost-effective energy efficiency offers, it is not achieving its full potential for a number of reasons. In July 2006, the Action Plan presented five key policy recommendations (see Figure ES-1) for fully developing the cost-effective energy efficiency resources in this country, building upon experiences in particular states and regions. It was a call to action to take investment in energy efficiency to the next level. As of November 2008, more than 120 organizations have endorsed these recommendations and/or made commitments to take energy efficiency to the next level within their spheres of influence.

As a next step, the Action Plan co-chairs challenged the Leadership Group to define a vision that would detail the steps necessary to fully implement the Action Plan. The Vision presented in this document is the response to that challenge. It includes establishment of a long-term aspirational goal and ten key implementation goals. It also describes what 2025 could look like if the

Figure ES-1. National Action Plan for Energy Efficiency Recommendations

- **Recognize energy efficiency as a high-priority energy resource.**
- **Make a strong, long-term commitment to implement cost-effective energy efficiency as a resource.**
- **Broadly communicate the benefits of and opportunities for energy efficiency.**
- **Promote sufficient, timely, and stable program funding to deliver energy efficiency where cost-effective.**
- **Modify policies to align utility incentives with the delivery of cost-effective energy efficiency and modify ratemaking practices to promote energy efficiency investments.**

long-term goal were achieved and provides a means for measuring progress over time. The Vision is provided as a framework to guide the changing policies toward energy efficiency for natural gas and electricity; it can be modified and improved over time.

Achieve All Cost-Effective Energy Efficiency

The long-term aspirational goal for the Action Plan is to achieve all cost-effective energy efficiency by the year 2025. Based on studies, the efficiency resource available may be able to meet 50 percent or more of the expected load growth over this time frame, similar to meeting 20 percent of electricity consumption and 10 percent of natural gas consumption.[2] The benefits from achieving this magnitude of energy efficiency nationally can be estimated to be more than $100 billion in lower energy bills in 2025 than would otherwise occur, over $500 billion in net savings, and substantial reductions in greenhouse gas emissions.

Importantly, the energy efficiency resource's role in meeting load and load growth may vary across the country due to regional differences in growth patterns, costs of energy, and other factors. Furthermore, the long-term goal is not a statement about the need for new power supply additions in the future, as new plants may be a critical component of the desired modernization of the energy supply and delivery system. However, the greater the energy efficiency savings, the greater the likelihood that efficiency gains can help replace older, less efficient power supply options, resulting in substantial environmental benefits.

Ten Implementation Goals

The Vision suggests that implementation of a number of policies will enhance the likelihood that the long-term goal will be achieved. Energy efficiency needs to be valued similarly to supply options. Utilities and investors need to be financially interested in saving energy. State activity is key in this transformation of natural gas and electricity supply and delivery, including updating and enforcing codes and standards to ensure that savings are captured as new buildings and products enter the system. Customers must also have the proper incentives to make investments in cost-effective energy efficiency. With such policies in place, cost-effective energy efficiency can be a key component of the modernization of the energy supply and delivery system and help to transform how customers receive and value energy services.

These policies are included in the following ten implementation goals. These goals provide a framework for implementing the recommendations of the Action Plan (see Figure ES-1) by outlining the key steps state decision-makers should consider to help achieve the 2025 Vision. The time line for achieving these implementation goals is by 2015 to 2020, so that the necessary policy foundation is in place to help ensure success of the 2025 Vision.

Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource

Utilities[3] and applicable agencies are encouraged to:

- Create a process, such as a state or regional collaborative, to explore the energy efficiency potential in the state and commit to its full development.
- Regularly identify cost-effective achievable energy efficiency potential in conjunction with ratemaking bodies.
- Set energy savings goals or targets consistent with the cost-effective potential.
- Integrate energy efficiency into energy resource plans at the utility, state, and regional levels, and include provisions for regular updates.

Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field

Applicable agencies are encouraged to:

- Explore establishing revenue mechanisms to promote utility and other program administrator indifference

to supplying energy savings, as compared to energy generation options.

- Consider how to remove utility and other program administrator disincentives to energy efficiency, such as by removing the utility throughput disincentive and exploring other ratemaking ideas.
- Ensure timely cost recovery in place for parties that administer energy efficiency programs.

Goal Three: Establishing Cost-Effectiveness Tests

Applicable agencies along with key stakeholders are encouraged to:

- Establish a process to examine how to define cost-effective energy efficiency practices that capture the long-term resource value of energy efficiency.
- Incorporate cost-effectiveness tests into ratemaking procedures going forward.

Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms

Ratemaking bodies are encouraged to:

- Work with stakeholders to adopt effective, transparent practices for the evaluation, measurement, and verification (EM&V) of energy efficiency savings.

Program administrators are encouraged to:

- Conduct EM&V consistent with these practices.

Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms

Applicable agencies are encouraged to:

- Clearly establish who will administer energy efficiency programs.
- Review programs, funding, customer coverage, and goals for efficiency programs; ensure proper administration and cost recovery of programs, as well as ensuring that goals are met.
- Establish goals and funding on a multi-year basis to be measured by evaluation of programs established.
- Create strong public education programs for energy efficiency.
- Ensure that the program administrator shares best practice information regionally and nationally.

Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices

Applicable agencies are encouraged to:

- Have a mechanism to review and update building codes.
- Establish enforcement and monitoring mechanisms of energy codes.
- Adopt and implement state-level appliance standards for those appliances not addressed by the federal government.
- Develop and implement lead-by-example energy efficiency programs at the state and local levels.

Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency

Utilities and ratemaking bodies are encouraged to:

- Examine, propose, and modify rates considering impact on customer incentives to pursue energy efficiency.
- Create mechanisms to reduce customer disincentives for energy efficiency (e.g., financing mechanisms).

Goal Eight: Establishing State of the Art Billing Systems

Utilities are encouraged to:

- Work with customers to develop methods of supplying consistent energy use and cost information across states, service territories, and the nation.

Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems

Utilities and other program administrators are encouraged to:

- In conjunction with their regulatory bodies, explore the development and implementation of state of the art energy delivery information, including smart grid infrastructures, data analysis, two-way communication programs, etc.
- Explore methods of integrating advanced technologies to help curb demand peaks and monitor efficiency upgrades to prevent equipment degradation, etc.
- Coordinate demand response and energy efficiency programs to maximize value to customers.
- Support development of an energy efficiency services and program delivery channel (e.g., quality trained technicians), with specific attention to residential programs.

Goal Ten: Implementing Advanced Technologies

Applicable agencies and utilities are encouraged to:

- Review policies to ensure that barriers to advanced technologies, such as combined heat and power (CHP), are removed; ensure inclusion into the broader resource plans.
- Work collectively to review advanced technologies and determine rapid integration timelines.

Measuring Progress

Measurement of the progress toward full implementation of these ten goals by 2015 to 2020 is an important part of the Vision. Progress will be measured and reported on every few years. As of December 31, 2007, based on information collected from across the country (see Table ES-1), there is a strong basis of experience with these energy efficiency policies upon which to draw and to expand. For example, more than a dozen states have:

- Established a policy to recognize energy efficiency as a high-priority resource.
- Identified the cost-effective, achievable potential for energy efficiency over the long term, and established energy savings goals or targets consistent with this potential.
- Established cost-effectiveness tests for energy efficiency consistent with the long-term benefits of energy efficiency.
- Established energy efficiency programs for their various types of customers.

There is also more progress to make. For example, several states have also implemented the following policy steps to advance energy efficiency:

- Removal of utility and other program administrator disincentives.
- Provided for stable (multi-year) funding for energy efficiency programs, consistent with energy efficiency goals.

These policies go hand in hand with significant investment in energy efficiency, as well as capturing the energy savings and environmental benefits from these programs. As of 2008, the most recent national benefits data show that:

- Cumulative electricity savings total 63 billion kilowatt-hours (kWh) (about 2 percent of retail sales) as of 2006, including incremental electricity savings of over 8 billion kWh in 2006 alone. These cumulative savings have avoided the need for 16 gigawatts of new capacity, equivalent to 32 new 500-megawatt power plants.[4]
- Cumulative natural gas savings total 135 million therms as of 2006.[5]

Table ES-1. Progress in Meeting Implementation Goals

	Implementation Goal and Key Steps	States Having Adopted Policy Step as of December 31, 2007			
		Electricity Services		Natural Gas Services	
		Completely	Partially	Completely	Partially
Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource					
1	Process in place, such as a state and/or regional collaborative, to pursue energy efficiency as a high-priority resource.	14	0	14	0
2	Policy established to recognize energy efficiency as high-priority resource.	21	22	8	8
3	Potential identified for cost-effective, achievable energy efficiency over the long term.	25	1	13	0
4	Energy efficiency savings goals or expected energy savings targets established consistent with cost-effective potential.	15	3	5	2
5	Energy efficiency savings goals and targets integrated into state energy resource plan, with provisions for regular updates.	0	16	0	1
6	Energy efficiency savings goals and targets integrated into a regional energy resource plan.**	N/A	N/A	N/A	N/A
Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field					
7	Utility and other program administrator disincentives are removed.	17	8	18	5
8	Utility and other program administrator incentives for energy efficiency savings reviewed and established as necessary.	10	5	5	2
9	Timely cost recovery in place.**	N/A	N/A	N/A	N/A
Goal Three: Establishing Cost-Effectiveness Tests					
10	Cost-effectiveness tests adopted which reflect the long-term resource value of energy efficiency.	29	2	9	0
Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms					
11	Robust, transparent EM&V procedures established.	14	6	5	2
Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms					
12	Administrator(s) for energy efficiency programs clearly established.	24	2	13	1
13	Stable (multi-year) and sufficient funding in place consistent with energy efficiency goals.	4	9	2	4
14	Programs established to deliver energy efficiency to key customer classes and meet energy efficiency goals and targets.	24	2	7	0
15	Strong public education programs on energy efficiency in place.	18	5	13	6
16	Energy efficiency program administrator engaged in developing and sharing program best practices at the regional and/or national level.	30	0	18	0

Table ES-1. Progress in Meeting Implementation Goals (continued)

Implementation Goal and Key Steps		States Having Adopted Policy Step as of December 31, 2007			
		Electricity Services		Natural Gas Services	
		Completely	Partially	Completely	Partially
Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices					
17	State policies require routine review and updating of building codes.	28	13	28	13
18	Building codes effectively enforced.**	N/A	N/A	N/A	N/A
19	State appliance standards in place.	11	0	11	0
20	Strong state and local government lead-by example programs in place.	13	24	13	24
Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency					
21	Rates examined and modified considering impact on customer incentives to pursue energy efficiency.	7	5	2	0
22	Mechanisms in place to reduce consumer disincentives for energy efficiency (e.g., including financing mechanisms).	4	1	0	0
Goal Eight: Establishing State of the Art Billing Systems					
23	Consistent information to customers on energy use, costs of energy use, and options for reducing costs.**	N/A	N/A	N/A	N/A
Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems					
24	Investments in advanced metering, smart grid infrastructure, data analysis, and two-way communication to enhance energy efficiency.	5	29	***	***
25	Coordinated energy efficiency and demand response programs established by customer class to target energy efficiency for enhanced value to customers.**	N/A	N/A	***	***
26	Residential programs established to use trained and certified professionals as part of energy efficiency program delivery.	9	0	9	0
Goal Ten: Implementing Advanced Technologies					
27	Policies in place to remove barriers to combined heat and power.	11	24	***	***
28	Timelines developed for the integration of advanced technologies.**	N/A	N/A	N/A	N/A

* See Appendix D for additional information on how these numbers have been determined.

** See Appendix D for discussion of why progress on this policy step is not currently measured.

*** Steps 24, 25, and 27 do not apply to natural gas.

N/A = Not available

Table ES-2. Current Benefits from and Funding for State- and Utility-Administered Energy Efficiency Programs*

Annual Benefits and Funding	Energy Savings		Avoided CO_2 Emissions (million tons)	Efficiency Funding	
	Energy Use (kWh or therms)	Peak Capacity (GW)		2006 Spending ($ billion)	2007 Budgets ($ billion)
Electricity					
Incremental	8 billion	1.3	5.8	$1.60	$1.88
Cumulative	63 billion (2% of retail sales)	16.0	46.1	—	—
Natural Gas					
Incremental	N/A	—	N/A	$0.29	$0.28
Cumulative	135 million (0.1% of retail sales)	—	0.8	—	—

Sources: ACEEE (Eldridge et al., 2008), CEE (Nevius et al., 2008), eGRID2007 Version 1.0 (EPA, 2008a), and EIA energy sales and savings data (EIA, 2008a, 2008b, 2008c).

*For information on how these numbers were derived, see Chapter 2 of the full Vision for 2025 report.

N/A = Not available

- Greenhouse gas emissions are being reduced by nearly 50 million metric tons annually, equivalent to emissions from 9 million vehicles per year.[6]
- Approximately $2 billion is being invested annually in state- and utility-administered energy efficiency programs.[7]
- State energy savings goals and utility energy savings targets are in place to encourage annual savings exceeding 200 billion kWh in 2025, in addition to current energy savings.[8]

Additional details on the estimates for current investments and benefits are provided in Table ES-2. Improving the available data will be an ongoing effort as the Action Plan continues to measure progress toward all cost-effective energy efficiency.

The Energy System in 2025

An energy system in 2025 that would evolve with the suite of energy efficiency policies in place as outlined above and that captures all cost-effective energy efficiency will be different from the one we have today. Some of the key differences based on the effects that some of these policy changes are having in parts of the country, as well as expectations of some of the advantages that new technology and system modernization can bring, are highlighted below from the perspectives of the energy customer and society.

- **Customers** across the residential, commercial, and industrial sectors would have ready, uniform access to comprehensive energy efficiency services across the country. These services would bring a range of efficiency improvements to homes, buildings, and

Table ES-3. Changes to Watch in Evolving Technology, Policy, and Program Practices for Energy Efficiency

Policy Area	Changes to Watch
Evaluation, measurement, and verification	• Development of national standards • Requirements for independent verification • Growing role for smart grid technologies in EM&V • Requirements for state and regional carbon programs
Demand response, advanced metering, and smart grids	• New technologies, such as advanced meters and smart appliances/ controls • Data collection networks and data analysis to enhance energy efficiency • New customer interfaces • Increased interoperability
Regional resource planning	• Regional value of energy efficiency identified
Building energy efficiency expertise/workforce	• Development and use of energy efficiency curriculum for various segments of the workforce • Development and broad use of training and certification programs
Integration of R&D, building codes, appliance standards, and market transformation efforts	• Regional and national coordination across these efforts

Sources: PJM, 2007; CEC and CPUC, 2005; Business Roundtable, 2007; Elliott et al., 2007; Roseman and Hochstetter, 2007; Schiller Consulting, 2007; Western Governors' Association, 2006.

facilities and reduce customers' bills below what they would have been without these programs. Customers would also have clear information on the cost of energy and increased awareness of their total energy use. In addition, new efficient appliances and other equipment will help to control the peak demand of utility systems and give large customers greater flexibility in how they manage and control their own operations to reduce energy use, reduce costs, and increase their own competitive positions. New homes and buildings would meet up-to-date energy codes.

- **Society** would benefit from significantly modernized energy supply, transmission, and distribution systems and, with increased investment in cost-effective energy efficiency, would benefit from lower overall cost of energy supply, increased fuel diversity, and lower emissions of air pollutants and greenhouse gases. The low-income populations would benefit, in particular, from the lower energy bills resulting from a commitment to deliver energy efficiency to these customer classes. Society may also see economic benefits from the greater employment necessary to build an industry capable of delivering energy efficiency services at this broad scale, from a robust business in energy efficiency products and services, and from using more capital locally.

There are a number of challenges to achieving this Vision, including the necessary evolution of technology, policy, and program practices. Table ES-3 highlights some of these evolving areas, including evaluation approaches for efficiency resources, customer involvement through demand response programs and smart grid technology, regional resource planning, workforce building, and integration across energy efficiency efforts.

Related State, Regional, and National Policies

Other energy and environmental policy decisions at the state, regional, and national levels can affect energy efficiency. Ideally, these policies will be designed and implemented in a manner that helps remove barriers to energy efficiency and helps capture energy efficiency resources for a lower-cost energy system than otherwise would be necessary. Integrating energy efficiency considerations into related policy areas, as appropriate, will be critical to achieving this Vision. Such related policy areas are those designed to:

- Limit emissions of greenhouse gases.
- Encourage the use of clean, efficient distributed generation.
- Promote clean energy supply, such as renewable energy.
- Promote load reductions at critical peak times through demand response.
- Modernize and maintain the nation's electric transmission and distribution system, including "smart grid" and advanced meter infrastructure.
- Maintain a sufficient reserve margin for reliable electricity supply.

Next Steps

This Vision is offered as a framework to assist change in energy efficiency and related policies and programs at the state level across the country, toward the goal of achieving all cost-effective energy efficiency in 2025. It presents a snapshot of where the country is as of December 31, 2007 based on the collection and organization of available information on the existing policy and program options. The decision of whether to adopt a policy or program and particular design details at the state level are, of course, to be determined through state processes that address state goals, objectives, and circumstances. The Action Plan Leadership Group and other public and private sources provide a wealth of tools and assistance to parties taking action to advance the Vision, as summarized in Table ES-4.

The Vision will be updated as new information becomes available and improved as information changes. Information on measuring progress at the state level will be updated on a regular basis at the Action Plan Web site, www.epa.gov/eeactionplan. People are encouraged to provide additional information and their comments for how to refine this Vision to the Action Plan Leadership Group. Please send feedback to the Action Plan sponsors via Larry Mansueti, U.S. Department of Energy (lawrence.mansueti@hq.doe.gov, 202-586-2588) and Stacy Angel, U.S. Environmental Protection Agency (angel.stacy@epa.gov, 202-343-9606).

Table ES-4. National Action Plan for Energy Efficiency Tools by Implementation Goals

Goal	Type of Tool or Resource		Detailed Action Plan Tools and Resources
	Introduction to Issues in Action Plan Report	Detailed Guide/ How-to Material	
Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource	X	X	• Guide to Resource Planning with Energy Efficiency • Guide for Conducting Energy Efficiency Potential Studies • Communications Kit
Goal Two: Developing Processes to Align Utilities Incentives Equally for Efficiency and Supply Resources	X	X	• Aligning Utility Incentives with Investment in Energy Efficiency Paper
Goal Three: Establishing Cost-Effectiveness Tests	X	X	• Understanding Cost-effectiveness of Energy Efficiency Programs Paper • Guide to Resource Planning with Energy Efficiency • Guide for Conducting Energy Efficiency Potential Studies
Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms	X	X	• Model Energy Efficiency Program Impact Evaluation Guide
Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms	X	X	• Regional Implementation Meetings • Resources Database • Program Design and Implementation Best Practices Guidance (under development)
Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices		X	• Building Codes for Energy Efficiency Fact Sheet • Efficiency Program Interactions with Codes Paper (under development) • State and Local Lead-by-Example Guide (under development)
Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency	X		• Executive Briefings on Customer Incentives Through Rate Design (under development)
Goal Eight: Establishing State of the Art Billing Systems		X	• Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data
Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems		X	• Paper on Coordination of Demand Response and Energy Efficiency (under development)
Goal Ten: Implementing Advanced Technologies			• Most Energy-Efficient Economy Scoping Paper (under development)

Notes

1. "Energy efficiency" refers to using less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way. As used here, the term includes using less energy at any time, including at times of peak demand through demand response and peak shaving efforts.

2. The energy efficiency savings as a percent of load growth and savings depend on forecast assumptions used and vary by region. This magnitude of savings is consistent with the potential savings documented in a number of recent studies. See Appendix B for references for these studies.

3. "Utility" refers to any organization that delivers electric and gas utility services to end-users, including investor-owned, cooperatively owned, and publicly owned utilities.

4. Annual incremental electricity savings are from the American Council for an Energy-Efficient Economy (ACEEE) and cumulative electricity savings are from Energy Information Administration (EIA) Form-861 data, both for year 2006. Values reflect reported data for administered energy efficiency programs only and do not include low-income programs nor other load management efforts such as demand response. Cumulative savings do not capture those programs administered by state entities. Peak electricity savings are from EIA Form-861 data for year 2006 and reflect reported data for utility-administered energy efficiency programs only and do not include load management programs.

5. Natural gas savings are from the Consortium for Energy Efficiency (CEE) (Nevius et al., 2008) and include estimated savings from measures installed in 2006, as well as from measures installed as early as 1992 that were still generating savings as of 2006.

6. The 2004 non-baseload output carbon dioxide (CO_2) emission rates from eGRID Version 2.1 were applied to cumulative electricity savings for 2006 at the North American Electric Reliability Corporation (NERC) region level. Emissions savings from cumulative natural gas savings assume 0.00585 tons CO_2 per therm. Vehicle conversion assumes that 5.46 tons CO_2 are emitted per vehicle annually.

7. Annual spending value considers both ACEEE's 2006 actual electricity efficiency program spending and CEE's 2007 budget estimates for residential, commercial, and industrial electricity and gas efficiency programs. CEE budget estimates capture both CEE members and nonmember administrators of energy efficiency program respondents. Program funding for low-income, load management, and other programs is not included in these estimates. Actual 2006 spending for electricity efficiency programs comes from ACEEE, leveraging EIA and ACEEE's independent information collection efforts.

8. Expected energy to be saved through energy savings goals assumes energy savings post-2007 from 19 states. More details on this methodology are included in Appendix E. No states were found to have comparable, enforceable savings goals for natural gas.

1: Introduction

Improving the energy efficiency of homes, businesses, schools, governments, and industries—which consume more than 70 percent of the natural gas and electricity used in the United States—is one of the most constructive, cost-effective ways to address the challenges of high energy prices, energy security and independence, environmental concerns, and global climate change in the near term (Figure 1-1). Mining this efficiency could help us meet on the order of 50 percent or more of the expected growth in U.S. consumption of electricity and natural gas in the coming decades, yielding many billions of dollars in saved energy bills and avoiding significant emissions of greenhouse gases and other air pollutants.[1]

Scope of the Vision for 2025

Recognizing the large opportunity for energy efficiency, more than 60 leading organizations representing diverse stakeholders from across the country joined together to develop the National Action Plan for Energy Efficiency. The Action Plan identifies many of the key barriers contributing to underinvestment in energy efficiency, outlines five key policy recommendations for achieving all cost-effective energy efficiency, focusing largely on state-level energy efficiency policies, and provides a number of options to consider in pursing these recommendations (Figure 1-2). As of November 2008, more than 120 organizations have endorsed the Action Plan recommendations and/or made public commitments to implement them in their areas (Table 1-1).

As a next step, the Action Plan co-chairs challenged the Leadership Group to define a vision for the Action Plan which would detail the steps necessary to fully implement the recommendations of the Action Plan. The Vision presented in this document is the response to that challenge.

This Vision includes establishment of a long-term aspirational goal and the establishment of ten key implementation goals. It also describes what 2025 could look like if the goal were achieved and provides a means for measuring progress over time. Further, the Vision reviews the potential interactions between the largely state-level energy efficiency policies of the Action Plan and other existing state, regional, or federal policies such as clean energy portfolio standards[2] and greenhouse gas mitigation policies and provides recommendations to ensure that these polices are designed to leverage energy efficiency as a cost-effective resource.

The 2025 Vision is offered as a general framework for pursuing a variety of policy options at the state level for advancing cost-effective energy efficiency as would be consistent with regional, state, and local circumstances, maintaining a fundamental principle of the Action Plan that one size does not fit all. This general framework leaves the policy details and the decision of whether to implement a policy to be determined through appropriate processes. It is a framework that can be updated and improved over time.

This document does not address the best practices for developing and implementing cost-effective energy efficiency program and portfolios, as these issues have been addressed elsewhere through the Action Plan.[3] However, it does offer the implementation goals and policy steps to assist in the establishment of the necessary policy framework to support the growth of best practice energy efficiency programs across the country. These types of programs are of interest for the following reasons:

- **Large energy savings available in existing homes, buildings, and industrial facilities.** The homes, commercial buildings, and industrial facilities already in place offer many opportunities for saving energy cost-effectively. Options exist through improved building envelopes and tighter ducts in addition to more efficient lighting, appliances, heating and cooling, and a variety of industrial process

Figure 1-1. Reasons for the National Action Plan for Energy Efficiency

- **Energy efficiency is a large, untapped, low-cost energy resource.** Energy efficiency on the order needed to meet 50 percent or more of expected growth for natural gas and electricity is available at a cost of less than half of new generation, in many parts of the country. Overall savings from pursing this efficiency would be more than $100 billion annually by 2025.*

- **Energy efficiency improves energy security.** Energy efficiency reduces the level of U.S. per capita energy consumption, thus decreasing the vulnerability of the economy and individual consumers to disruptions from natural disasters or terrorist acts. Energy efficiency also improves system reliability and reduces the potential for disruptions from brownouts or blackouts.

- **Energy efficiency mitigates risk of future carbon policy.** Pending regulation of greenhouse gas emissions presents significant uncertainty as to the generation investments that will contribute to a low-cost energy system for the future. Importantly, energy efficiency is low-cost now, will stay low-cost, and presents an important resource option for the future, particularly while waiting for the uncertainty to be resolved. Efficiency also makes sizable reductions in carbon emissions more attainable. Without moderating demand growth, investment in energy efficiency and other clean energy sources will be necessary.

- **Higher prices do not remove the barriers that impede investment in cost-effective energy efficiency.** Price signals alone (based on time of use rates) are insufficient to realize the full energy efficiency potential, in part due to large and persistent market barriers, including the principal-agent problem** transaction costs, and lack of information as well as customer requirements for very short paybacks.*** Specific policies are necessary to target and overcome these well-defined barriers for energy efficiency. Many policies play a role in overcoming the barriers, such as up-to-date appliance standards, building codes, and organized energy efficiency programs.

- **Carbon policies will not necessarily remove the barriers to energy efficiency.** A variety of approaches for limiting emissions of greenhouse gases are at various stages of discussion and development across the country at the state, regional, and national levels. Most approaches (e.g., cap and trade and carbon taxes) provide a carbon price signal but do not directly address the unique barriers to energy efficiency. Therefore, provisions to address these barriers to efficiency within carbon policies as well as complementary policies to promote the delivery of cost-effective energy efficiency will be essential to mine the low-cost greenhouse gas reductions from energy efficiency.

- **Utilities are well-positioned to deliver energy efficiency programs, but regulatory changes may be necessary so that they are as profitable when saving energy as in generating or delivering energy.** Utilities typically have strong relationships with their customers, will accept longer paybacks for investments than customers will, and have access to lower-cost capital. However, the regulatory structure has historically rewarded utilities for building supply infrastructure (e.g., power plants, transmission lines, pipelines) and selling energy, while discouraging energy efficiency, even when energy-saving measures cost less than constructing new infrastructure. Some states have modified utility regulatory policies to eliminate efficiency disincentives. Alternative mechanisms such as third-party administration of energy efficiency programs have also been used.

- **Parties embrace energy efficiency for different reasons and solutions can be designed to address all these motivations.** For all of these reasons, advancing energy efficiency programs and policies requires attention and commitment by a critical mass of leading parties, including regulators, utilities, state governments, consumer advocates, environmental groups, and large end-users.

* See Chapter 2 for more information on these benefits.

** The principal-agent problem exists when the entity who makes energy efficiency investments, such as a landlord, is different from the entity who pays the energy bills, such as a tenant.

*** See Appendix B for references to studies that discuss the existing barriers to energy efficiency in more detail.

Note: This set of reasons is based on experience of the Action Plan Leadership Group and input received through Regional Implementation Meetings and the Sector Collaborative for Energy Efficiency.

Figure 1-2. National Action Plan for Energy Efficiency Recommendations and Options

Recognize energy efficiency as a high-priority energy resource.

Options to consider:

- Establishing policies to establish energy efficiency as a priority resource.
- Integrating energy efficiency into utility, state, and regional resource planning activities.
- Quantifying and establishing the value of energy efficiency, considering energy savings, capacity savings, and environmental benefits, as appropriate.

Make a strong, long-term commitment to implement cost-effective energy efficiency as a resource.

Options to consider:

- Establishing appropriate cost-effectiveness tests for a portfolio of programs to reflect the long-term benefits of energy efficiency.
- Establishing the potential for long-term, cost-effective energy-efficiency savings by customer class through proven programs, innovative initiatives, and cutting-edge technologies.
- Establishing funding requirements for delivering long-term, cost-effective energy efficiency.
- Developing long-term energy saving goals as part of energy planning processes.
- Developing robust measurement and verification procedures.
- Designating which organization(s) is responsible for administering the energy-efficiency programs.
- Providing for frequent updates to energy resource plans to accommodate new information and technology.

Broadly communicate the benefits of and opportunities for energy efficiency.

Options to consider:

- Establishing and educating stakeholders on the business case for energy efficiency at the state, utility, and other appropriate level, addressing relevant customer, utility, and societal perspectives.
- Communicating the role of energy efficiency in lowering customer energy bills and system costs and risks over time.
- Communicating the role of building codes, appliance standards, and tax and other incentives.

Provide sufficient, timely, and stable program funding to deliver energy efficiency where cost-effective.

Options to consider:

- Deciding on and committing to a consistent way for program administrators to recover energy efficiency costs in a timely manner.
- Establishing funding mechanisms for energy efficiency from among the available options, such as revenue requirement or resource procurement funding, system benefits charges, rate-basing, shared-savings, and incentive mechanisms.
- Establishing funding for multi-year periods.

Modify policies to align utility incentives with the delivery of cost-effective energy efficiency and modify ratemaking practices to promote energy efficiency investments.

Options to consider:

- Addressing the typical utility throughput incentive and removing other regulatory and management disincentives to energy efficiency.
- Providing utility incentives for the successful management of energy efficiency programs.
- Including the impact on adoption of energy efficiency as one of the goals of retail rate design, recognizing that it must be balanced with other objectives.
- Eliminating rate designs that discourage energy efficiency by not increasing costs as customers consume more electricity or natural gas.
- Adopting rate designs that encourage energy efficiency by considering the unique characteristics of each customer class and including partnering tariffs with other mechanisms that encourage energy efficiency, such as benefit-sharing programs and on-bill financing.

Table 1-1. Commitments to Implement the Recommendations of the Action Plan (as of November 2007)*

Type of Commitment	Number of Organizations
Establishing and supporting state-level collaborative processes to explore how best to increase investment in energy efficiency	15
Additional money to be spent on energy efficiency programs	4
Start new and/or expand existing energy efficiency programs	17
Exploring policies and practices to align utility incentives with the delivery of cost-effective energy efficiency	5
Advancing efforts to include energy efficiency on a consistent and comparable basis with supply-side resources in future resource planning activities	24
Meeting aggressive energy savings goals	26
Proactively educating stakeholders on the benefits of and opportunities for energy efficiency	68

* See the Action Plan Web site (www.epa.gov/eeactionplan) for a full listing of energy efficiency commitments.

improvements. The buildings in existence today will remain the vast majority of the nation's buildings and facilities for years to come, and there are a variety of proven, cost-effective energy efficiency programs that can be employed to pursue these opportunities.

- **Importance of new construction.** Efforts to encourage higher energy efficiency in building codes and building beyond code complement energy efficiency programs focused on existing buildings and facilities. In any given year, more energy savings can be harvested from existing buildings in total than from new construction, but new buildings determine the long-term energy footprint of the built infrastructure. Thus it is critical to identify and realize the cost-effective efficiency potential in new buildings. There are a number of approaches for improving the requirements, training, and verification of new construction efforts.

- **Opportunities across customer classes.** Energy efficiency measures are available and can be pursued in all customer classes. Conventional regulatory cost allocation practices can be applied to energy efficiency to ensure that all classes pay their fair share of program costs. The barriers to energy efficiency in each of the customer classes are distinct; policies and programs can account for these differences. Energy efficiency programs may be especially important and yet challenging for low-income energy consumers, because these customers can face difficult economic choices that lead to inefficient energy use. Because of the larger economic barriers in place and because of the distinct social value associated with energy efficiency for low-income households, programs targeting these households may not be expected by some regulatory authorities to meet the same cost-effectiveness thresholds as other programs.

- **Evolving technology will offer new opportunities.** Technology performance and costs are evolving rapidly, offering new opportunities to meet load growth. These new technologies need to be effectively integrated into energy efficiency program design as well as the enabling policies for energy efficiency programs to capture these new opportunities. This document incorporates several policies for making progress with the integration of these technologies. It is expected that this is one of the areas that will be updated in the future.

This Document

The 2025 Vision is presented in the following sections:

- **Chapter 2: The Goals of the 2025 Vision.** This chapter outlines the long-term goal of this Vision and ten implementation goals for pursing the steps necessary to meet the long-term goal. It also outlines how to measure progress toward the 2025 goal in terms of state progress toward adopting the various policy steps, as well as national benefits.
- **Chapter 3: The Vision for 2025.** This chapter describes what the energy system could look like in 2025 if the Vision is achieved and the Action Plan recommendations are fully implemented from a variety of perspectives. It also outlines a number of evolving policies and technologies and the role they may play in achieving the Vision. As the Vision is updated in the future, attention will be paid to how best to address these changes.
- **Chapter 4: Related State, Regional, and National Policies.** This chapter identifies important interrelationships between other federal, regional, and state energy and environmental policies, and provides a number of recommendations and considerations for integrating these efforts so that they act in tandem to promote investment in cost-effective energy efficiency and do not impede each other.
- **Chapter 5: Tools and Assistance to Help Realize the Vision.** This chapter reviews the progress that is expected through the first goal period of this national Vision and shows the tools and resources that are available to help states make progress toward these goals.

Development of the Action Plan Vision for 2025

The National Action Plan for Energy Efficiency was developed by a diverse group of leading organizations from across the country, including public and private utilities, regulators, other state decision-makers, policy advocates, and large end-users. It also engaged many trade associations (see Appendix A). The Action Plan process is chaired by James Rogers, CEO and President of Duke Energy and Marsha Smith, President of the National Association of Regulatory Utility Commissioners (NARUC) and Commissioner, Idaho Public Utilities Commission.[4] It is facilitated by the U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE).

The Vision document was developed under the guidance of a work group of Leadership Group participants. The work group was composed of 17 organizations, representing stakeholder perspectives including investor-owned utilities, regulatory commissions, other state decision-makers, cooperatives, municipal utilities, and energy and environmental policy advocates. Prior to the original November 2007 release, four conference calls were held for the work group to discuss the initial outline and approach, goals and tracking, complementary policies, and the draft report. Two additional conference calls were offered to the entire Leadership Group in order to solicit further comments and provide additional information. The Vision work group members are:

Glenn Cannon	Waverly Light and Power
Jorge Carrasco	Seattle City Light
Sheryl Carter	Natural Resources Defense Council
Ollie Frazier	Duke Energy
Anne George	Connecticut Department of Public Utility Control
Dian Grueneich	California Public Utilities Commission
Jeff Genzer	National Association of State Energy Officials
Sandra Hochstetter	Arkansas Electric Cooperative Corporation (formerly with the Arkansas Public Service Commission)

Chris James	Formerly with the Connecticut Department of Environmental Protection
Mary Kenkel	Alliance One (consultant to Duke Energy)
Michelle New	National Association of State Energy Officials
Bill Prindle	American Council for an Energy-Efficient Economy
Roland Risser	Pacific Gas and Electric
Richard Robinson	National Rural Electric Cooperative Association
Gene Rodrigues	Southern California Edison
James Rogers	Duke Energy
Marsha Smith	NARUC and Idaho Public Utilities Commission
Jim Spiers	Tri-State Generation and Transmission Association, Inc.
Janet Streff	Minnesota Department of Commerce
Mike Winka	New Jersey Board of Public Utilities

During 2008, another work group was formed to help refine the initial strawman approach to measuring progress under the Vision. Four conference calls were held with the new work group to address the topics of refining initial approaches, developing new approaches for those policy steps that were not addressed in the Vision, and developing new approaches for quantifying the national benefits. The Leadership Group reviewed and provided additional comments on the new approaches to measuring progress that were prepared by the work group. To integrate the new revised approaches, the state-level information compiled for the initial release of the Vision was updated and used to develop the baseline (December 31, 2007) for measuring progress at the state level. This information was subsequently sent to state organizations for comment. Members of the Vision measuring progress work group are:

Cheryl Buley	New York State Public Service Commission
Kateri Callahan	Alliance to Save Energy
Dan Francis	American Electric Power
Phil Giudice	Massachusetts Division of Energy Resources
Dian Grueneich	California Public Utilities Commission
Leonard Haynes	Southern Company
Joe Hoagland	Tennessee Valley Authority
Sandy Hochstetter	Arkansas Electric Cooperative Corporation
Mark Hoffman	Consortium for Energy Efficiency
Eric Hsieh	National Electrical Manufacturers Association
Mary Kenkel	Alliance One (consultant to Duke Energy)
Richard Robinson	National Rural Electric Cooperative Association
Andrew Spahn	National Council on Electricity Policy
Jim Spiers	Tri-State Generation and Transmission Association
Richard Steeves	Connecticut Consumer Counsel
Rick Tempchin	Edison Electric Institute
Mark Tye	Santee Cooper
Rick Voytas	Ameren Services

The Intent of the 2025 Vision

This Vision document is offered as a framework to guide changes in energy efficiency policies and programs toward the goals of achieving all cost-effective energy efficiency. The decision of whether to adopt a policy or program and particular design details at the state level are, of course, to be determined through state processes that address state goals, objectives, and circumstances.

Notes

1. Meeting 50 percent of energy consumption is similar to meeting 20 percent of electricity consumption and 10 percent of natural gas consumption, subject to forecast assumptions used. These savings are consistent with the potential savings documented in a number of recent studies. See Appendix B for references for these studies. Across the country, the potential for cost-effective energy efficiency varies, subject to a number of area-specific factors, such as load growth, energy efficiency approaches pursued, local economics, and existing infrastructure.

2. Clean energy portfolio standards direct utilities and other retail electric providers to supply a specified amount of energy from clean resources, such as energy efficiency and renewable energy.

3. See "Energy Efficiency Program Best Practices," Chapter 6 in the *National Action Plan for Energy Efficiency* Report.

4. Diane Munns of the Iowa Utilities Board, while President of NARUC, served as the initial co-chair of the Action Plan.

2: The Goals of the 2025 Vision

The 2025 Vision for the National Action Plan for Energy Efficiency includes establishment of a long-term aspirational goal and ten key implementation goals. These goals, and a set of steps to take to achieve them, are offered as a framework for implementing the Action Plan recommendations and to guide state-level policies toward energy efficiency where it is cost-effective. In addition, the framework helps in measuring progress toward the 2025 Vision. This Vision will be updated and improved over time as new information becomes available.

The Long-Term Goal: Achieve All Cost-Effective Energy Efficiency

Building upon the five recommendations of the National Action Plan, the long-term aspirational goal of this effort is to achieve all cost-effective energy efficiency by the year 2025. Achieving this goal will yield important environmental and economic benefits while integrating energy efficiency into the modernization of the nation's energy system.

Based on available studies, the cost-effective energy efficiency resource available may be able to meet 50 percent or more of the expected load growth nationally. This is similar to meeting 20 percent of electricity consumption and 10 percent of natural gas consumption given current forecasts for future energy demand.[1] Benefits from achieving this magnitude of energy efficiency can be estimated to be:

- More than $100 billion in lower energy bills in 2025 than would otherwise occur.
- Annual energy savings exceeding 900 billion kWh.
- Equivalent to over 50 GW of power, or more than 100 500-MW power plants over 20 years.
- Over $500 billion of total net savings.[2]
- Reductions in greenhouse gas emissions on the order of 500 million metric tons of CO_2 annually, equivalent to 90 million cars off the road.

These benefits reflect the full implementation of best practice energy efficiency programs currently being delivered in some parts of this country, as well as the broad adoption of up-to-date building codes and other energy efficiency policies.

Importantly, the role that the energy efficiency resource may play in meeting load or load growth (or in replacing existing generation options) varies across the country due to regional differences in growth patterns, costs of energy, existing infrastructure, and other factors. In high growth areas, as an example, perhaps less of the expected growth could be addressed and in slower growing areas, perhaps substantially more. In addition, cost-effectiveness needs to be determined at a state and local level. Furthermore, the long-term goal is not meant to imply that new power plant additions are not needed in the future, as new plants may be a critical component of the desired modernization of the energy supply and delivery system. Indeed, the greater the energy efficiency savings, the greater the likelihood that efficiency gains can help replace older, less efficient power supply options, resulting in substantial environmental benefits.

Ten Implementation Goals

For the long-term goal to be achieved, a number of policies need to be in place. Energy efficiency needs to be valued similarly to supply options. Utilities and investors need to be financially interested in saving energy. States must be active in this transformation of energy

supply and delivery, including updating and enforcing codes and standards to ensure that savings are captured as new buildings and products enter the system. Customers must also have the proper incentives to invest in cost-effective energy efficiency. With such policies in place, cost-effective energy efficiency can be a key component of the modernization of the energy supply and delivery system and help transform how customers receive and value energy services.

These policies are included in the following ten implementation goals. These goals provide a framework for implementing the recommendations of the Action Plan by outlining the key steps state decision-makers should consider to help achieve the 2025 Vision. The timeline for achieving these implementation goals is by 2015 to 2020, so that the necessary policy foundation is in place to help ensure success of the 2025 Vision. With most of these policy and program steps, there is significant experience across the country and substantial materials and lessons learned that can be drawn upon. However, there are some policies and technologies that are emerging and may evolve in a variety of ways; such policies are explored further in Chapter 3, and future updates to the Vision will highlight progress in these areas.

The ten implementation goals and key steps to achieve them are outlined below. A description of how progress in implementing these goals can be measured follows.

Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource

Utilities[3] and applicable agencies are encouraged to:

- Create a process, such as a state or regional collaborative, to explore the energy efficiency potential in the state and commit to its full development.
- Regularly identify cost-effective achievable energy efficiency potential in conjunction with ratemaking bodies.
- Set energy savings goals or targets consistent with the cost-effective potential.
- Integrate energy efficiency into energy resource plans at the utility, state, and regional levels, and include provisions for regular updates.
- Quantify energy savings from building codes and incorporate into resource planning.

Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field

Applicable agencies are encouraged to:

- Explore establishing revenue mechanisms to promote utility and other program administrator indifference to supplying energy savings, as compared to energy generation options.
- Consider how to remove utility and other program administrator disincentives to energy efficiency, such as by removing the utility throughput disincentive and exploring other ratemaking ideas.
- Ensure timely cost recovery in place for parties that administer energy efficiency programs.

Goal Three: Establishing Cost-Effectiveness Tests

Applicable agencies along with key stakeholders are encouraged to:

- Establish a process to examine how to define cost-effective energy efficiency practices that capture the long-term resource value of energy efficiency.
- Incorporate cost-effectiveness tests into ratemaking procedures going forward.

Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms

Ratemaking bodies are encouraged to:

- Work with stakeholders to adopt effective, transparent practices for the evaluation, measurement, and verification (EM&V) of energy efficiency savings.

Program administrators are encouraged to:

- Conduct EM&V consistent with these practices.

Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms

Applicable agencies are encouraged to:

- Clearly establish who will administer energy efficiency programs.
- Review programs, funding, customer coverage, and goals for efficiency programs; ensure proper administration and cost recovery of programs, as well as ensuring that goals are met.
- Establish goals and funding on a multi-year basis to be measured by evaluation of programs established.
- Create strong public education programs for energy efficiency.
- Ensure that the program administrator shares best practice information regionally and nationally.

Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices

Applicable agencies are encouraged to:

- Have a mechanism to review and update building codes.
- Establish enforcement and monitoring mechanisms of energy codes.
- Adopt and implement state-level appliance standards for those appliances not addressed by the federal government.
- Develop and implement lead-by-example energy efficiency programs at the state and local levels.

Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency

Utilities and ratemaking bodies are encouraged to:

- Examine, propose, and modify rates considering impact on customer incentives to pursue energy efficiency.
- Create mechanisms to reduce customer disincentives for energy efficiency (e.g., financing mechanisms).

Goal Eight: Establishing State of the Art Billing Systems

Utilities are encouraged to:

- Work with customers to develop methods of supplying consistent energy use and cost information across states, service territories, and the nation.[4]

Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems

Utilities and other program administrators are encouraged to:

- In conjunction with their regulatory bodies, explore the development and implementation of state of the art energy delivery information, including smart grid infrastructures, data analysis, two-way communication programs, etc.
- Explore methods of integrating advanced technologies to help curb demand peaks and monitor efficiency upgrades to prevent equipment degradation, etc.
- Coordinate demand response and energy efficiency programs to maximize value to customers.
- Support development of an energy efficiency services and program delivery channel (e.g., quality trained technicians), with specific attention to residential programs.

Goal Ten: Implementing Advanced Technologies

Applicable agencies and utilities are encouraged to:

- Review policies to ensure that barriers to advanced technologies, such as combined heat and power (CHP), are removed; ensure inclusion into the broader resource plans.
- Work collectively to review advanced technologies and determine rapid integration timelines.

The Vision for Cooperatively and Publicly Owned Utilities

The Vision goals are broad, and are intended to encourage all types of utilities to take the applicable steps to capture the benefits of greater energy efficiency. While many of the resource planning and energy efficiency program issues relate to all utility types, cooperatively and publicly owned utilities operate under different ratemaking and utility financing considerations than investor-owned utilities. Some of the key steps under Goal Two, relating to utility financial incentives, may not apply to cooperatively and publicly owned utilities. These utilities typically operate on an annual budget basis rather than a cost-recovery basis, are regulated by their board members, and are typically not subject to state utility regulation.

The key financial indicator for a cooperatively or publicly owned utility is its debt coverage ratio (which is critical to maintaining a high bond rating and low cost capital) or its minimum cash position (for utilities with no debt). Typically, such a utility can adjust rates whenever the debt coverage ratio or minimum cash position falls below a threshold. An investor-owned utility may need to wait until a formal rate case proceeding to adjust rates for decreases in sales from energy efficiency; the effect of energy efficiency on cooperatively and publicly owned utilities' financial health, however, is relatively modest. The publicly and cooperatively owned utilities will experience similar financial health problems as investor-owned utilities if they do not adjust rates.

Measuring Progress

Measurement of the progress in achieving the ten implementation goals by 2015 to 2020 is an important part of the Vision. Progress will be measured and reported on every few years, with an emphasis on measurable outcomes. Progress will be measured in terms of both state policy and program steps, as well as national benefits.

State Measuring Progress

Tables 2-1 and 2-2 summarize (for electricity and natural gas services, respectively) the implementation of key policy and program steps in support of the Vision across the 50 states and the District of Columbia. The tables show the number of states that have implemented key policy and program steps, in whole or in part, as of December 31, 2007. The information they present was collected through a series of interactions with state-level organizations. More detail on this approach is provided below and in Appendix D. The summary of progress shows there is a strong base of experience, with many energy efficiency policies and programs upon which to draw and expand.

Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource

Progress can be measured as utilities and applicable agencies work to achieve the following:

1. **Process in place, such as a state and/or regional collaborative, to pursue energy efficiency as a high-priority resource.** A valuable early step is to establish a collaborative process involving all appropriate stakeholders. State and or regional collaboratives, representing a diverse group of stakeholders such as utilities, state policy makers, consumers, businesses, and energy service companies, help raise awareness of the value of greater investment in energy efficiency, review the available options, reach agreement among stakeholders on feasible energy savings goals and appropriate funding, and resolve important program and administrative issues. The resulting broader understanding of energy efficiency leads to generally smoother processes in energy efficiency programming, both as new programs are being started and as programs are expanded and improved over time. A collaborative for energy efficiency can be a stand-alone process or one that is part of a state energy planning, state clean energy planning, or climate change planning process. It can have a variety of charters and anticipated longevity. Examples include California, Kentucky, and Minnesota at the state level and the Western

Table 2-1. Progress in Meeting Implementation Goals: Approach for Electricity Services*

	Implementation Goal and Key Steps: Electricity Services	States Having Adopted Policy Step as of December 31, 2007	
		Completely	Partially
Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource			
1	Process in place, such as a state and/or regional collaborative, to pursue energy efficiency as a high-priority resource.	14	0
2	Policy established to recognize energy efficiency as high-priority resource.	21	22
3	Potential identified for cost-effective, achievable energy efficiency over the long term.	25	1
4	Energy efficiency savings goals or expected energy savings targets established consistent with cost-effective potential.	15	3
5	Energy efficiency savings goals and targets integrated into state energy resource plan, with provisions for regular updates.	0	16
6	Energy efficiency savings goals and targets integrated into a regional energy resource plan.**	N/A	N/A
Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field			
7	Utility and other program administrator disincentives are removed.	17	8
8	Utility and other program administrator incentives for energy efficiency savings reviewed and established as necessary.	10	5
9	Timely cost recovery in place.**	N/A	N/A
Goal Three: Establishing Cost-Effectiveness Tests			
10	Cost-effectiveness tests adopted which reflect the long-term resource value of energy efficiency.	29	2
Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms			
11	Robust, transparent EM&V procedures established.	14	6
Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms			
12	Administrator(s) for energy efficiency programs clearly established.	24	2
13	Stable (multi-year) and sufficient funding in place consistent with energy efficiency goals.	4	9
14	Programs established to deliver energy efficiency to key customer classes and meet energy efficiency goals and targets.	24	2
15	Strong public education programs on energy efficiency in place.	18	5
16	Energy efficiency program administrator engaged in developing and sharing program best practices at the regional and/or national level.	30	0

Table 2-1. Progress in Meeting Implementation Goals: Approach for Electricity Services* (continued)

	Implementation Goal and Key Steps: Electricity Services	States Having Adopted Policy Step as of December 31, 2007	
		Completely	Partially
Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices			
17	State policies require routine review and updating of building codes.	28	13
18	Building codes effectively enforced.**	N/A	N/A
19	State appliance standards in place.	11	0
20	Strong state and local government lead-by example programs in place.	13	24
Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency			
21	Rates examined and modified considering impact on customer incentives to pursue energy efficiency.	7	5
22	Mechanisms in place to reduce consumer disincentives for energy efficiency (e.g., including financing mechanisms).	4	1
Goal Eight: Establishing State of the Art Billing Systems			
23	Consistent information to customers on energy use, costs of energy use, and options for reducing costs.**	N/A	N/A
Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems			
24	Investments in advanced metering, smart grid infrastructure, data analysis, and two-way communication to enhance energy efficiency.	5	29
25	Coordinated energy efficiency and demand response programs established by customer class to target energy efficiency for enhanced value to customers.**	N/A	N/A
26	Residential programs established to use trained and certified professionals as part of energy efficiency program delivery.	9	0
Goal Ten: Implementing Advanced Technologies			
27	Policies in place to remove barriers to combined heat and power.	11	24
28	Timelines developed for the integration of advanced technologies.**	N/A	N/A

* See Appendix D for additional information on how these numbers have been determined.

** See Appendix D for discussion of why progress on this policy step is not currently measured.

N/A = Not available

Table 2-2. Progress in Meeting Implementation Goals: Approach for Natural Gas Services*

	Implementation Goal and Key Steps: Natural Gas Services	States Having Adopted Policy Step as of December 31, 2007	
		Completely	Partially
Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource			
1	Process in place, such as a state and/or regional collaborative, to pursue energy efficiency as a high-priority resource.	14	0
2	Policy established to recognize energy efficiency as high-priority resource.	8	8
3	Potential identified for cost-effective, achievable energy efficiency over the long term.	13	0
4	Energy efficiency savings goals or expected energy savings targets established consistent with cost-effective potential.	5	2
5	Energy efficiency savings goals and targets integrated into state energy resource plan, with provisions for regular updates.	0	1
6	Energy efficiency savings goals and targets integrated into a regional energy resource plan.**	N/A	N/A
Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field			
7	Utility and other program administrator disincentives are removed.	18	5
8	Utility and other program administrator incentives for energy efficiency savings reviewed and established as necessary.	5	2
9	Timely cost recovery in place.**	N/A	N/A
Goal Three: Establishing Cost-Effectiveness Tests			
10	Cost-effectiveness tests adopted which reflect the long-term resource value of energy efficiency.	9	0
Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms			
11	Robust, transparent EM&V procedures established.	5	2
Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms			
12	Administrator(s) for energy efficiency programs clearly established.	13	1
13	Stable (multi-year) and sufficient funding in place consistent with energy efficiency goals.	2	4
14	Programs established to deliver energy efficiency to key customer classes and meet energy efficiency goals and targets.	7	0
15	Strong public education programs on energy efficiency in place.	13	6
16	Energy efficiency program administrator engaged in developing and sharing program best practices at the regional and/or national level.	18	0

Table 2-2. Progress in Meeting Implementation Goals: Approach for Natural Gas Services* (continued)

	Implementation Goal and Key Steps: Natural Gas Services	States Having Adopted Policy Step as of December 31, 2007	
		Completely	Partially
Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices			
17	State policies require routine review and updating of building codes.	28	13
18	Building codes effectively enforced.**	N/A	N/A
19	State appliance standards in place.	11	0
20	Strong state and local government lead-by example programs in place.	13	24
Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency			
21	Rates examined and modified considering impact on customer incentives to pursue energy efficiency.	2	0
22	Mechanisms in place to reduce consumer disincentives for energy efficiency (e.g., including financing mechanisms).	0	0
Goal Eight: Establishing State of the Art Billing Systems			
23	Consistent information to customers on energy use, costs of energy use, and options for reducing costs.**	N/A	N/A
Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems			
26	Residential programs established to use trained and certified professionals as part of energy efficiency program delivery.	9	0
Goal Ten: Implementing Advanced Technologies			
28	Timelines developed for the integration of advanced technologies.**	N/A	N/A

* See Appendix D for additional information on how these numbers have been determined.

** See Appendix D for discussion of why progress on this policy step is not currently measured.

N/A = Not available

Governors' Association's Clean and Diversified Energy Advisory Committee at the regional level (National Action Plan for Energy Efficiency, 2006).[5,6] Five best practices for successful collaboratives have been identified: (1) neutral facilitation of meetings, (2) clear objectives for the group overall and for each meeting, (3) explicit definition of the stakeholder group's role in resource or program planning (usually advisory only), (4) explicit and fair processes for providing input, and (5) a timeline for the stakeholder process (National Action Plan for Energy Efficiency, 2006).

2. **Policy established to recognize energy efficiency as a high-priority resource.** Another important early step is recognizing energy efficiency as a high-priority resource in energy planning. Energy efficiency needs to be considered on the same basis as conventional supply options when it is less expensive than the conventional options. This may be an important change in perspective for entities that are used to focusing on conventional supply options. It is important to review and address any limitations in state statutes to ensure that energy efficiency can be appropriately considered. Further, explicitly establishing energy efficiency as the first or among the first resources requires the relevant entities to bring energy efficiency to the top of their planning process. A number of states have recognized energy efficiency as a high-priority resource due to its broad benefits through a variety of policy directives. For example, the California Energy Action Plan II has established energy efficiency as the first resource to be developed in the state (CEC and CPUC, 2005). In addition, legislation passed in Illinois in 2007, and gubernatorial action in New York, Connecticut and Massachusetts, initiate actions that will recognize energy efficiency as a high-priority resource.

3. **Potential identified for cost-effective, achievable energy efficiency over the long term.** A key step in developing energy efficiency programs is analyzing the potential for all cost-effective energy efficiency in the specific jurisdiction over the long term across all customer classes. Because energy usage patterns, technologies, and costs change over time, it is important to have an up-to-date study that incorporates the latest information on energy costs, energy forecasts, and available energy efficiency options. Such a study helps parties have realistic expectations of what can be achieved, informs energy efficiency savings goals and funding targets, and guides program design.

4. **Energy efficiency savings goals or expected energy savings targets established consistent with cost-effective potential.** Energy efficiency savings goals or targets are used in states to help set a high-level policy direction and to establish energy savings targets that can be integrated into resource planning efforts. These savings targets should reflect an understanding of the true cost-effective potential for increased effectiveness.

5. **Energy efficiency savings goals and targets incorporated into state energy resource plan, with provisions for regular updates.** The integration of energy efficiency resources, including energy savings from building codes, and an energy savings target into formalized resource planning processes at the state and utility levels can help establish the rationale for energy efficiency funding levels and for properly valuing the benefits. Resource plans account for the long-term benefits from energy savings, capacity savings, potential reductions of air pollutants and greenhouse gases, and improved reliability, as well as other benefits. Provisions for routine review and updating of these resource plans are important.

6. **Energy efficiency savings goals and targets integrated into a regional energy resource plan.** The integration of energy efficiency resources and an energy savings target into a resource planning process at the regional level may also have value by developing a view of the resources necessary and the role that energy efficiency can play across a broader area. There may be opportunities to explore the role that energy efficiency can play

in regional efforts as entities respond to the federal policies promulgated by the Federal Energy Regulatory Commission (FERC) and DOE which promote the use of regional electric system planning efforts.

Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field

Progress can be measured as the following steps are achieved:

7. **Utility and other program administrator disincentives are removed.** Under conventional ratemaking, utilities have typically been compensated based on the volume of energy delivered to customers; this creates a disincentive for investing in efficiency, which reduces throughput. Removing this disincentive so that utilities are indifferent to selling energy or saving energy is an important step.

8. **Utility and other program administrator incentives for energy efficiency savings reviewed and established as necessary.** Removing the utility throughput incentive (see #7) is important but does not fully align utility incentives with increased cost-effective energy efficiency. Some states are providing incentives for achievement of specific energy efficiency savings to place efficiency on an equal playing field with supply options. Reviewing existing utility incentive structures and determining whether or not to provide incentives linked to performance, or to ensure that appropriate shareholder incentives are in place, similar to those associated with generation options, is an important step.

9. **Timely cost recovery in place.** A basic requirement for the elimination of disincentives to energy efficiency programs is establishing a fair, expeditious process for recovery of costs. Failure to recover program costs directly negatively affects a utility's cash flow, net operating income, and earnings. Further, lack of timely cost recovery increases regulatory risk and requires the utility to incur carrying costs.

Goal Three: Establishing Cost-Effectiveness Tests

Progress can be measured as the appropriate state agencies accomplish the following step:

10. **Cost-effectiveness tests adopted which reflect the long-term resource value of energy efficiency.** Energy efficiency can provide long-term benefits to an energy system when it costs less to reduce energy consumption than it does to generate additional energy, particularly when the energy savings are accumulated over time and the costs of new generation and transmission can be avoided. Cost-effectiveness tests that reflect these long-term benefits help stakeholders set goals and develop programs to put them on a path to capturing all cost-effective energy efficiency.[7] As an example, the total resource cost test compares the total costs and benefits of an efficiency program, including benefits to the utility and all participants and avoided costs of energy supply. Cost-effectiveness tests may also require establishing values for saved energy (kWh or therms) and capacity (kW or decatherms/day). These values may account for a variety of costs and risks, including the costs of all supply options (including losses); the risks associated with permitting, construction, and operation; the costs and risks of fuel supplies; and the costs and risks of environmental regulations. They may also include the social value of low-income programs, if applicable.

Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms

Progress can be measured as the following step is achieved:

11. **Robust, transparent EM&V procedures established.** Robust and transparent EM&V serves a number of objectives including: (1) measuring and documenting the impacts of a program and how well it met its goals with respect to being a reliable energy resource, (2) helping to identify ways to improve current and future programs,

(3) determining the cost-effectiveness of a program, and (4) when public or ratepayer funds are involved, documenting compliance with regulatory requirements. Establishing robust and transparent EM&V approaches will, over time, also contribute to greater consistency in EM&V across utilities, programs and states; which will reduce the burden on individual program developers to establish such protocols, and build consistent understanding of proven efficiency programs that can participate in regional and national markets. Most existing efficiency programs have some form of EM&V, but improving those programs and standardizing them over time are a key part of the Vision. EM&V of energy efficiency may also become a feature of grid modernization programs where real-time monitoring and evaluation of energy use is achieved.

Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms

Progress can be measured as the following steps are achieved:

12. **Administrator(s) for energy efficiency programs clearly established.** There are a variety of successful program models for delivering energy efficiency. They use different types of administrators, including utilities, state agencies (e.g., NYSERDA), third parties (e.g., Efficiency Vermont), or a combination of administrator types. Clearly establishing parties to administer energy efficiency programs is an important step.

13. **Stable (multi-year) and sufficient funding in place consistent with energy efficiency goals.** It is critical to establish adequate, multi-year funding to support the energy efficiency program measures, consistent with the established energy savings target and cost-effective potential. Multi-year funding more easily allows longer-term planning and development of programs, particularly ones that have some upfront costs to access the larger energy savings in a customer group. Many funding mechanisms have been applied for different program structures. Funding might be through a systems benefit charge, another rate mechanism, or rate-based recovery mechanisms such as revenue requirement funding or resource procurement funding.

14. **Programs established to deliver energy efficiency to key customer classes and meet energy efficiency goals and targets.**[8] There are significant cost-effective energy savings to tap into through well-designed energy efficiency programs across all customer classes, for both new and existing buildings. There are many successful efficiency programs, providing reliable results that serve as best practice models for new programs. A robust efficiency program portfolio that provides broad access to energy savings is the linchpin of a successful energy efficiency effort.

15. **Strong public education programs on energy efficiency in place.** Public education is an important element of encouraging customers to take advantage of available energy efficiency programs as well as to take greater control of their energy costs through energy saving measures they can undertake themselves. Many states and utilities have public outreach efforts, but greater integration with energy efficiency programs, both at the state and regional level, and leveraging the national ENERGY STAR® platform can increase overall effectiveness.

16. **Energy efficiency program administrator(s) engaged in developing and sharing program best practices at the regional and/or national level.** Sharing of best practices in program design, implementation, and evaluation, as well as keeping current on emerging technologies and practices, is an important part of maintaining well-designed, cost-effective programs and potentially enhancing the consistency of energy efficiency programs offered across a state and region. Coordination at the national level—such as that offered by

the Consortium for Energy Efficiency—can be an important way to effectively engage with national organizations such as manufacturers, retailers, and others that are essential for effective energy efficiency programs. Coordination and sharing of best practice at the regional level (e.g., through NEEP, NEEA, SWEEP, MEEA, and SEEA) is also important to improve the consistency in energy efficiency programs offered across a region and to help reduce program costs.[9] This coordination can be especially effective when utilities serve multiple states in the region. The Edison Electric Institute's newly formed Institute for Energy Efficiency will provide another forum for best practice sharing.

Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices

Progress can be measured as the following steps are achieved:

17. **State policies require routine review and updating of building codes.** New construction and major renovations represent cost-effective opportunities to incorporate energy-efficiency measures into buildings because these improvements save energy throughout the life of those buildings and can be expensive to adopt later. Building energy codes specify a series of efficiency measures including construction practices and technologies that have been shown to yield cost-effective savings, providing a minimum set of requirements. Building energy codes are typically developed at the national level, adopted at the state level, and implemented and enforced by local governments. Having up-to-date building codes in place is an important part of realizing the energy savings in new construction and major renovation.

18. **Building codes effectively enforced.** Up-to-date, implemented, and enforced energy codes can lock in cost-effective energy savings of 30 percent or more at the time of building construction relative to typical practices,[10] lowering costs for businesses and consumers. Seeing that the necessary training and enforcement of building codes is in place is an important part of realizing the savings that building codes offer.

19. **State appliance standards in place.** State appliance efficiency standards establish minimum energy efficiency levels for appliances and other energy-consuming products (if those appliances have not already been addressed by federal efficiency standards). These standards typically prohibit the sale of less-efficient models within a state. Many states have implemented appliance and equipment efficiency standards for products not addressed by the federal government.

20. **Strong state and local government lead-by-example programs in place.** State and local lead-by-example initiatives include a range of programs and policies that advance the use of clean energy within their own facilities, fleets, and operations. In pursuing lead-by-example strategies, states can leverage their purchasing power, their control of significant energy-using resources, and the high visibility of their public facilities to demonstrate clean energy technologies and approaches that lower their energy costs and reduce emissions. Strong programs involve establishing goals and the processes necessary to implement them and report on progress. Energy efficiency program administrators can be important partners in helping governments achieve their goals (EPA, 2006).

Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency

Progress can be measured as the following steps are achieved:

21. **Rates examined and modified considering impact on customer incentives to pursue energy efficiency.** Rate designs with clear and meaningful price signals to customers, coupled with increased information to customers through time- and usage-sensitive rates, can encourage energy efficiency from the consumer side. For example, removing "declining block" rate structures that discourage energy efficiency by

decreasing costs as more electricity or natural gas is consumed may be an initial step.

22. **Mechanisms in place to reduce customer disincentives for energy efficiency (e.g., including financing mechanisms).** Electricity and natural gas rates can also be partnered with other mechanisms that encourage energy efficiency, such as benefit sharing programs and on-bill financing. These mechanisms help provide the financing that the customer may need to pursue an energy efficiency measure.

Goal Eight: Establishing State of the Art Billing Systems

Progress can be measured as the following step is achieved:

23. **Consistent information to customers on energy use, costs of energy use, and options for reducing costs.** Providing customers with clear information on their energy use, the costs of energy use, and the variety of options available for reducing their costs is an important part of the Vision. Further, greater consistency in how energy use and cost information is provided to customers would assist customers with properties in more than one service territory. And greater ability to access data on their energy use for several years at a time, and to access electronic versions of the data, would assist many customers. This step has resulted from the Sector Collaborative for Energy Efficiency of the National Action Plan (National Action Plan for Energy Efficiency, 2007).

Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems

Progress can be measured as the following steps are achieved:

24. **Investment in advanced metering, smart grid infrastructure, data analysis, and two-way communication to enhance energy efficiency.** Many utilities are studying, piloting, or deploying advanced metering as part of grid modernization, and many millions of advanced meters are now on order for installation over the next five years. Advanced metering, combined with communication, energy information collection systems, and time-based rates, can be used to help identify and promote energy efficiency opportunities, in addition to enhancing system reliability and reducing peak demands. These technologies enable demand response, automated energy management, and better data collection for load analysis and program evaluation. Two-way communications between the grid and the customer and their energy-using devices help reap the full value of advanced meters and automate the operation of buildings and energy-using devices in ways that save energy and reduce peak loads. Exploration of these opportunities and investment as the business case can be made is a key step in the Vision.

25. **Coordinated energy efficiency and demand response programs established by customer class to target energy efficiency for enhanced value to customers.** Energy efficiency programs aim primarily to reduce total electricity usage (kWh), and demand response programs aim to change customers' usage patterns in response to price signals or incentives that vary over time. Demand response programs today are targeted primarily toward reducing peak load or total demand at times of system emergency when load relief is needed; in the longer term, demand response technologies can enable round-the-clock, automated customer energy management that is interactive with the grid. Customers participating in demand response programs may also reduce their energy consumption[11] and invest in energy efficiency improvements that save kWh and peak demand usage. Coordinated, complementary energy efficiency and demand response measures will be valuable for energy customers and important to achieving the Vision goals.

26. **Residential programs established to use trained and certified professionals as part of energy efficiency program delivery.** Energy

efficiency programs play a vital role in increasing the availability of qualified energy professionals for quality program delivery through training and certification. Further, programs using certified technicians from accredited companies can conduct a whole-building assessment and recommend and professionally install comprehensive improvements that yield the best results in energy efficiency, comfort, health and safety, and building durability.

Goal Ten: Implementing Advanced Technologies

Progress can be measured as the following steps are achieved:

27. **Policies in place to remove barriers to combined heat and power.**[12] CHP is an efficient distributed generation resource and an important component of an integrated energy resource plan. Coordinated policies (such as interconnection rules, reviewing CHP as part of the planning process and incorporating it where effective, and standby rates) that remove barriers to CHP are valuable toward achieving this integration.

28. **Timelines developed for the integration of advanced technologies.** To ensure integration of advanced technologies and their adaptation into the broader resource plans, utilities and their regulators are encouraged to work collectively to review advanced technologies and determine rapid integration timelines.

National Benefits

Beyond the adoption of key policies and programs at the state level, progress will be measured in terms of:

- Annual energy savings and greenhouse gas emissions avoided from state- and utility-administered energy efficiency programs.
- Annual investment in energy efficiency through state- and utility-administered energy efficiency programs.
- Expected future energy savings from established energy savings goals across the state and utility policies and resource plans.

Initial estimates for measuring progress in terms of these national benefits are summarized below. Additional details on the estimates for current investments and benefits are provided in Table 2-3.

- Cumulative electricity savings total 63 billion kWh (about 2 percent of retail sales) as of 2006, including incremental electricity savings of over 8 billion kWh in 2006 alone. These cumulative savings have avoided the need for 16 GW of new capacity, equivalent to 32 new 500-MW power plants.
- Cumulative natural gas savings total 135 million therms (0.1 percent of retail sales) as of 2006.
- Greenhouse gas emissions are being reduced by nearly 50 million metric tons annually, equivalent to emissions from 9 million vehicles per year.[13]
- Approximately $2 billion is being invested annually in state- and utility-administered energy efficiency programs.
- State energy savings goals and utility energy savings targets are in place to encourage annual savings exceeding 200 billion kWh in 2025, in addition to current energy savings.[14]

These estimates have been developed by collecting information from a variety of available information sources, which introduces inconsistencies in timeframes, reporting categories, universe of respondents, and quality control of data. Due to data limitations, these initial values are likely to underestimate the full contribution that energy efficiency investments are making to reduce energy demand as well as the full cost of investing in energy efficiency. Some of the key limitations include:

- The energy savings values as of 2005 and 2006 only capture savings from administered energy efficiency programs and do not reflect energy savings from other state and local efforts such as building energy codes, state-level appliance standards, and local and state lead-by-example initiatives.

- The energy savings values do not include the benefits from national efforts to promote energy efficiency, federal appliance standards, or the autonomous rate of improvement in efficiency across the economy.
- The program funding values represent program costs alone and not the costs that program participants may bear.

Additional attention will be given to expand the breadth and accuracy of energy efficiency resource information in order to improve the ability to measure progress toward all cost-effective energy efficiency using these national performance metrics.

Table 2-3. Current Benefits from and Funding for State- and Utility-Administered Energy Efficiency Programs

Annual Benefits and Funding	Energy Savings		Avoided CO_2 Emissions[c] (million tons)	Efficiency Funding[d]	
	Energy Use[a] (kWh or therms)	Peak Capacity[b] (GW)		2006 Spending ($ billion)	2007 Budgets ($ billion)
Electricity					
Incremental	8 billion	1.3	5.8	$1.60	$1.88
Cumulative	63 billion (2% of retail sales)	16.0	46.1	—	—
Natural Gas					
Incremental	N/A	—	N/A	$0.29	$0.28
Cumulative	135 million (0.1% of retail sales)	—	0.8	—	—

N/A = Not available

[a] Annual incremental electricity use savings are from ACEEE (Eldridge et al., 2008) and cumulative electricity savings are from EIA Form-861 data (EIA, 2008b), both for 2006. Values reflect reported data for administered energy efficiency programs only and do not include low-income programs nor other load management efforts such as demand response. Cumulative electricity use savings do not capture those programs administered by state entities. Natural gas savings are from the Consortium for Energy Efficiency (CEE) (Nevius et al., 2008) and include estimated savings from measures installed in 2006, as well as from measures installed as early as 1992 that were still generating savings as of 2006. Total retail sales data are from EIA (2008a, 2008c).

[b] Peak electricity savings are from EIA Form-861 data for 2006 (EIA, 2008b). They reflect reported data for utility-administered energy efficiency programs only and do not include load management programs.

[c] 2005 non-baseload output CO_2 emission rates from eGRID2007 Version 1.0 (EPA, 2008a) were applied to incremental electricity use savings for 2006 by state and cumulative electricity use savings for 2006 at the NERC region level. The calculation of emissions savings from cumulative natural gas savings assumes 0.00585 tons CO_2 per therm based on EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006* (EPA, 2008b).

[d] Actual 2006 spending for energy efficiency programs is from ACEEE (Eldridge et al., 2008) leveraging Form EIA-861 and ACEEE's independent information collection efforts. Energy efficiency program budget values are from CEE (Nevius et al., 2008) for residential, commercial, and industrial efficiency programs. Budget estimates are for the 2007 program year, as reported in 2006 by CEE members and nonmember administrators of energy efficiency programs. Program funding for low-income, load management, and other programs are not included in these estimates. Spending values reflect a similar universe of administered energy efficiency programs, but different surveys and respondents contribute to inconsistencies.

Notes

1. These savings are consistent with the potential savings documented in a number of recent studies. See Appendix B for references for these studies. Appendix C includes information on how these benefits were derived.

2. Net savings equals the savings from reduced electricity purchases and capital expenditures by the utility minus utility and participant costs of energy efficiency. Value is given in net present value, assuming a 5 percent discount rate.

3. "Utilities" refers any organization that delivers electric and gas utility services to end-users, including investor-owned, cooperatively owned, and publicly owned utilities.

4. See the findings of the Sector Collaborative for Energy Efficiency for additional information via <www.epa.gov/eeactionplan>.

5. The Action Plan's report has a number of examples of successful collaborative efforts. Examples can be found on pages 2-14, 3-6, 3-8, 6-13, and 6-25. The report also lists several best practices to follow when soliciting stakeholders' input, on page 6-32.

6. See the reports of the Western Governors' Association's Clean and Diversified Energy Advisory Committee: <http://www.westgov.org/wga/initiatives/cdeac/cdeac-reports.htm>.

7. For more information on cost-effectiveness tests, see the Action Plan Guides on Resource Planning with Energy Efficiency and Conducting Potential Studies.

8. See Chapter 6, "Energy Efficiency Program Best Practices," of the Action Plan's report (National Action Plan for Energy Efficiency, 2006).

9. There are a number of regional energy efficiency coordination organizations across the country. They include the Northeast Energy Efficiency Partnership (NEEP), the Northwest Energy Efficiency Alliance (NEEA), the Midwest Energy Efficiency Alliance (MEEA), the South West Energy Efficiency Partnership (SWEEP), and the new Southeast Energy Efficiency Alliance (SEEA).

10. Determined using a Building Codes Assistance Project calculator that compares each state's current code to the 2006 International Energy Conservation Code (IECC) for residential and commercial construction. The sum of savings in all 50 states produces a 30 to 40 percent savings range.

11. Based on a survey of over 100 demand response programs, the effect of demand response programs on total energy consumption was found to range from increasing total energy use by 5 percent to achieving total energy savings in excess of 20 percent (King and Delurey, 2005).

12. The term "clean distributed generation" is used in this document to mean distributed generation that is cleaner than the average central station power plant.

13. Vehicle conversion assumes that 5.46 tons CO_2 are emitted per vehicle annually.

14. Expected energy to be saved through energy savings goals assumes energy savings post-2007 from 19 states. More details on this methodology are included in Appendix E. No states were found to have comparable, enforceable savings goals for natural gas.

3: The Vision for 2025

The long-term goal for the Vision for the National Action Plan for Energy Efficiency is to achieve all cost-effective energy efficiency by 2025. As energy efficiency policies are pursued, the energy system is modernized, and new technologies emerge, there will be a lower-cost, more reliable energy system with significant environmental benefits. The energy system that offers these benefits is likely to look very different than the one we have today.

A Look at 2025

By 2025, the energy system would focus on providing energy services rather than energy supply, energy providers would see energy efficiency as an important business area, a vibrant energy efficiency services industry would be in place, there could be greater reliance on clean distributed generation, and the system would be modernized to facilitate appropriate price signals and digital communication, analysis, and system control. It would be very different in terms of how consumers receive and value energy services. Additional description of some of the key differences in 2025 is provided below and illustrated in Figure 3-1. This includes a discussion of some of the challenges and emerging technologies critical to meeting the long-term goal of the Vision.

Energy Customers

Customers across the residential, commercial, and industrial sectors will have new opportunities and experiences with energy efficiency services, energy information, and energy system interactions. They will be offered a variety of innovative energy service packages to help them manage their energy use and costs better, including universal access to comprehensive energy efficiency services. These services will routinely assess the energy efficiency of homes, buildings, and industrial plants and help customers undertake low-cost energy efficiency improvements, access high-quality contractors, and access financing where necessary. Customers will also have clear information on their use and costs of energy and more options for lowering their energy bills by allowing building appliances and controls to help meet peak energy demands.

For example, with advanced meters, time-of-use information about energy prices, and automated devices to control their energy usage, customers will face higher energy costs when energy costs more to provide but be able to avoid some of these costs through advances in two-way communication and grid-connected controls, appliances, and equipment.

Customers will have lower energy bills in 2025 than if cost-effective energy efficiency programs were not pursued. Based on technologies and practices available, today many individual homes and buildings can be improved by 20 percent or more, and many industrial plants can be improved by 10 percent or more.[1] These savings are being achieved through well-designed energy efficiency programs and policies that deliver a variety of technologies and practices. Some of the approaches that can substantially lower the costs of energy in existing and new homes, buildings, and industries include:

- **Homes:** There are a variety of proven programs delivering energy savings to many types of homes. These programs range from product-based incentive programs to whole-home audit and improvement programs that use trained, certified home professionals. These programs are providing home energy savings of 20 percent savings or more and up to 50 percent.[2,3] Improvements include greater insulation and air sealing, efficient lighting and appliances, efficient windows, properly sized and installed heating and air conditioning, low-standby home products, and efficient water heating. In addition, controls such as programmable thermostats deliver significant savings

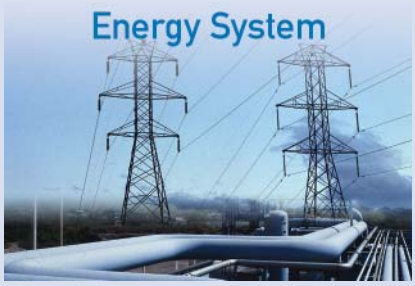
Figure 3-1. Achieving All Cost-Effective Energy Efficiency: Key Perspectives

Home Energy Savings: 20% to 50%*

- Efficient home envelope: insulation and air sealing
- Tight ducts
- Efficient windows
- Efficient, properly sized and installed heating and cooling equipment
- Efficient lighting and appliances
- Low-standby energy use
- Verification of home energy efficiency
- Grid-connected controls and appliances
- Good information on energy use, costs of energy, and savings opportunities
- Whole-building design to achieve greater energy savings

Net Benefits

- Lower energy bills
- Environmental benefits
- Lower greenhouse gas emissions
- Enhanced reliability through reduced peak demands
- Assistance to low-income and elderly customers
- Economic benefits from new jobs and growing local services industry
- Increased fuel diversity to meet U.S. electric load



- Pursue all cost-effective energy efficiency resources
- Universal efficiency services across all customer classes
- Enhanced use of clean distributed generation
- Modernized grid supports greater data analysis, customer control, utility control of peak-driving equipment, self-healing capabilities

Building Energy Savings: 20% to 50%*

- Energy-efficient equipment
- Low-standby energy
- Efficient lighting systems using good design, controls, daylighting, and efficient technology
- Properly sized, efficient, and controlled cooling and heating
- Commissioning and recommissioning
- Routine assessment of building energy performance
- Grid-connected controls and equipment
- Good information on energy use, costs of energy, and savings opportunities
- Whole-building design to achieve greater energy savings

Industry Energy Savings: 10% or More*

- Energy-efficient equipment
- Efficient lighting systems using good design, controls, daylighting, and efficient technology
- Efficient motor systems
- Manufacturing processes tuned for energy efficiency
- Waste heat recovered and utilized
- Good information on energy use, costs of energy, and savings opportunities

*These are savings on a per facility basis, reflecting the energy consumption savings possible to new and existing homes and buildings based on information available today; these savings could be larger in the future based on development from a range of ongoing research and development efforts.

when used properly. Programs are also resulting in the construction of new homes that use substantially less energy than today's homes and go beyond local codes; some organizations have set goals for net zero energy homes by 2015 to 2020.[4]

- **Buildings:** There are a variety of proven programs for delivering energy savings to commercial and institutional buildings as well—public and private office buildings, schools, hospitals, hotels, and others. Proven energy efficiency programs assist with building system improvements, training of building operators, commissioning and recommissioning of buildings, and routine assessment of building energy use. These programs offer savings of 20 percent or more at the building level.[5] They deliver technologies such as optimized, efficient lighting systems employing controls and day lighting; properly sized and efficient heating and cooling equipment; and low-standby and otherwise efficient products and equipment. Additional savings can be achieved when constructing a new building, and some organizations have energy savings goals of 50 percent or more for newly constructed buildings.[6] Additional savings can be achieved from two-way information communications that let customers see and respond to the true costs of service for their building energy use.
- **Industry:** There are also a variety of programs available for the industrial sector, including equipment-specific programs, systems optimization assistance, performance contracting, financial incentives, and low-interest financing. These programs are identifying and achieving energy savings of 10 percent or more.[7] The efforts target high-energy-consuming equipment including air compressors, boilers, motors, furnaces, chillers, cooling towers, fans, pumps, and refrigeration for replacement, tune-up, and enhanced maintenance. Some programs also help utilize waste heat through combined heat and power applications and industrial process optimization.

Society

Society will benefit environmentally and economically from achieving all cost-effective energy efficiency and integrating it into a modernized energy system. Such a modernized system, with more options for meeting peak demand, will provide greater reliability and have lower costs. Energy prices will be lower than otherwise since the most cost-effective resource, on the demand or supply side, will be used first, both in planning and day-to-day operations. This system will also have lower vulnerability to disruptions, such as supply curtailments from natural disasters due to greater use of demand-side resources.

Wiser use of natural gas and electricity also has a number of environmental benefits. These benefits include lower air pollution and reduced emissions of greenhouse gas, lower water use, and a lower environmental impact from fossil fuel extraction. Importantly, it offers a low-risk, low-cost approach to address climate change emissions between now and 2025 as decision-makers continue to discuss the level of reductions on greenhouse gas emissions that are necessary. By 2025, depending on the generation sources at the local level and whether efficiency has displaced existing generation or new generation, millions of tons of emissions of carbon dioxide will be prevented from entering the atmosphere, tons of reductions that would cost much more to go back and capture in 2025.

Greater investment in energy efficiency also helps create jobs, improve local economies, and assist low-income populations. Energy efficiency programs can create construction and installation jobs, with positive impacts on employment and local economies, and the savings from energy efficiency are often redirected to other activities that increase local and national employment (Kushler et al., 2005; NYSERDA, 2004; Goldstein, 2007). Local investments in energy efficiency can also lead to more sustainable local economies, requiring less power from elsewhere, as well as reducing load on overly taxed transmission systems; and it can create valuable long-lasting infrastructure changes to building, equipment and appliance stocks (Innovest, 2002). Low-income populations can also benefit when energy efficiency programs are effectively delivered and help relieve some of the financial pressures on these customers. However, it may be important to target specific measures and

market transformation efforts toward the low-income and other "hard-to-reach" groups to address social equity issues with those customers that may have had less access to specific efficiency benefits.

Further, this is a future that would spur greater technology innovation and increase the opportunity for a growing U.S. clean energy technology industry. A more energy-efficient economy benefits the entire U.S. population, with higher productivity from fewer units of energy consumed, fewer dollars spent on energy, and less air pollution.

Evolving Policies and Technologies

Achieving the ten implementation goals by 2015 to 2020 would create an energy efficiency picture in 2025 with a number of important features, as summarized above and highlighted in Figure 3-2. There are a number of challenges to achieve this Vision, including the necessary evolution of technology, policy, and program practices. Some of these evolving areas are described below, followed by an overview of what developments to look for as progress is made (see Table 3-1).

Regional Resource Planning

In some regions, there is growing focus on energy resource planning at the regional level or regional resource planning (RRP), with the development of regional wholesale markets and regional transmission organizations, the need for new regional interstate transmission, and the need to respond to policies promulgated by FERC and DOE (Roseman and Hochstetter, 2007). RRP is the planning and evaluation of new major generation, transmission, and demand-side resource investments based on their regional and state effects on electricity service, reliability, and rates. A regional view helps identify the value from demand and energy reductions that a more localized perspective could miss. It may be an effective planning process that can inform state and local energy efficiency planning processes and serve a valuable complementary role without superseding local activity or options.

Evaluation, Measurement, and Verification Procedures

Robust EM&V is essential to the success of achieving all cost-effective energy efficiency. EM&V measures and documents the impacts of an energy efficiency program, allowing energy efficiency to be a reliable energy resource. Effective EM&V protocols are consistent and accurate, allow for transparent evaluation of energy savings and emission reductions, and are independently administered (Schiller Consulting, 2007). While a variety of the EM&V protocols in use today may be useful and credible, a more consistent, standardized set of independently administered protocols would facilitate greater reliance on energy efficiency as a resource in regional and national energy, capacity, and ancillary service markets.

Additional attention is necessary to reach this milestone. Importantly, several developments may push EM&V protocols in this direction. New requirements are being developed for energy efficiency to participate in regional energy markets. Another development is new requirements for greenhouse gas regulations at the state and regional level. This may extend internationally as well, as interest grows in having consistent approaches for measuring energy savings and the related avoided greenhouse gas emissions across country borders. Further, by 2025, EM&V protocols may benefit from the wider deployment of measurement technology at customers' premises which may produce data on energy efficiency savings. This technology may improve the quality of EM&V, raise the level of savings credited to efficiency as conservative estimates are replaced by more accurate data, reduce the costs of delivering energy efficiency through advanced diagnostics, and reduce the costs of EM&V.

Demand Response, Advanced Metering, and Smart Grids

These technologies can make a valuable contribution to achieving the goals of the Vision. Demand response and grid technologies, programs, and pricing can help reduce overall energy use when designed with this goal in mind. Measures of interest include time-of-use pricing, advanced meters, power quality management, load management devices like "smart" thermostats, and distributed generation (also see DOE, 2003). As demand

response programs become more established and offer financial, operational, energy, and environmental benefits, more utilities and states are expected to develop these types of programs. Right now, states are addressing EPAct 2005 requirements to investigate time-based pricing and advanced meters. As the development and implementation of demand response programs require customer contact and education, these efforts can be combined with efforts to explore energy efficiency programs for greater energy savings and peak reductions. Continued exploration of how to best coordinate energy efficiency and demand response programs, as these technologies evolve, will be important.[8] It is also important to encourage smart grid interoperability[9] and coordination between and across utilities and regions.

Building Energy Efficiency Expertise/ Workforce

The large-scale ramp-up in energy efficiency programs and services described in this Vision requires the efforts of a diverse set of professionals well-versed in a many aspects of energy efficiency. Many believe that successfully investing in energy efficiency as a key component of the nation's energy mix requires substantial additional investment in trained personal in a number of areas, including:

- Policy-makers and planners
- Program designers and implementers
- Energy service contractors
- Evaluators

Figure 3-2. Important Features of Energy Systems and Services in 2025 to Achieve All Cost-Effective Energy Efficiency

- Universal energy efficiency services provided across residential, commercial, and industrial sectors
- Funding for energy efficiency programs that is consistent with cost-effective potential and allows for multi-year program planning
- Utility incentives aligned with the delivery of cost-effective energy efficiency
- Energy savings (capacity and energy) from efficiency programs integrated into long-term state/regional resource plans
- Consistent, robust, and independent evaluation, measurement, and verification of energy efficiency programs in place
- Strong public education on energy efficiency benefits and opportunities
- Updates to building codes to reflect the current cost-effective potential; enforcement of the updated codes
- Strong state, local, and federal government lead-by-example energy efficiency programs
- Energy bills that provide consistent information on energy use and costs, reflect true cost of service, and provide appropriate price signals
- New financing mechanisms for a variety of energy efficiency measures and services
- Modernized energy systems, including advanced meters, that enable demand-side resources; energy-efficient appliances and building controls that are connected to the electric grid
- Energy efficiency and demand response programs delivered in a coordinated manner
- Training on energy efficiency expertise in utility, regulatory, and private sectors
- Cost-effective, clean, efficient distributed generation integrated into energy resource plans
- Integration of R&D, building codes, appliance standards, and market transformation efforts

Table 3-1. Overview of Evolving Technologies and Practices

Policy Area	Now	Long Term	Changes to Watch
Evaluation, measurement, and verification	• Robust, transparent procedures established	• Consistent EM&V approaches across the United States • Independent administered EM&V	• Development of national standards • Requirements for independent verification • Growing role for smart grid technologies in EM&V • Requirements for state and regional carbon programs
Demand response, advanced metering, and smart grids	• Customer energy use is not routinely linked to the energy system	• Consistent energy use and energy cost information available to all customers • Customers connected with two-way electricity grid • Delivery of energy efficiency enhanced through diagnostics	• New technologies, such as advanced meters and smart appliances/controls • Data collection networks and data analysis to enhance energy efficiency • New customer interfaces • Increased interoperability
Regional resource planning	• State-level resource planning • Some regional energy efficiency program coordination • Federal policies at FERC and DOE	• Regional coordination informs state-level resource planning	• Regional value of energy efficiency identified
Building energy efficiency expertise/workforce	• Some established protocols and certification programs for key industry services • Some curriculum for universities and community colleges	• Robust energy efficiency industry across policy, planning, programming, and energy efficiency services	• Development and use of energy efficiency curriculum for various segments of the workforce • Development and broad use of training and certification programs
Integration of R&D, building codes, appliance standards, and market transformation efforts	• Some states managing programs in and across these key program areas	• States have processes to integrate R&D, updates to building codes and appliance standards, and market transformation programs	• Regional and national coordination across these efforts

Sources: PJM, 2007; CEC and CPUC, 2005; Business Roundtable, 2007; Elliott et al., 2007; Roseman and Hochstetter, 2007; Schiller Consulting, 2007; Western Governors' Association, 2006.

- And more

While there have been important developments in these areas—such as programs focusing on quality installation, new training and certification programs for home contractors, and new curricula for colleges and universities—more work is necessary to assess the workforce infrastructure required to support the robust energy efficiency industry envisioned in 10 or more years, and to see that the necessary training is provided.

Integration of R&D, Building Codes, Appliance Standards, and Market Transformation Efforts

While there is significant cost-effective potential for meeting growing energy demand through energy efficiency and demand response technologies and practices in the coming years, technology continues to evolve and produce new opportunities for additional energy savings. Effectively taking advantage of these emerging opportunities requires coordination of the results of these R&D efforts with other key policy areas such as building codes, appliance standards, and market transformation programs. Further, the findings and results from delivering energy efficiency programs can inform the development of R&D strategies. Successful coordination across all of these efforts is important to increasing the overall benefits that energy efficiency can provide.

Notes

1. Sources are provided in the following notes for each of the key sectors: residential, commercial, and industrial. Additional sources on cost-effective opportunities for energy savings across these sectors can be found in Appendix B.

2. Home Performance with ENERGY STAR is an example of a whole home improvement program offering 20 percent, and up to 50 percent, savings per home and currently being implemented in more than a dozen jurisdictions around the country.

3. Nadel et al. (2004) found the median achievable potential for the residential sector is 26 percent; EPA analysis shows that the typical home can save about 30 percent on home energy bills through use of ENERGY STAR-qualified products. New homes are being constructed to offer savings of 20 percent from improvements to building envelopes and heating, ventilation, and air conditioning, without accounting for energy savings from plug loads such as lighting and appliances.

4. Austin Energy has announced a goal of zero-net-energy new homes by 2015; California is developing a roadmap for their new homes programs to get to zero-net-energy new homes by 2020; and the American Institute of Architects has a goal of zero-carbon new buildings by 2030, with an interim goal of 50 percent better than average buildings by 2010.

5. Nadel et al. (2004) found that the median achievable potential for the commercial sector is 22 percent. The Action Plan's Sector Collaborative found savings of 20 to 40 percent to be readily achievable in typical office buildings, hotels, and retail stores through common energy efficiency measures. EPA has information on a number of typical buildings that have been improved by 20 percent, 30 percent, or more. It also has information on more than 400 buildings that use 50 percent less energy than average buildings.

6. The American Institute of Architects has a goal of zero-carbon new buildings by 2030 with an interim goal of 50 percent better than average buildings by 2010.

7. Nadel et al. (2004) found the median achievable potential for the industrial sector is 14 percent. In addition, the DOE Save Energy Now program is identifying energy savings at the plant level of 10 percent or more across audits performed at hundreds of industrial facilities.

8. State decision-makers may want to design price-based demand response programs carefully to minimize the use of less-efficient and high-polluting distributed generation, which can negate the environmental benefits that can be achieved through demand response or energy efficiency. (For discussion, see EPA's analysis on clean energy options for the Ozone Transport Commission High Electric Demand Day Ozone Attainment Strategies, 2006 and 2007: <http://www.otcair.org/document.asp?fview=meeting#>.)

9. See the GridWise Architecture Council <http://www.gridwiseac.org> for more information on interoperability needs and potential benefits.

4: Related State, Regional, and National Policies

A number of energy and environmental policies are being advanced at the state, regional, and national levels that have important interrelationships with the state-level energy efficiency policies of the Action Plan and the achievement of the Vision goal. These policies can be designed and implemented through a variety of approaches. Some would assist in breaking down the barriers to energy efficiency and work in conjunction with the Action Plan to help integrate cost-effective energy efficiency into a modernized energy system, while achieving other objectives. Other approaches might overlook energy efficiency and thereby lead to a higher-cost energy system than otherwise necessary.

Introduction to Policies

This chapter identifies important interrelationships between the Action Plan and six other state, regional, and federal policy areas. These policy areas are those designed to:

- Limit emissions of greenhouse gases.
- Encourage the use of clean, efficient distributed generation.
- Promote clean energy supply, such as renewable energy.
- Promote load reductions at critical peak times through demand response.
- Modernize and maintain the nation's electric transmission and distribution system, including "smart grid" and advanced meter infrastructure.
- Maintain a sufficient reserve margin for reliable electricity supply.

Policies in these areas each impact the nation's energy system and the energy customer.

Recommendations and Considerations

Key interrelationships, recommendations, and considerations for effectively integrating these efforts so that they act together to achieve the goals of the Vision are provided below.

- **Limit emissions of greenhouse gases.** Climate change is a serious environmental issue and a number of states are advancing policies to limit emissions of these gases. In addition, there are a variety of legislative proposals at the federal level. Energy efficiency is a near-term, low-cost approach for reducing emissions of carbon dioxide, the primary greenhouse gas.[1] However, particular attention needs to be paid to the design of these regulatory approaches so that they provide sufficient funding and/or incentives to overcome the market barriers that persistently limit greater investment in energy efficiency, and incorporate energy efficiency as part of the solution. If efforts are not taken to integrate cost-effective energy efficiency, carbon regulation can be expected to cost society substantially more. States and others are exploring a variety of approaches to integrating energy efficiency. It is recommended that:
  - Greenhouse gas regulation be designed to capture all low-cost carbon emission reductions available through energy efficiency by creating funding/incentives for energy efficiency programs and investments.
  - Methodologies for reporting greenhouse gas emissions be standardized and include guidance for measuring and verifying reductions from energy efficiency.

- Potential costs of reducing emissions of greenhouse gases be reflected in resource planning processes, including the application of cost-effectiveness tests for energy efficiency, where appropriate.

- **Encourage the use of clean, efficient distributed generation.** Distributed generation brings generation close to demand loads. When clean and efficient, distributed generation can help meet demand in congested areas, while lowering emissions of greenhouse gases and other pollutants and lower distribution losses. As an example, many states recognize combined heat and power as a type of clean distributed generation since it provides increased efficiency compared to grid-purchased power and on site thermal production, helps meet load in congested areas, and avoids line losses.[2] Other examples of clean distributed generation include solar and localized wind generation. Distributed generation sources can help stave off new larger generation options, reduce line losses, and help to provide alternatives to meeting existing air pollution requirements such as regulations for limiting emissions of nitrogen oxides. Some states consider output-based emission regulations for distributed generation to encourage the use of greater fuel conversion efficiency as an air pollution control measures (EPA, 2004). This is in addition to the policies included in Goal Ten of the Vision.

- **Promote clean energy supply, such as renewable energy.** Several policies help advance both energy efficiency and renewable energy. For example, clean energy portfolio standards are in place in one form or another (e.g., renewable portfolio standards, alternative energy portfolio standards) in more than half the states across the country, and discussions continue at the national level.[3] As energy efficiency is available in many parts of the country, allowing energy efficiency savings to help meet clean energy requirements can help bring clean energy into the resource mix at lower overall costs. For example, by coupling renewable energy with energy efficiency, states have found that the total cost for portfolio standards is reduced (La Capra Associates, 2006). It is recommended that energy efficiency be considered in the development of clean energy portfolio policies. In addition, a number of states are promoting distributed renewable energy such as photovoltaics. Because these systems may best contribute to the overall energy system when properly sized to meet local energy demand, it may be important to promote them as part of efforts that first reduce the demand for energy through cost-effective energy efficiency. It is recommended that cost-effective energy efficiency be explored as an important first step to programs that incentivize investment in distributed renewable energy.

- **Modernize and maintain the nation's electric transmission and distribution system.** Economic and environmental benefits from modernizing the electric grid will come from enabling demand-side resources to provide supply and ancillary services, facilitating the dispatch of the most energy-efficient supply, and reducing line losses. As advanced metering infrastructure is deployed, recognizing opportunities to leverage energy efficiency through new rate designs and customer education campaigns will increase the benefits achieved by the technology. It is recommended that advancements in grid-connected appliances, controls, transformers, energy storage, and on site generation incorporate energy-efficient design. This is in addition to the policies included in Goal Nine of the Vision.

- **Maintain a sufficient reserve margin for reliable electricity supply.** The level of investment needed by the utility sector to maintain system reliability can be lowered through the delivery of cost-effective energy efficiency, clean distributed generation, demand response, grid advancements, and advancements in storage capabilities. It is recommended that energy efficiency be recognized as a high priority resource in energy resource planning and that this suite of demand-related efforts be incorporated in resource planning and reliability efforts. Increasing investment in energy efficiency will also increase the diversity of fuels and resources used to meet electricity demand and maintain resource adequacy.

In addition to these policies, there are several technology areas to monitor under the Action Plan for inclusion in future updates. These technologies have not yet achieved enough penetration to determine how to effectively incorporate energy efficiency, but are anticipated to make significant progress over the coming years. These technologies include plug-in hybrid vehicles and "smart" appliances.

- **Plug-in hybrid vehicles.** These vehicles use the same technology as electric/gas hybrid vehicles today, but include a larger battery that can be recharged by plugging it into an electric outlet.[4] Currently, they are not mass-produced, so consumers cannot purchase them. However, many believe that they will be available on a large scale in the future, providing owners the opportunity to charge the battery with grid electricity. Studies and demonstrations are in place to examine how plug-in hybrids might be integrated into the network to provide demand response options—using battery-charged electricity when the load curve is at its highest point, a version of pumped storage currently in use by many utilities.
- **Smart appliances.** There is increasing discussion of manufacturing appliances that communicate with the electric grid. These "smart" appliances "talk" to the grid through technology, sensing grid conditions by monitoring system frequency and providing automatic demand response in times of disruption.[5] This technology is a computer chip that can be integrated during the appliance manufacturing process. Pilots underway in the Pacific Northwest include approximately 200 homes, but this technology is not currently available on a large scale (PNNL, 2006). Many experts believe that this technology will be widely used across the country in the coming years, providing an increased opportunity to leverage energy efficiency.

Notes

1. See Appendix B for references to studies that discuss the carbon emissions savings from energy efficiency.
2. States including Connecticut, Hawaii, Maine, North Carolina, Pennsylvania, and Washington include combined heat and power as an eligible resource in their renewable portfolio standards.
3. See EPA's *Guide to Action* and policy tracking resources.
4. For more information on plug-in hybrid vehicles, visit <http://www.pluginpartners.org> or <http://www.calcars.org>.
5. For more information on "smart" appliances, visit <http://gridwise.pnl.gov/technologies> and <http://www.gridwiseac.org>.

5: Tools and Assistance to Help Realize the Vision

This chapter discusses the tools and other assistance currently available to help leading parties realize the Vision's long-term goal of achieving all cost-effective energy efficiency by 2025. A lack of familiarity with best practice policy and program options remains a key barrier to increased investment in cost-effective energy efficiency and a number of tools and resources are available to help leading parties, including regulators, utilities, state governments, consumer advocates, environmental groups, and large end-users to explore these options (National Action Plan for Energy Efficiency, 2006). Some of this assistance is available through the Action Plan and some is available through other efforts of the federal government and the private sector.

National Action Plan for Energy Efficiency Tools

A number of tools and resources have been developed under the Action Plan to assist organizations as they strive to meet their commitments under the Action Plan. These tools and resources will help state decision-makers and others achieve many of the ten implementation goals outlined in Chapter 2, as shown in Table 5-1 and available on the Action Plan Web site, www.epa.gov/eeactionplan.

The Leadership Group will prioritize the development of new tools and assistance based on what is needed to help parties meet the Vision goals within their company, organization, or state. In addition, materials may need to be developed to address some of the challenges to meeting the Vision outlined in Chapter 3 or to facilitate the development of other state, regional, and federal policies so that they complement the achievement of the Vision goals, as outlined in Chapter 4. The Leadership Group will consider these gaps when identifying and prioritizing the Action Plan's future activities. Additional areas for attention to address evolving policies and technologies for achieving the Vision and integrating with other state, regional, and federal policies include:

- Integration of R&D, building codes, appliance standards, and market transformation efforts.
- Integration of energy efficiency into regional energy markets.
- Training on energy efficiency expertise in the utility, regulatory, and private sectors.
- State, regional, and federal carbon policies designed to encourage energy efficiency where cost-effective.

In addition to the development of tools and other resources, the Leadership Group members are helping others through peer-to-peer assistance.

Federal Government Assistance

A number of federal programs are available to encourage energy efficiency and can be crucial resources for meeting the Vision goals. EPA and DOE's ENERGY STAR program is one such resource. Nationally, ENERGY STAR provides a platform for program implementation across customer classes and defines voluntary efficiency levels for homes, buildings, and products. ENERGY STAR is a voluntary public-private partnership designed to reduce energy use and related greenhouse gas emissions. The program has an extensive network of partners including equipment manufacturers, retailers, builders, energy service companies, private businesses, and public sector organizations.

Since the late 1990s, EPA and DOE have worked with utilities, state energy offices, and regional nonprofit organizations to help leverage ENERGY STAR messaging, tools, and strategies to enhance local energy efficiency programs. Today more than 450 utilities (and other efficiency program administrators), servicing 65

Table 5-1. National Action Plan for Energy Efficiency Tools by Implementation Goals

Goal	Type of Tool or Resource		Detailed Action Plan Tools and Resources
	Introduction to Issues in Action Plan Report	Detailed Guide/ How-to Material	
Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource	X	X	• Guide to Resource Planning with Energy Efficiency • Guide for Conducting Energy Efficiency Potential Studies • Communications Kit
Goal Two: Developing Processes to Align Utilities Incentives Equally for Efficiency and Supply Resources	X	X	• Aligning Utility Incentives with Investment in Energy Efficiency Paper
Goal Three: Establishing Cost-Effectiveness Tests	X	X	• Understanding Cost-effectiveness of Energy Efficiency Programs Paper • Guide to Resource Planning with Energy Efficiency • Guide for Conducting Energy Efficiency Potential Studies
Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms	X	X	• Model Energy Efficiency Program Impact Evaluation Guide
Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms	X	X	• Regional Implementation Meetings • Resources Database • Program Design and Implementation Best Practices Guidance (under development)
Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices		X	• Building Codes for Energy Efficiency Fact Sheet • Efficiency Program Interactions with Codes Paper (under development) • State and Local Lead-by-Example Guide (under development)
Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency	X		• Executive Briefings on Customer Incentives Through Rate Design (under development)
Goal Eight: Establishing State of the Art Billing Systems		X	• Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data
Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems		X	• Paper on Coordination of Demand Response and Energy Efficiency (under development)
Goal Ten: Implementing Advanced Technologies			• Most Energy-Efficient Economy Scoping Paper (under development)

percent of U.S. households, participate in the ENERGY STAR program. More information on ENERGY STAR can be found at <http://www.energystar.gov>.

Two other federal resources that provide assistance for energy efficiency measures are the Low Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP). The LIHEAP, administered by the U.S. Department of Health and Human Services, helps eligible low-income homeowners and renters pay their heating and cooling bills. The WAP helps reduce the energy bills of low-income households by making their homes more energy efficient. Both of these programs have proven to be very effective. Since 1999, DOE has been encouraging the network of weatherization providers to adopt a whole-house approach whereby they approach residential energy efficiency as a system rather than as a collection of unrelated pieces of equipment (DOE, 2006).

Federal financial grants can also be used by parties to explore energy efficiency policy and program issues. DOE issues many grant solicitations throughout the year that provide funding for R&D activities, for the development of specific types of technologies, and for many other types of activities that promote energy efficiency. The U.S. Department of Agriculture sometimes issues funding for the development of energy efficiency projects in rural areas.

There are also federal and state tax credits available for installing energy efficiency projects. Many energy efficiency program administrators are now pointing consumers and businesses to the new federal tax credits and incorporating them in their programs. In addition, program administrators can educate their customers on existing tax strategies, such as accelerated depreciation and investment tax strategies, to help them recoup the costs of their investments faster. Some states offer additional tax credits, and/or offer sales tax "holidays," where sales tax is waived at point of sale for a specified period of time ranging from one day to a year (National Action Plan for Energy Efficiency, 2006, p. 6-37).

Leveraging Other Resources

Private sector resources will be critical in achieving the Action Plan Vision for 2025. Private sector resources provide expertise, job training and certification, and additional funding and financing of energy efficiency programs and services. Many organizations provide education and training to their members, including training on energy efficiency. Working with these organizations provides access to their members, and the opportunity to leverage funding or marketing opportunities provided by these organizations (National Action Plan for Energy Efficiency, 2006, p. 6-37). Private foundations often provide grants to fund the exploration of energy efficiency policy and program issues.

In addition, a number of private firms and not-for-profit entities deliver energy efficiency programs throughout the United States or in specific regions. These firms can quickly get a program up and running, as they have the expertise, processes, and infrastructure to handle program activities. New program administrators can contract with these organizations to deliver energy efficiency program design, delivery, and/or implementation support in their service territory (National Action Plan for Energy Efficiency, 2006, p. 6-38). Also, those looking to establish an energy efficiency program can look to well-regarded programs as a reference. Utilities that are starting up or revising existing programs can look to other programs in their area or the country to utilize existing and emerging best programs. Many successful program models have emerged and are being refined to achieve even more cost-effective results (National Action Plan for Energy Efficiency, 2006, p. 6-39). The Consortium for Energy Efficiency's "Ask an Expert" initiative helps share this best practice program information beyond their membership.

Engaging All Stakeholders

To achieve the full potential for energy savings and the related societal benefits, many parties need to work

together toward the Vision. Energy efficiency policies and programs affect numerous parties, including local, state, and federal governments; utilities; customers; energy efficiency product and service providers; manufacturers; builders; architects; environmental groups; energy system operators; labor advocates; the financial community; and economic development groups. Educating and soliciting input from all key parties, either through local, state, and regional collaboratives or though other outreach efforts, will greatly increase the economic and environmental benefits achieved through energy efficiency.

Appendix A: National Action Plan for Energy Efficiency Leadership Group

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Commissioner, Idaho Public Utilities Commission
President, National Association of Regulatory Utility Commissioners

James E. Rogers
Chairman, President, and C.E.O.
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Leadership Group

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Alliance to Save Energy

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Superintendent
Seattle City Light

Lonnie Carter
President and C.E.O.
Santee Cooper

Sheryl Carter
Co-Director, Energy Program
Natural Resources Defense Council

Gary Connett
Director of Environmental Stewardship and Member Services
Great River Energy

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Chairman and C.E.O.
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(New Jersey Resources Corporation)

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Austin Energy

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Senior Vice President, Energy Services and Technology
New York Power Authority

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Philip Giudice
Commissioner
Massachusetts Division of Energy Resources

Dian Grueneich
Commissioner
California Public Utilities Commission

Blair Hamilton
Policy Director
Vermont Energy Investment Corporation

Maureen Harris
Commissioner
New York State Public Service Commission

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Connecticut Consumer Counsel

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American Council for an Energy-Efficient Economy

Rick Leuthauser
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Janine Migden-Ostrander
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Office of the Ohio Consumers' Counsel

Michael Moehn
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The Dow Chemical Company

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Washington Utilities and Transportation Commission

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Consumer Advocate
Iowa Office of Consumer Advocate

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Association of Energy Services Professionals

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Vice President, Secretary and General Counsel
Gas Appliance Manufacturers Association

Kenneth Mentzer
President and C.E.O.
North American Insulation Manufacturers Association

Ellen Petrill
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Jerry Schwartz
Senior Director
American Forest and Paper Association

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Edison Electric Institute

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Executive Director
Energy Programs Consortium

Facilitators

U.S. Department of Energy

U.S. Environmental Protection Agency

Appendix B: Related Studies and Documents

Studies That Include the Potential Magnitude of Energy Savings from Energy Efficiency

Author/ Source, Date	Title	Magnitude Description (MWh, MW, etc.)	Web Site
William R. Prindle, Anna Monis Shipley, and R. Neal Elliott (ACEEE), 2006	Energy Efficiency's Role in a Carbon Cap-and-Trade System: Modeling Results from the Regional Greenhouse Gas Initiative	Doubling efficiency would cut load growth by about two-thirds in 2024, from about 20% to about 6% above 2006 levels. Electricity generation is measured in GWh; by 2024, under the reference case, generation would reach around 480,000 GWh, and with doubled efficiency it would reach around 430,000 GWh.	http://aceee.org/pubs/e064.pdf?CFID=3568249&CFTOKEN=25476090
ACEEE, 2007	Energy Efficiency Resource Standards—Summary Paper	ACEEE analysis estimates that EERS requirements now in place could reduce national electricity demand by more than 1% per year by 2013.	http://aceee.org/energy/state/utpolicy.htm
McKinsey Global Institute, 2007	Curbing Global Energy Demand Growth: The Energy Productivity Opportunity	By capturing the potential available from existing technologies with an internal rate of return of 10% or more, we could cut global energy demand by half or more over the next 15 years. Collectively, we have the potential to cut global energy demand by 135 quadrillion Btus—the equivalent of 64 million barrels of oil per day, or almost 150% of the entire U.S. energy consumption today.	http://www.mckinsey.com/mgi/publications/Curbing_Global_Energy/index.asp
Michael Rufo and Fred Coito, (XENERGY, Inc.), 2002	California's Secret Energy Surplus: The Potential for Energy Efficiency	This study examines the potential energy and peak demand savings from energy efficiency measures in California. The study finds that, if all measures that are economic were implemented, potential peak demand savings would amount to roughly 10,000 MW. Additionally, net program peak savings potential ranges from roughly 1,800 MW under current funding (business as usual) to 3,500 MW if funding is doubled (advanced efficiency), to 5,900 MW if funding is quadrupled (maximum efficiency).	http://www.ef.org/documents/Secret_Surplus.pdf

Studies That Include the Potential Magnitude of Energy Savings from Energy Efficiency (continued)

Author/ Source, Date	Title	Magnitude Description (MWh, MW, etc.)	Web Site
Optimal Energy, Inc. (Northeast Energy Efficiency Partnerships, Inc.), 2004, updated 2005	Economically Achievable Energy Efficiency Potential in New England	This paper looks at the economically achievable potential for energy efficiency in New England. If the region were to commit to fully capturing the energy efficiency potential (at an average cost of 3.1 cents per kWh) it could provide energy savings of 17,103 GWh by 2008 and 34,375 GWh by 2013—bringing energy demand back to 1993 levels. This represents a decrease in energy demand of approximately 1.38% a year, as opposed to ISO New England's forecasted 1.2% annual increase.	http://www.neep.org/files/Updated_Achievable_Potential_2005.pdf
R. Neal Elliott, Maggie Eldridge, Anna M. Shipley, John "Skip" Laitner, Steven Nadel, Alison Silverstein, Bruce Hedman, and Mike Sloan (ACEEE)	Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs	This paper looks at the immediate and long-term future of using energy efficiency, renewables, and demand response in Texas to meet peak demand, to enhance energy security, and to sustain the state's economic growth. Across all sectors, these studies show a median technical potential of 33% for electricity and 40% for gas, and median economic potentials for electricity and gas of 20% and 22% respectively.	http://www.environmentaldefense.org/documents/6029_ACEEE_Texas_Report.pdf
Western Governors' Association, 2006	Clean Energy, A Strong Economy and a Healthy Environment: Report of the Clean and Diversified Energy Advisory Committee to the Western Governors	By adopting the WGA's best practices scenario in the 18 WGA states, load growth could be reduced by as much as 75% over the next 15 years (report published in 2006). The best practices scenario shows that it is possible to reduce electricity consumption in 2020 by 20% relative to that in the reference scenario (measured in TWh per year).	http://www.westgov.org/wga/publicat/CDEAC06.pdf
Steven Nadel, Anna Shipley, and R. Neal Elliott (ACEEE), 2004	The Technical, Economic and Achievable Potential for Energy-Efficiency in the U.S.—A Meta-Analysis of Recent Studies	This paper summarizes 11 studies on the technical, economic, and/or achievable potential for energy efficiency within the U.S. The studies show, across all sectors, a median technical potential of 33% for electricity and 40% for gas, and median economic potentials for electricity and gas of 20% and 22% respectively.	http://www.aceee.org/conf/04ss/rnemeta.pdf

Studies That Include the Potential Magnitude of Energy Savings from Energy Efficiency (continued)

Author/ Source, Date	Title	Magnitude Description (MWh, MW, etc.)	Web Site
DOE EERE, 2006	Projected Benefits of Federal Energy Efficiency and Renewable Energy Programs, FY 2007–FY 2050	The Office of Energy Efficiency and Renewable Energy (EERE) estimates benefits for each of its nine programs in the mid-term (2010–2025) and long term (2030–2050). If the goals of EERE's investment portfolio are achieved and the corresponding market outcomes realized, nonrenewable energy consumption will drop by 8 quadrillion Btus by 2025, or about 28% of the expected incremental growth in energy demand over this time period; and by 32 quadrillion Btus by 2050, or about 78% of the expected incremental growth in annual energy demand over this time period. This results in a declining demand for nonrenewable energy consumption starting in 2030, despite a growing economy.	http://www1.eere.energy.gov/ba/

Studies That Value the Benefits from Energy Efficiency

Author/ Source, Date	Title	Magnitude Description (MWh, MW, etc.)	Web Site
Neal Elliott and Anna Monis-Shipley (ACEEE), 2005	Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets: Updated and Expanded Analysis	This study evaluates the potential reduction in natural gas consumption energy efficiency and renewable energy. It projects an annual consumer savings for energy efficiency only of $32 billion in 2010 and $54 billion in 2020.	http://aceee.org/pubs/e052full.pdf?CFID=65288&CFTOKEN=51121347
Anthony Wright, Michaela Martin, Bob Gemmer, Paul Scheihing, and James Quinn (DOE EERE), 2007	Save Energy Now: Results from the U.S. DOE 2006 Save Energy Now Assessment Initiative	DOE, through its 2006 Save Energy Now initiative, trained teams from 200 plants on ways to reduce energy use and carbon emissions. The results from this program show that individual plants can: • Cut energy bills by 10% or more each year (over $2.5 million per plant, on average). • Save an average of 17.3% of natural gas annually. • Save an average of 20,200 metric tons of CO_2 emissions annually. In all, the 200 assessments found over $500 million in potential energy savings and 4 million metric tons in potential CO_2 emissions reductions.	http://www.eere.energy.gov/industry/saveenergynow/partners/pdfs/sen_2006_results_summary_9-20-07.pdf

Studies That Value the Benefits from Energy Efficiency (continued)

Author/ Source, Date	Title	Magnitude Description (MWh, MW, etc.)	Web Site
DOE EERE	DOE's Save Energy Now Initiative Recognizes High Performing Plants	Through its Save Energy Now initiative, DOE gives manufacturers the opportunity to receive free energy assessments and recognition for energy savings. Manufacturers received awards if they reported their energy savings results within 6 months and met the criteria in one of the following categories: 1. **Energy saver plant**—more than 75,000 million Btu total energy savings or more than 7.5% total energy savings. 2. **Energy champion plant**—more than 250,000 million Btu total energy savings or more than 15% total energy savings.	http://www1.eere.energy.gov/news/progress_alerts/progress_alert.asp?aid=248
Martin Kushler, Dan York, and Patti Witte, 2005	Examining the Potential for Energy Efficiency to Help Address the Natural Gas Crisis in the Midwest	This report identifies a number of savings/benefits from energy efficiency: 1. Potential percentage of natural gas savings by sector in key benchmark years (2006, 2010, 2015, 2020). 2. Potential percentage of electricity savings by sector in key benchmark years. 3. Projected net natural gas consumption savings (due to energy efficiency) by sector in key benchmark years (MMcf). 4. Projected net electricity consumption savings (due to energy efficiency) by sector in key benchmark years (MWh). 5. Projected net natural gas customer dollar savings (due to energy efficiency) by sector in key benchmark years. 6. Projected net electricity customer dollar savings (due to energy efficiency) by sector in key benchmark years, and some other estimates of dollar savings.	http://www.pickocc.org/publications/natural_gas/Natural_Gas_Crisis_Report.pdf
Mark Bernstein, Christopher Pernin, Sam Loeb, Mark Hanson (RAND), 2002	The Public Benefit of Energy Efficiency to the State of Massachusetts	This study estimates public benefits of energy efficiency in Massachusetts and finds that improvements in energy efficiency in the commercial, industrial, and residential sectors is associated with benefits to the state economy from 1977 to 1997 that range from $1,664 per capita to $2,562 per capita in 1998 dollars and approximately 11% lower air emissions from Massachusetts' share of local emissions from power generation.	http://www.rand.org/pubs/monograph_reports/2005/MR1588.pdf

Studies That Estimate the Carbon Reduction Benefits from Energy Efficiency

Author/ Source, Date	Title	Report Description	Web Site
Charles F. Kutscher (American Solar Energy Society), 2007	Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions from Energy Efficiency and Renewable Energy by 2030	This report looks at how much energy efficiency and renewable technologies can contribute towards reducing U.S. carbon emissions to atmospheric concentrations of 450 to 500 ppm (levels desired by a number of current legislative proposals). The report summarizes the potential carbon reduction contributions from various areas: energy efficiency, concentrating solar power, photovoltaics, wind, biofuels, biomass, and geothermal. The report found that energy efficiency and renewable technologies could meet most, if not all, of the U.S. carbon emissions reductions that will be needed to help limit the atmospheric concentration of CO_2 to 450 to 500 ppm. "Approximately 57% of the total carbon reduction contribution is from energy efficiency and (EE) about 43% is from renewables. Energy efficiency measures can allow U.S. carbon emissions to remain about level through 2030, whereas the renewable supply technologies can provide large reductions in carbon emissions below current values."	http://www.ases.org/climatechange/climate_change.pdf
Electric Power Research Institute (EPRI), 2008	The Power to Reduce CO_2 Emissions: The Full Portfolio	EPRI analyzes the technical feasibility of seven advanced technologies (the "PRISM" analysis), and then uses the "MERGE" model to identify the lowest-cost options for reaching specific emissions reduction targets. The technologies include energy efficiency, renewable energy, advanced nuclear reactors, advanced coal power plants, carbon capture and storage, plug-in hybrid vehicles, and distributed energy resources. EPRI's analysis found that, together, these technologies could reduce the estimated cost of CO_2 emissions reductions to the U.S. economy by $1 trillion.	http://mydocs.epri.com/docs/public/DiscussionPaper2007.pdf, http://epri.com/portal/server.pt?open=512&objID=205&&PageID=410&mode=2&in_hi_userid=2&cached=true

Studies That Estimate the Carbon Reduction Benefits from Energy Efficiency (continued)

Author/ Source, Date	Title	Report Description	Web Site
Ernst Worrell, Nathan Martin, and Lynn Price (Ernest Orlando Lawrence Berkeley National Laboratory), 1999	Energy Efficiency and Carbon Dioxide Emissions Reduction Opportunities in the U.S. Iron and Steel Sector	This paper focuses on the U.S. iron and steel industry and identifies cost-effective energy and carbon dioxide emissions savings that can be accomplished currently and in the short-term future. In a detailed analysis of U.S. blast furnaces and steel mills (SIC 3312 only), the authors examined over 45 specific energy efficiency technologies and measures and estimated energy savings, carbon dioxide savings, investment costs, and operation and maintenance costs for each of these measures. Based on this information, they constructed a conservation supply curve for U.S. iron and steelmaking that found a total cost-effective reduction of 3.8 GJ/t, equivalent to an achievable energy savings of 18% of 1994 U.S. iron and steel energy use and 19% of 1994 U.S. iron and steel carbon dioxide emissions.	http://www.energystar.gov/ia/business/industry/41724.pdf
Howard Geller, John DeCicco, and Steven Nadel (ACEEE), 1993	Cost-Effective Carbon Dioxide Reduction Initiatives	This paper proposes and analyzes ten different national energy efficiency measures that could be used to meet President Clinton's former proposal to reduce Greenhouse gas emissions to 1990 levels by 2000. If these ten initiatives were undertaken, ACEEE projected, national CO_2 emissions would be reduced by nearly 9% in 2000. In addition, national energy use in 2000 would fall by 7% and consumers' energy bills would be reduced by over $50 billion that year. By 2010, CO_2 emissions would fall by 20%, national energy use would fall by nearly 17%, and consumers' energy bills would be slashed by over $160 billion per year. These reductions in CO_2 emissions, energy consumption, and energy bills are relative to projected levels based on the reference case in DOE's Annual Energy Outlook 1993.	http://www.aceee.org/pubs/e934.htm
Illinois Governor Rod R. Blagojevich Climate Change Advisory Group, 2007	Modeling of Policy Proposals	This presentation contains an estimate of reductions of $MtCO_2e$, changes in electricity sales due to implementing policies, changes in electricity generation, policies' contributions to generation growth, effects on coal generation, greenhouse gas policy impact outside Illinois, and other impacts of adopting a number of policies such as "enhanced energy efficiency programs." The presentation finds that a mixed program could reduce electricity load growth by 100%.	http://www.epa.state.il.us/air/climate change/documents/07-09-06/modeling-of-policy-proposals.ppt

Studies That Estimate the Carbon Reduction Benefits from Energy Efficiency (continued)

Author/ Source, Date	Title	Report Description	Web Site
Interlaboratory Working Group (Oak Ridge National Laboratory and Lawrence Berkeley National Laboratory), 1997	Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy Efficient and Low-Carbon Technologies by 2010 and Beyond	This report shows the results of a study conducted by five DOE labs on the U.S. potential to reduce greenhouse gas emissions by employing energy-efficient and low-carbon technologies. The study looked at business-as-usual forecasts from the Energy Information Administration's 1997 Outlook, which projected an increase of 390 million metric tonnes of carbon (MtC) per year (from 1340 to 1730 MtC) between 1990 and 2010. The study concluded that, along with utility sector investments, a vigorous national commitment to develop and deploy energy-efficient and low-carbon technologies could cost-effectively reduce U.S. carbon emissions by approximately 390 MtC per year.	http://enduse.lbl.gov/Projects/5Lab.html
McKinsey & Company, 2007	Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?	This paper analyzes the costs and benefits of more than 250 possible options to reduce or prevent greenhouse gas emissions in the U.S. over the next 25 years, including various energy efficiency measures. The study concluded that the U.S. can reduce greenhouse gas emissions by 7 to 28 percent by 2030 using tested approaches and high-potential emerging technologies. Improving energy efficiency in buildings, appliances, and industrial sectors could offset 85 percent of the increased demand for electricity anticipated by 2030, reducing the average net cost to the economy of reducing greenhouse gas emissions.	http://www.mckinsey.com/clientservice/ccsi/greehousegas.asp
John Mortensen (National Renewable Energy Laboratory), 2002	Projected Benefits of Federal Energy Efficiency and Renewable Energy Programs: FY 2003–FY 2020	The report summarizes the results of EERE's annual Government Performance and Results Act data for fiscal year 2003. The survey reviewed a number of energy, environmental, and financial metrics including carbon emissions displaced by EERE's programs. The report predicts that "By 2020, EERE's programs could reduce total fossil energy consumption by 9–15% and reduce total carbon emissions by 9–17% compared to the 'No-EE' case. Projected growth in fossil energy consumption could be reduced by 40–67% by 2020. Projected growth in carbon emissions could be reduced by 34–67% by 2020."	http://www1.eere.energy.gov/ba/pdfs/fy03_benefits_report.pdf

Studies That Discuss Existing Barriers to Greater Investment in Energy Efficiency

Author/ Source, Date	Title	Report Description	Web Site
Miriam Pye (ACEEE), 2008	Making Business Sense of Energy Efficiency and Pollution Prevention	This paper outlines a number of successful projects that have combined energy efficiency and pollution prevention technologies. The paper also highlights the benefits of energy efficiency in preventing pollution and reducing greenhouse gases, along with energy savings potential and economic benefits. An overview of barriers to energy efficiency is also provided, along with solutions to overcome these barriers.	http://www.aceee.org/pubs/ie982.htm
Ernest Worrell and Lynn Price (Lawrence Berkeley National Laboratory), 2001	Barriers and Opportunities: A Review of Selected Successful Energy-Efficiency Programs	This paper looks at barriers that prevent the implementation of energy efficiency improvements.	http://industrial-energy.lbl.gov/node/198
Johnathan Garo Koomey, 1990	Energy Efficiency in New Office Buildings: An Investigation of Market Failures and Corrective Policies	This dissertation examines policies used to encourage energy efficiency in commercial buildings. It delves into the technical evidence for market failures and other sources that prevent optimal energy efficiency measures from being used. More specifically, the paper looks at technical evidence for market failures affecting the energy efficiency of new office buildings and looks at the type of market failures and regulatory distortions, such as imperfect competition, economic non-rationality, and regulatory distortions. The paper also provides a number of corrective policies that can be used to encourage energy efficiency.	http://enduse.lbl.gov/Info/JGKdissert.pdf
William H. Golove and Joseph H. Eto (Lawrence Berkeley National Laboratory), 1996	Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency	The report discusses seven different market barriers to investment in energy efficiency: 1. Misplaced incentives. 2. Lack of access to financing. 3. Flaws in market structure. 4. Mis-pricing imposed by regulation. 5. Decision influenced by custom. 6. Lack of information or misinformation. 7. "Gold-plating" and inseparability of features.	http://eetd.lbl.gov/ea/EMS/reports/38059.pdf

Studies That Discuss Existing Barriers to Greater Investment in Energy Efficiency (continued)

Author/ Source, Date	Title	Report Description	Web Site
William H. Golove and Joseph H. Eto (Lawrence Berkeley National Laboratory), 1996	Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency	The report discusses seven different market barriers to investment in energy efficiency: 1. Misplaced incentives. 2. Lack of access to financing. 3. Flaws in market structure. 4. Mis-pricing imposed by regulation. 5. Decision influenced by custom. 6. Lack of information or misinformation. 7. "Gold-plating" and inseparability of features.	http://eetd.lbl.gov/ea/EMS/reports/38059.pdf
Steven Nadel (ACEEE), 1997	Appliance Energy Efficiency: Opportunities, Barriers and Policy Solutions	The study reviews recent progress in improving the energy efficiency of appliances in the United States. Nonetheless, for many products in the United States, appliance energy efficiency has not progressed much in recent years due to market barriers and the lack of certain policies that would require increased efficiency. The paper presents technical opportunities for increasing the energy efficiency of appliances and discusses policies that can overcome barriers to energy efficiency.	http://www.aceee.org/pubs/a972.htm

Documents That Discuss a Vision for Energy Efficiency and Related Policies, Programs, and Technologies

Author/ Source, Date	Title	Scope	Web Site
Alliance to Save Energy, 2005	Vision 2010: The Alliance Energy Efficiency Plan	This Web site describes legislative provisions that should be implemented to improve energy efficiency in different sectors of the economy: transportation, buildings, industry, and electric and natural gas utilities.	http://www.ase.org/content/article/detail/2131
Business Roundtable, 2007	More Diverse, More Domestic, More Efficient: A Vision for America's Energy Future	The Business Roundtable report was developed by a group of chief executives of major U.S. corporations. The report describes the energy challenges the U.S. is facing today and provides specific recommendations on how to solve energy needs such as increasing the efficiency of buildings, appliances, increased use of efficient generating technologies such as CHP.	http://www.businessroundtable.org/pdf/Energy/Business_Roundtable_Energy_Report_06062007.pdf

Documents That Discuss a Vision for Energy Efficiency and Related Policies, Programs, and Technologies (continued)

Author/ Source, Date	Title	Scope	Web Site
California Energy Commission, 2007	Distributed Generation and Cogeneration Policy Roadmap for California	This report provides a vision for 2020 on how distributed generation and combined heat and power can be utilized. MWh targets are identified for different distributed generation and combined heat and power technologies. Long-term strategies and policies are discussed.	http://www.energy.ca.gov/2007publications/CEC_500-2007-021/CEC-500-2007-021.pdf
California Energy Commission and California Public Utilities Commission, 2005	Energy Action Plan II	The Energy Action Plan sets state goals and identifies policies to help meet the California's future energy needs. The specific action areas addressed in the paper are energy efficiency; demand response; renewables; electricity adequacy, reliability, and infrastructure; electricity market structure; natural gas supply; transpiration fuels; R&D; and climate change.	http://www.energy.ca.gov/energy_action_plan/2005-09-21_EAP2_FINAL.PDF
California Public Utilities Commission, 2008	California's Long Term Energy Efficiency Strategic Plan	California's first Long Term Energy Efficiency Strategic Plan provides an integrated framework of goals and strategies for saving energy, covering government, utility, and private sector actions. The plan provides a roadmap for 2009 to 2020, focusing on four "Big Bold strategies" for energy savings: 1. All new residential construction in California will be zero net energy by 2020. 2. All new commercial construction in California will be zero net energy by 2030. 3. The heating, ventilation, and air conditioning industry will be reshaped to ensure optimal equipment performance. 4. All eligible low-income homes will be energy-efficient by 2020.	http://www.californiaenergyefficiency.com
Representatives of the commercial building industry (DOE EERE), 2000	High Performance Commercial Buildings: A Technology Roadmap	The paper describes how to improve commercial buildings through new designs, new technologies, improved building codes and standards, and other measures.	http://www.eere.energy.gov/buildings/info/documents/pdfs/roadmap_lowres.pdf

Documents That Discuss a Vision for Energy Efficiency and Related Policies, Programs, and Technologies (continued)

Author/ Source, Date	Title	Scope	Web Site
Energy Future Coalition	Challenge and Opportunity: Charting a New Energy Future	This report provides recommendations and discussion of what is needed to address today's energy challenges.	http://www.energyfuturecoalition.org/pubs/EFC Report.pdf
EPA Combined Heat and Power Partnership	Funding Database	This Web site lists a number of state and federal incentives for combined heat and power projects and for projects using biomass/biogas.	http://www.epa.gov/chp/funding/funding.html
McKinsey Global Institute, 2007	Curbing Global Energy Demand Growth: The Energy Productivity Opportunity	This paper is a global study on different sectors of the economy: buildings, transportation, and industries. It details how implementing certain policies and technology developments can help reduce forecasted energy use.	http://www.mckinsey.com/mgi/publications/Curbing_Global_Energy/index.asp
National Energy Technology Laboratory, 2007	A Vision for the Modern Grid	This document expands on the vision for a modern grid that will "revolutionize the electric system by integrating 21st century technology to achieve seamless generation, delivery, and end-use that benefits the nation."	http://www.netl.doe.gov/moderngrid/docs/A%20Vision%20for%20the%20Modern%20Grid_Final_v1_0.pdf
National Petroleum Council, 2007	Facing the Hard Truths About Energy	This draft report provides a comprehensive view to 2030 of global oil and natural gas.	http://downloads.connectlive.com/events/npc071807/pdf-downloads/Facing_Hard_Truths-Report.pdf
North American Electric Reliability Council, 2006	2006 Long-Term Reliability Assessment	This report includes an assessment of the reliability of the bulk power systems in North America, as well as key findings and actions needed.	ftp://www.nerc.com/pub/sys/all_updl/docs/pubs/LTRA2006.pdf

Documents That Discuss a Vision for Energy Efficiency and Related Policies, Programs, and Technologies (continued)

Author/ Source, Date	Title	Scope	Web Site
PJM, 2007	Bringing the Smart Grid Home	This piece provides a vision of how the U.S. electrical infrastructure will look. The concept of a smart grid is examined and its benefits are identified.	http://www2.pjm.com/documents/downloads/strategic-responses/letters/smartgrid.pdf
State of New Jersey, 2008	State of New Jersey Energy Master Plan	The Energy Master Plan analyzes New Jersey's current and future energy challenges and proposes a series of actions to ensure adequate, reliable energy supplies that are both environmentally responsible and competitively priced. This roadmap includes several actions to maximize energy conservation and energy efficiency. According to this analysis, the proposed course of action would effectively reduce energy consumption by 20 percent, leading to more than $30 billion in energy savings between 2010 and 2020.	http://www.nj.gov/emp/

Documents with More Information on Energy Efficiency and Related Policies, Programs, and Technologies

Author/ Source, Date	Title	Scope	Web Site
Appliance Standards Awareness Project		This Web site provides information and resources on federal and state appliance standards.	http://www.standardsasap.org
Building Codes Assistance Project		This nonprofit organization is dedicated to helping states adopt and implement up-to-date building energy codes.	http://www.bcap-energy.org
Bonneville Power Administration	Industrial Audit Guidebook	This is a guidebook for performing walk-through energy audits of industrial facilities. It highlights key measures for industrial energy savings.	http://www.bpa.gov/energy/n/projects/industrial/pdf/audit_guide.pdf
Chris King and Dan Delurey	Twins, Siblings, or Cousins	Discusses the effect of demand response programs on total energy consumption based on a survey of over 100 demand response programs.	Published in Public Utilities Fortnightly in March 2005

Documents with More Information on Energy Efficiency and Related Policies, Programs, and Technologies (continued)

Author/ Source, Date	Title	Scope	Web Site
U.S. DOE	Information on Smart Grid Technologies	This Web site provides several resources on smart grid technology, including results from several ongoing federal research efforts.	http://www.oe.energy.gov/smartgrid.htm
ERG and Energy and Environmental Analysis (EPA)	Output-Based Regulations: A Handbook for Air Regulators	EPA designed this handbook to help air regulators understand and then establish output based regulations. The report details the attributes of output-base regulations, which reward energy efficient projects by allocating allowances or issuing standards based on the productive output of the process instead of how much fuel is used. Output-based regulation design issues are also discussed.	http://www.epa.gov/cleanrgy/pdf/output_rpt.pdf
Elliott Roseman and Sandra Hochstetter	Regional Resource Planning Makes Sense	This article gives historical background on the regional resource planning process, discusses recent developments, and provides recommendations for how regional resource planning should be conducted.	http://www.energypulse.net/centers/article/article_display.cfm?a_id=1416
Galvin Electricity Initiative	Information on "Perfect Power" systems and related efforts	This privately funded initiative aims to help modernize the U.S. electric power system to be environmentally sound, fuel-efficient, and able to withstand natural disasters or a potential terrorist attack. The initiative has developed reports and other resources that describe technology options, consumer needs, and functional specifications for achieving the "perfect" power system.	http://www.galvinpower.org/
Gridwise at PNNL and Gridwise Architecture Council	Information on modernizing the power grid	This Web site provides information on how to update/modernize the power grid. It offers a number of resources on how to transform the grid, including the Gridwise Architecture Council's interoperability checklist (<http://www.gridwiseac.org/pdfs/gwac_decisionmakerchecklist.pdf>)	http://gridwise.pnl.gov/technologies http://www.gridwiseac.org
Michael R. Muller and Kyriaki Papadaratsakis (Industrial Assessment Center at Rutgers University), 2003	Self-Assessment Workbook for Small Manufacturers	This workbook provides information on key measures for industrial energy savings.	http://www.iac.rutgers.edu/database/technicaldocs/IAC_Manuals/selfassessment.pdf

Documents with More Information on Energy Efficiency and Related Policies, Programs, and Technologies (continued)

Author/ Source, Date	Title	Scope	Web Site
Innovest Strategic Value Advisors, 2003	Energy Management and Investor Returns: The Real Estate Sector	This paper examines energy efficiency and energy management performance in the real estate sector. It finds that companies that used energy-efficient technologies and other highly efficient products achieved the best stock and financial performance over a 2-year period.	http://www.energystar.gov/ia/business/guidelines/assess_value/reit.pdf
La Capra Associates, GDS Associates, and Sustainable Energy Advantage (North Carolina Utilities Commission), 2006	Analysis of a Renewable Portfolio Standard for the State of North Carolina	This report identifies the potential for renewable generation in North Carolina and helps identify achievable targets for a statewide renewable portfolio standard.	http://www.lacapra.com/downloads/NC_RPS_Report.pdf
Martin Kushler, Dan York, and Patti Witte (ACEEE), 2005	Examining the Potential for Energy Efficiency to Help Address the Natural Gas Crisis in the Midwest	The Midwest has a significant number of industries that rely on natural gas and many Midwestern homes are heated by natural gas–fueled space heaters. Due to this large reliance on natural gas, the Midwest needs other fuels/technologies to meet its energy needs. This report examines the potential for energy efficiency as a way to curb the Midwest's dependence on natural gas.	http://www.aceee.org/pubs/u051.htm
Massachusetts Technology Collaborative	Decoupling of Utility Rates	This Web site contains a number of reports and other information related to decoupling of utility rates.	http://www.mtpc.org/dg/decoupling.htm
National Action Plan for Energy Efficiency, 2006	National Action Plan for Energy Efficiency	The Action Plan is a strategy developed by a diverse group of stakeholders to realize energy savings and environmental benefits through energy efficiency-related policies and other measures.	http://www.epa.gov/cleanenergy/actionplan/eeactionplan.htm
New Jersey Board of Public Utilities, Office of Clean Energy, 2005	New Jersey's Clean Energy Program 2005 Annual Report	New Jersey's Clean Energy Program offers a comprehensive suite of programs that makes energy efficiency and renewable energy technologies affordable and accessible to residential customers, businesses, schools, and local governments in New Jersey.	http://www.njcleanenergy.com/files/file/2005%20Annual%20Report.pdf

Documents with More Information on Energy Efficiency and Related Policies, Programs, and Technologies (continued)

Author/ Source, Date	Title	Scope	Web Site
NYSERDA, 2007	New York Energy $mart[SM] Program Evaluation and Status Report: Report to the System Benefits Charge Advisory Group	Energy $mart provides funding for energy efficiency, low-income consumers, R&D, environmental protection programs, and projects in other areas. This report describes how much money has been collected for the program, how the money is allocated, what types of projects have received funding, and identifies the benefits of the program.	http://www.nyserda.org/Energy_Information/SBC/sbcmar07coverTOC.pdf
Optimal Energy (Natural Resources Defense Council and Ceres), 2007	Power to Save: An Alternative Path to Meet Electric Needs in Texas	This report presents the potential for energy efficiency and demand reductions in Texas and recommends strategies to meet this potential.	http://www.ceres.org/pub/docs/Ceres_texas_power.pdf
Plug-in Partners National Campaign and The California Cars Initiative	Information on plug-in hybrid vehicles	These two Web sites provide information on plug-in hybrids.	http://www.pluginpartners.org http://www.calcars.org

Appendix C: Energy Efficiency Benefits Analysis Assumptions

The analysis of program benefits for the Action Plan's Vision uses the Energy Efficiency Benefits Calculator, a tool that demonstrates the benefits to customers, utilities, and society of implementing energy efficiency programs. The Calculator was developed for the Leadership Group and is one of the resources available to aid users in educating stakeholders on the benefits of energy efficiency programs.

For this analysis, the Calculator was used to estimate the benefits of displacing more than 50 percent of load growth through 2025, or 20 percent of electricity consumption and 10 percent of gas consumption in 20 years. These savings were assumed to be achieved by broad adoption of a range of conventional energy efficiency programs. The estimates are based on assumptions of average program spending levels by utilities or other program administrators, with conservatively high numbers for the cost of energy efficiency programs. The economic and environmental savings estimate are extrapolations of the results from existing utility and state programs to a national scope. Emission savings are based on a marginal generation factor that is double that of the annual average.

The key assumptions are summarized in Figure C-1. Total consumption, load growth, peak demand, and retail rate assumptions are based on current data as tabulated by the Energy Information Administration (EIA) or as projected in the EIA Annual Energy Outlook 2007.

The levelized program cost of $35.00/MWh for electricity and $3.00/MMBtu for gas is assumed. Energy efficiency program costs are based on assumptions of average program spending levels by utilities and other program administrators, as well as program participants. Administrator costs are assumed at $20.00/MWh for electricity and $1.50/MMBtu for natural gas. Participant costs are assumed at $15.00/MWh for electricity and $1.50/MMBtu for natural gas. Many of today's programs deliver energy savings for less than these assumed costs.

Figure C-1. Assumptions and Inputs

Electric

- Annual consumption 2008: 3,992,000 GWh
- Peak load 2008: 971.926 MW
- Annual growth in consumption: 1.6%/year
- Annual revenue (customer bills) 2008: $351,129 million
- Efficiency program cost: $35.00/MWh
- Power plant capital cost: $1,000/kW
- Average CO_2 emission factor: 0.52 tonne/MWh
- Annual cost escalation: 2%/year

Natural Gas

- Annual consumption 2008: 22,497 Tcf
- Annual growth in consumption: 0.7%/year
- Annual revenue (customer bills) 2008: $190,726 million
- Efficiency program cost: $3.00/MMBtu
- Average CO_2 emission factor: 0.053 tonne/MMBtu
- Annual cost escalation: 2%/year

Other

- Discount rate for net present value: 5%
- Energy efficiency measure life: 15 years

Appendix D: Approach for Measuring Progress at the State Level

Appendix D provides an explanation of an approach for how progress toward the vision goals will be measured, as presented in Figures 2-1 and 2-2. A summary of existing state policies and actions that can assist in achieving the Vision goals has been developed and is described below. This appendix describes how the information was collected at the state and regional level, as well as describing the approach for determining if a state has completed a step in whole or in part. This approach was refined by the Action Plan Leadership Group in 2008.

Collection of Information

As part of the Action Plan's Regional Implementation Meetings in 2007, the status of 40 policy and program options to promote cost-effective energy efficiency was collected at the state level and grouped into five regions: West, Mid-Atlantic, New England, Midwest, and Southeast. This detailed information has been updated and used to develop the baseline (December 31, 2007) for measuring progress at the state level. Information on the 28 policies or program steps is presented in Figures 2-1 and 2-2. In some cases, this information was supplemented with additional sources as noted in the specific program step. Further, this information was sent to state organizations for further comment. Information on measuring progress at the state level will be updated on a regular basis at the Action Plan Web site, www.epa.gov/eeactionplan.

Determining the Status of a Policy

Figures 2-1 and 2-2 summarize the status of a state-level policy or program based on it being considered to be "complete" or "partial/some elements of policy in place." These two categories have been developed from more detailed information, based on the format used for the Regional Implementation Meetings. If information was not readily available at the state level it is not included. If additional information on these policies is available based on a review of the current information on measuring progress on the Action Plan Web site, please send it to Katrina Pielli at pielli.katrina@epa.gov and it will be included as the information is updated in the future.

A more detailed explanation of the assessment for each of the implementation goals and the key policies or program steps in Figures 2-1 and 2-2 is provided below.

Goal One: Establishing Cost-Effective Energy Efficiency as a High-Priority Resource

1. **Process in place, such as a state and/or regional collaborative, to pursue energy efficiency as a high-priority resource.** A state where stakeholders were involved in an advisory or collaborative role with program administrators,[1] while developing energy resource plans and/or energy efficiency program plans or determining the best use of efficiency or sustainable energy funds, was considered as having "completed" this step. Collaboratives should incorporate the following best practice attributes for successful collaborative processes, taken from the Action Plan Report: 1) neutral facilitation of meetings; 2) clear objectives for the group overall and for each meeting; 3) explicit definition of stakeholder group's role in resource or program planning (usually advisory only); 4) explicit and fair processes for providing input; and 5) a timeline for the stakeholder process. The sources for this information included interviews with regulators and program administrators, as well as online materials such as utility commission orders and rules.

The totals in Figures 2-1 and 2-2 represent those that have been positively confirmed. There is no "partially complete" for this step.

2. **Policy established to recognize energy efficiency as high-priority resource.** A state was considered to have "completely" established energy efficiency as a high-priority resource, equivalent or superior to supply resources, if there was a clearly established policy to that effect (such as an integrated resource planning objective of acquiring all cost-effective energy efficiency). A state was considered to have "partially completed" this step if it was found to have completed one out of the following seven possible policies that states are pursuing in this area. The list of possible policies is purposely diverse to represent the different circumstances of states and the expectation is not that all policies are appropriate for all states.

   – Energy efficiency is integrated into an active integrated resource planning, portfolio management, or other planning process.

   – Energy efficiency is procured as a resource for default service/standard offer customers.

   – Energy efficiency is an alternative to transmission based on a long-term transparent integrated resource planning or transmission system plan.

   – Energy efficiency is a biddable commodity.

   – State implementation plans include energy efficiency set-asides.

   – Energy efficiency commitment is in statute.

   – Energy efficiency can be used to fulfill requirements of a renewable portfolio standard or similar standard.

3. **Potential identified for cost-effective, achievable energy efficiency over the long term.** A state was considered to have "completely" established the potential for cost-effective energy efficiency through a potential study if there was a recent (within the past five years), comprehensive study available for attainable energy efficiency. A state was considered to have "partially completed" this step if, for example, it had announced plans for a study but not yet completed it.

4. **Energy efficiency savings goals or expected energy savings targets established consistent with cost-effective potential.** A state was considered to have "completed" this step if it had established the potential for cost-effective energy efficiency through a potential study, and also established at least one of the following:

   – Funding requirements for all long-term, cost-effective energy efficiency.

   – Quantitative MW and MWh savings goals established and producing incremental investment.

   If a state had completed one or even both of the above items, but had not established the potential for cost-effective energy efficiency by completing a potential study, then that state was considered to have "partially completed" this step.

5. **Energy efficiency savings goals and targets integrated into state energy resource plan, with provisions for regular updates.** A state was considered to have "completed" this step if all of the following options have been accomplished:

   – Energy efficiency was integrated into an active integrated resource planning, portfolio management, or other resource planning process.

   – Resource plans were regularly updated.

   – Energy savings from building codes quantified and incorporated into resource planning.

   A state was considered to have "partially completed" this step if it had completed two of the above items. The third option requires that a state quantify the impact of building codes in energy saved and the state resource planning processes direct utilities to explicitly account for building

codes in their base case load forecast for resource planning.

6. **Energy efficiency savings goals and targets integrated into a regional energy resource plan.** Progress will be measured for this step in the future as regional resource planning efforts evolve across the country.

Goal Two: Developing Processes to Align Utility and Other Program Administrator Incentives Such That Efficiency and Supply Resources Are on a Level Playing Field

7. **Utility and other program administrator disincentives are removed.** A state was considered to have "completed" this step if it had addressed the utility throughput incentive and removed disincentives, such as through decoupling or lost revenue recovery. A state was considered to have "partially completed" this step if it had addressed the throughput incentive and removed disincentives for one or more utilities, but not for all utilities. If a state had an open docket on these issues but had not yet issued a final decision, it was not considered to have "partially completed" this step. Note that a state that has approved a pilot to remove disincentives and includes a date to revisit the pilot for future monitoring is considered "complete."

8. **Utility and other program administrator incentives for energy efficiency savings reviewed and established as necessary.** A state was considered to have "completed" this step if the utility commission has explored establishing incentives for energy efficiency savings for utilities and other program administrators and has issued a decision; or if the utility commission has ruled on incentive proposals filed in the last three years by all utilities or program administrators under their jurisdiction. A state was considered to have "partially completed" this step if the utility commission has an open docket to explore this but has not yet issued a decision, or if the utility commission has ruled within the last three years on incentive proposals filed by either half of the utilities under their jurisdiction or by program administrator/s serving at least half of the state's customers of regulated utilities.

9. **Timely cost recovery in place.** Progress on this policy is not currently being measured, but it is hoped that in each state's process of exploring additional energy efficiency, the timeliness of program cost recovery will be addressed.

Goal Three: Establishing Cost-Effectiveness Tests

10. **Cost-effectiveness tests adopted which reflect the long-term resource value of energy efficiency.** A state was considered to have "completed" this step if it included a testing method such as the total resource cost (TRC) or societal cost test in the suite of cost-effectiveness tests performed to evaluate energy efficiency programs. The TRC or societal tests do not need to be the sole tests performed for a state to have "completed" this step. A state was considered to have "partially completed" this step if, for example, these testing methods were allowed to be used but had not been to date, or if a docket was open that was looking at cost-benefit evaluation.

Goal Four: Establishing Evaluation, Measurement, and Verification Mechanisms

11. **Robust, transparent EM&V procedures established.** A state was considered to have "completed" this step if it had a robust EM&V process in place. Robust procedures include completing impact, market, and process evaluations. A state was considered to have "partially completed" this step if, for example, utilities were required to develop a measurement and verification process by commission order but this action was pending, or if a docket was open that was looking at EM&V procedures.

Goal Five: Establishing Effective Energy Efficiency Delivery Mechanisms

12. **Administrator(s) for energy efficiency programs clearly established.** A state was considered to have "completed" this step if the energy efficiency delivery structure had been established. A state was considered to have "partially

completed" this step if, for example, a docket was open that was looking at which entity would be the energy efficiency program administrator.

13. **Stable (multi-year) and sufficient funding in place consistent with energy efficiency goals.** A state was considered to have "completed" this step if funding requirements for all long-term, cost-effective energy efficiency had been established. If a state had completed three of the following five items, it was considered to have "partially completed" this step:
    - Cost recovery process exists.
    - Funding is for multi-year periods (more than 2 years).
    - A base energy efficiency spending level exists, with opportunity to justify higher level.
    - A percentage of net (retail) utility revenue presently used for energy efficiency.
    - Other mechanisms that provide stable, multi-year funding to meet energy efficiency goals.

14. **Programs established to deliver energy efficiency to key customer classes and meet energy efficiency goals and targets.** A state was considered to have "completed" this step if it had established energy efficiency programs that reach all customer classes. Programs for low-income customers are a key customer class and must be included to "complete" this step. If a customer class chooses to opt out of energy efficiency programs because they argue they are addressing energy efficiency on their own, and the utility commission states that the utility does not need to offer programs to this customer class, a state can still "complete" this step. A state was considered to have "partially completed" this step if, for example, there was an open docket that was exploring energy efficiency programs.

15. **Strong public education programs on energy efficiency in place.** A state was considered to have "completed" this step if all state-approved energy efficiency program portfolios (administered by the utility and other program administrators) include public education programs. A state was considered to have "partially completed" this step if state-approved energy efficiency program portfolios (administered by the utility and other program administrators) serving at least half of the state's customers of regulated utilities include public education program/s.

16. **Energy efficiency program administrator engaged in developing and sharing program best practices at the regional and/or national level.** A state was considered to have "completed" this step if over two-thirds of its energy efficiency budget was administered by entities that either: 1) belong to the Consortium for Energy Efficiency; 2) belong to or serve on the board of a regional energy efficiency market transformation organization (such as Northeast Energy Efficiency Partnerships) or a regional organization dedicated to the promotion of energy efficiency; or 3) belong to a national or regional organization that engages in the development and sharing of program best practices.

Goal Six: Developing State Policies to Ensure Robust Energy Efficiency Practices

17. **State policies require routine review and updating of building codes.** A state was considered to have "completed" this step if it had building energy codes in place and these codes were regularly updated. A state can also "complete" this step if its building codes are reviewed and updated to reflect the current national building code (Model Energy Code or IECC model energy code for residential buildings; ASHRAE or IECC model energy code for commercial buildings). A state was considered to have "partially completed" this step if it had building energy codes in place but they were not regularly updated.

18. **Building codes effectively enforced.** States do not regularly conduct evaluations on code enforcement, so this information is not available. The few evaluations done to date are dated and assess the

enforcement landscape very differently. Few states have plans to conduct future evaluations, given the cost of conducting these studies versus the need to use building code funding for education and training.

19. **State appliance standards in place.** A state was considered to have "completed" this step if it has appliance and equipment efficiency standards in place that are regularly updated. This step does not suggest that state appliance standards are necessary for all appliances; only the set of additional appliances that are not addressed by the federal government.

20. **Strong state and local government lead-by-example programs in place.** In The State Energy Efficiency Scorecard for 2006 (Eldridge et al., 2007), states are ranked in terms of their enactment of lead-by-example programs. The ranking categories are energy efficiency performance, new and existing state building targets, energy-efficient product procurement, and research and development. A state was considered to have "completed" this step if it received 2 or more points. A state was considered to have "partially completed" this step if received below 2 points but above 0 points.

Goal Seven: Aligning Customer Pricing and Incentives to Encourage Investment in Energy Efficiency

21. **Rates examined and modified considering impact on customer incentives to pursue energy efficiency.** A state was considered to have "completed" this step if it had considered the impact on energy efficiency when designing retail rates. If a state had not considered that impact but had completed two of the three following items, it was considered to have "partially completed" this step:

    – Declining block rates and fixed variable rate designs have been eliminated.

    – Time-sensitive rates in place.

    – Usage-sensitive rates in place.

22. **Mechanisms in place to reduce consumer disincentives for energy efficiency (e.g., including financing mechanisms).** A state was considered to have "completed" this step if it had mechanisms in place to encourage energy efficiency. A state was considered to have "partially completed" this step if the commission had requested that utilities submit proposals for mechanisms to reduce consumer disincentives or if a utility had submitted a proposal but the commission had not yet issued an order. Note that incentives for customer installation of energy efficiency measures and products are treated as part of energy efficiency programs, which are addressed in step 14.

Goal Eight: Establishing State of the Art Billing Systems

23. **Consistent information to customers on energy use, costs of energy use, and options for reducing costs.** Progress on this policy is not currently measured. It is hoped that, in coming years and with further advanced metering infrastructure (AMI) roll-out and increased efforts to benchmark building energy use, progress will be able to be measured.

Goal Nine: Implementing State of the Art Efficiency Information Sharing and Delivery Systems

24. **Investments in advanced metering, smart grid infrastructure, data analysis, and two-way communication to enhance energy efficiency.** A state was considered to have "completed" this step if it had electric utilities that had contracted for AMI. A state was considered to have "partially completed" this step if it had electric utilities that were running AMI pilots, had AMI deployment planned, or were planning a deployment. Some "partial" states reflect investments in smart grid infrastructure, data analysis, and two-way communication. These states were listed as partial if, for example, not all electric utilities in the state had made investments, if investments were not yet installed, or if only some of the programs had been invested in.

Three sources were used for this step: the regional summary tables tracking for AMI deployments; Appendix F of FERC (2007); and discussion with outside parties, including experts at <http://www.SmartGridNews.com> and GridWise Alliance.

25. **Coordinated energy efficiency and demand response programs established by customer class to target energy efficiency for enhanced value to customers.** Progress will be measured for this step in the future once ongoing related work under the National Action Plan for Energy Efficiency is complete.

26. **Residential programs established to use trained and certified professionals as part of energy efficiency program delivery.** A state was considered to have "completed" this step if utilities and other program administrators representing 75 percent or more of the state's customers of regulated utilities have at least one state-approved energy efficiency program for new and one for existing residential homes that utilize professionals trained and certified by one of the following organizations: Residential Energy Services Network (RESNET), Building Performance Institute (BPI), organizations identified under the LEED For Homes and the NAHB Green Building Program, and the North American Technician Excellence (NATE) or comparable HVAC organizations, or utilize utility training programs for program delivery. A state was considered to have "partially completed" this step if utilities and other program administrators representing 50-74 percent of the state's customers of regulated utilities have at least one state-approved energy efficiency program for new and one for existing residential homes that utilize professionals trained and certified by one of the previously listed organizations or a utility training program. In addition, a state was considered to have "completed" this step if there are established programs requiring these certified professionals but which exist without utility or state support. In such cases, these programs equal or exceed 20 percent of market penetration.

Goal Ten: Implementing Advanced Technologies

27. **Policies in place to remove barriers to combined heat and power.** Progress was measured on policies associated with interconnection rules; reviewing combined heat and power as part of the planning process and incorporating it where effective; and standby rates. For states with statewide policies on standby rates for distributed generation, the two largest utilities (based on EIA data) were also reviewed to see if the policies were being implemented in a way that valued the costs and benefits of distributed generation. If there was no state policy, the two largest utilities were reviewed to determine if their rates valued the costs and benefits of distributed generation. A state that had completed two of the three following items was considered to have "completed" the step below, and a state that had completed one of the items was considered to have "partially completed" if:

    - A statewide interconnection policy is in place.
    - As part of the resource planning process, combined heat and power is reviewed and incorporated where effective.
    - An effective state standby rate policy is in place, or the two largest utilities have implemented rates that "value the costs and benefits of distributed generation."

28. **Timelines developed for the integration of advanced technologies.** Progress on this policy is not currently measured. It is hoped that, in coming years and with the maturity of energy efficiency technology efforts, progress will be able to be measured.

Notes

1. Program administrators can include utilities, third parties, energy offices and other public sector entities.

Appendix E: Approach for Measuring Progress by National Benefits

[Note to reviewers: The text for Appendix E is currently undergoing an internal copyedit for grammar and consistency. Please focus your comments on the content.]

Appendix E provides additional information on the approaches currently being used to quantitatively measure progress toward the Vision goal of achieving all cost-effective energy efficiency. Currently, five national metrics are being used, as presented in Chapter 2 and Table 2-3. Existing data, primarily from surveys of administered energy efficiency programs, are used to establish initial national values for these metrics for the year 2006.[1] This appendix also outlines the key limitations with the existing data. Future efforts will explore options for expanding the breadth and accuracy of energy efficiency information in order to improve the ability to measure progress. Additional metrics may also be explored.

Background

A Work Group on Measuring Progress Toward the 2025 Vision was established as a result of the January 2007 Action Plan Leadership Group Meeting. This Work Group developed a proposed approach for quantitatively measuring progress toward the Vision goal in Spring 2008 which was subsequently reviewed by the full Leadership Group. Expert consultants from Lawrence Berkeley National Laboratory (LBNL) were retained to collect the available data and develop baseline estimates for 2006. The following broad principles were followed throughout this effort.

- Data will be collected at the state and regional level, but only national numbers will be released within the Vision document.
- New data collection efforts will not be undertaken through this effort, only collection of data from new effort existing sources.
- Energy efficiency will be the focus of the metrics where possible, versus the full suite of demand-side management efforts.
- Quantitative metric measurement approach will be modified over time as additional, more robust data becomes available.
- Limitations of the data will be clearly stated and areas for improvement will be identified.

This appendix documents the approaches used to measure progress through the set of five quantitative metrics presented in Chapter 2. These metrics are:

- Metric 1: Projected energy savings from existing energy savings goals and targets (kWh).
- Metric 2: Current energy savings (kWh, kW, and therms).
- Metric 3: Current avoided emissions of carbon dioxide (tons).
- Metric 4: Current funding of energy efficiency programs.
- Metric 5: Current energy consumption across the building and industrial sectors (kWh, therms).

Metric 1: Projected Energy Savings from Existing Energy Savings Goals and Targets (kWh)

In order to estimate expected energy to be saved through energy savings goals and or targets that are in place across the country using a relatively consistent approach, decisions were made as to the scope of the policies to include and a general methodology was developed to estimate the impacts of the energy savings goals/targets through 2025. Further, key assumptions

were made for each state. These elements of the approach are detailed below.

Scope of Policies

Long-term electricity savings projections were developed for 14 states. These states had one or more of the following in place by the end of 2007:[2]

1. Long-term energy savings goals, including (but not limited to) formal energy efficiency portfolio standards (EEPS) established through legislation or regulatory action.[3]

2. Renewable portfolio standards (RPS) or broader alternative resource portfolio standards under which energy efficiency is a qualifying resource.[4]

3. Long-term electricity savings projections from the most recent integrated resource plans filed by IOUs in Connecticut, Idaho, Montana, and Oregon.[5]

Consistent with the broad principles above, states were included in this approach only if a goal or target was readily available in an existing source.[6] As work on projecting the benefits of energy savings goals and targets continues under the Action Plan, this baseline can become more comprehensive, In particular, the baseline currently focuses exclusively on electricity usage savings (kWh), as these are the units in which EEPS and RPS goals are typically expressed. Relatively few states have long-term electricity capacity (kW) or gas (therm) savings goals, and the few that do represent a fairly minimal part of total electricity and natural gas savings in the U.S. Thus, existing work in the areas of projecting the impacts of energy savings goals is not yet capturing future electricity capacity and natural gas savings from these policies.

Across the 14 states, the scope of the savings projections varies in terms of the portion of statewide retail sales covered and the types of policy interventions included (see Table E-1). For example, EEPS and RPS policies may apply only to certain types of utilities (e.g., just investor-owned utilities), or they may apply statewide. Similarly, the policies may establish savings goals solely for voluntary, incentive-based energy efficiency programs, or they may establish savings goals that could be met through a combination of policy interventions (e.g., incentive-based energy efficiency programs, codes and standards, market transformation programs, etc.). The projections used to establish the Vision baseline reflect the varying scope of the state policies included, and thus some caution must be employed in comparing savings projections across states or if comparing to historical savings levels.

General Methodology

The methodology used to develop savings projections included the general elements of load forecasts, compliance, measure lifetime and projection time horizon. The general methodology for these key elements are described below, followed by the key assumptions and sources by state.

Key Elements

Load forecasts: EEPS and RPS targets are often specified as a percentage of retail sales, in which case a load forecast is needed to project energy savings. Load forecasts were developed for each state by applying the census-region growth rate projections from EIA's 2008 *Annual Energy Outlook* to 2006 retail sales in that state (from EIA Form-861). If necessary, any exemptions from compliance obligations were accounted for under the state's EEPS or RPS law (e.g., for municipal or small utilities).

Compliance: The energy savings projections assume full compliance with state RPS and EEPS targets, although in reality, full compliance may not be achieved – for example, if cost caps become binding. Similarly, the projection assumes that utilities will acquire the energy efficiency savings targets identified in their IRPs, although in reality, IRPs rarely represent firm long-term commitments or obligations, and in any case, utilities regularly revise their long-term energy savings goals with each subsequent IRP filing.

Measure lifetime: Many states have an EEPS that is specified in terms of incremental annual savings. To convert to cumulative savings, a standard 15-year measure life was used.

Table E-1. Basis and Scope of Energy Savings Projections by State

State	Basis for Projection	Retail Sales Covered	Types of Policy Interventions
CA	Regulatory goal to acquire all cost-effective energy efficiency	Statewide	Voluntary programs, codes and standards, market transformation programs
CO	Statutory savings targets	IOU retail sales	Voluntary programs
CT	IRP filing	IOU and competitive retail sales	Voluntary programs
HI	Expected use of energy efficiency for RPS compliance	Statewide	Voluntary programs
ID	IRP filings	IOU retail sales	Voluntary programs
IL	Statutory savings targets	IOU & competitive retail sales	Voluntary programs
MN	Statutory savings targets	Statewide	Voluntary programs, codes and standards, market transformation programs, utility infrastructure improvements
MT	IRP filings	NorthWestern Energy default service sales	Voluntary programs
NC	Expected use of energy efficiency for RPS compliance	Statewide	Voluntary programs
NV	Expected use of energy efficiency for RPS compliance	IOU and competitive retail sales	Voluntary programs
NY	Governor's savings goal and regulatory targets	Statewide	Voluntary programs, codes and standards, market transformation programs, utility infrastructure improvements
OR	IRP filings	IOU retail sales	Voluntary programs
TX	Statutory savings targets	IOU and competitive retail sales	Voluntary programs
WA	Statutory requirement to acquire all cost-effective energy efficiency	Statewide	Voluntary programs

Projection time horizon: The energy savings projections extend through 2025. Some EEPS policies have a specific end-date (e.g., 2015 or 2020), and similarly, energy efficiency savings projections in utility IRPs may not extend all the way to 2025. In these cases, energy efficiency savings were extrapolated out through 2025 by assuming that savings continue to accrue based on the annual savings in the last year for which the EEPS or IRP specifies a numerical target.

State Policies, Key Assumptions, and Data Sources

California: The California Energy Commission has adopted the policy of acquiring all cost-effective energy efficiency in the state. The projection of energy efficiency savings is based on the estimated statewide economic potential of 39,576 GWh by 2016, reported in the Energy Commission's 2007 *Integrated Energy Policy Report.* This potential estimate is annualized by assuming a steady incremental annual savings rate from 2007 to 2016, and extrapolate past 2016 by assuming

that savings continue to accrue at the same rate. Note that the California PUC has established savings targets for the IOUs' energy efficiency programs, and the state's publicly owned utilities have also filed, with the Energy Commission, energy efficiency plans containing long-term savings goals. Utility-specific targets within the projection are not explicitly accounted for, as they are assumed to be embedded within the overall statewide goal of acquiring all cost-effective energy efficiency.

Colorado: HB07-1037 (2007) requires the Colorado PUC to establish energy savings targets for the state's two electric IOUs and establishes a minimum target of 5 percent of retail sales in 2006, to be met in 2018 by measures implemented from 2006 to 2018. The savings projection for Colorado reflects statutory minimum targets for Aquila and PSCo.

Connecticut: PA 07-242 (2007) required the state's two electric distribution companies to submit a joint comprehensive resource plan to the Connecticut Energy Advisory Board (CEAB). The plan identifies two alternate energy efficiency savings targets out to 2018: a reference case, which assumes continuation of existing funding levels, and a "DSM-Focus" case, which is intended to eliminate load growth and entails substantially higher funding levels. CEAB has indicated its support for the DSM-Focus case, and the projection is therefore based on that case.

Hawaii: Under the state's current RPS law (2006), up to 50 percent of the overall target in each year may be met through energy efficiency (including CHP and heat pumps). It appears that utilities can count energy savings from energy efficiency measures implemented as far back as 1996. Hawaii's utilities are assumed to utilize energy efficiency for RPS compliance to the maximum extent allowed, starting in 2010 (the first RPS compliance year). This equates to achieving incremental annual savings of approximately 1.0 percent of retail sales per year, on average.

Idaho: The projection of energy savings reflects the energy efficiency savings proposed by the state's three IOUs (Idaho Power (2006), Avista (2007), and PacifiCorp (2007)), in their most-recent IRPs. All three IOUs have retail load in multiple states, but provide energy efficiency savings targets only for their service territory as a whole. The savings projection pro-rates their energy efficiency savings targets based on the percentage of their 2006 retail sales occurring in Idaho.

Illinois: SB1592 (2007) established annual energy savings targets for all investor-owned distribution utilities with more than 100,000 customers in Illinois, ramping up from 0.2 percent of distribution sales in 2008 to 2.0 percent in 2015 and each year thereafter. Because the state's EEPS applies to distribution sales, it effectively covers retail sales by both the IOUs and competitive retail providers. No specific assumptions were used for Illinois, beyond those described in the previous general methodology section.

Minnesota: HB436 (The Next Generation Energy Act of 2007) established a statewide electricity savings target equal to 1.5 percent of retail sales beginning in 2010. No specific assumptions were used for Minnesota, beyond those described in the previous general methodology section.

Montana: The state's "restructured" utility, NorthWestern Energy, is required to periodically file a long-term default service supply plan. The savings projection reflects the energy efficiency savings targets proposed in NorthWestern's 2007 default supply procurement plan, which reflect the utility's goal of acquiring the full achievable, cost-effective potential.

Nevada: Under the state's RPS law (2005), which applies only to the state's two IOUs and to competitive retail suppliers, load serving entities can meet up to 25 percent of their annual RPS target with energy efficiency measures installed in 2005 or later. All energy efficiency savings receive a multiplier of 1.05 for line losses, and energy savings during the peak period receive an additional multiplier of 2.0. Based on the utilities' 2006 RPS compliance filing, the net multiplier for all energy savings used for RPS compliance in 2006 was approximately 1.35, reflecting the fact that about 29 percent of the total energy savings occurred during peak period. The savings projection assumes that the utilities will use energy efficiency for RPS compliance to the maximum

extent allowed, which is consistent with their practice thus far, and a multiplier of 1.35 was used. This is equivalent to achieving annual incremental savings of approximately 0.3 percent of retail sales, on average.

New York: In 2007, Governor Eliot Spitzer and Lt. Governor David A. Paterson announced a comprehensive plan for reducing energy costs and curbing pollution in New York. Their plan included a goal to reduce electricity consumption by 15 percent from forecasted levels by the year 2015 through new energy efficiency programs in industry and government, and called out for the need to create new appliance efficiency standards and set more rigorous energy building codes. The savings projections assume annual savings targets by utility consistent with the NY Public Service Commission's 2008 Order to implement the 2007 savings goal. The savings projections extrapolate past 2015 by assuming that savings continue to accrue at the same rate as in 2015.

North Carolina: Under the state's RPS law (2007), utilities can meet a portion of their annual RPS requirement with energy efficiency savings from measures implemented in 2007 and later. For IOUs, the contribution of energy efficiency is capped at 25 percent of the total annual RPS requirement. The savings projection assumes that IOUs will use energy efficiency to the maximum extent allowed, which equates to average annual incremental savings of approximately 0.2 percent of retail sales. Unlike IOUs, municipal utilities and cooperatives have no cap on the portion of their RPS target that can be met with energy efficiency. All utilities, however, are subject to a variety of RPS set-asides (for solar, swine waste, poultry waste). In addition, cooperatives and municipal utilities are allowed to meet up to 30 percent of their RPS requirement in each year with large hydroelectric power. The projection assumes that, after all RPS set-asides are met and the large hydro allowance is fully exhausted, municipal utilities and cooperatives will meet 75 percent of their remaining RPS target with energy efficiency. This equates to average annual incremental savings of approximately 0.2 percent of retail sales (the same as for IOUs).

Oregon: The projection of energy savings reflects the energy efficiency savings proposed by the state's three IOUs; Portland General Electric (2007), PacifiCorp (2007), and Idaho Power (2006); in their most-recent IRPs. PacifiCorp and Idaho Power have retail load in multiple states, but provide energy efficiency savings targets only for their service territory as a whole. The projection therefore pro-rates their energy efficiency savings targets based on the percentage of their 2006 retail sales occurring in Oregon.

Texas: HB3693 (2007) established new energy efficiency targets for the state's investor-owned distribution utilities, requiring peak demand savings of at least 15 percent of peak load growth in 2008, and at least 20 percent of peak load growth in 2009 and each year thereafter. Because the state's EEPS applies to distribution sales, it effectively covers retail sales by both the IOUs and competitive retail providers. In order to project peak demand savings, a peak demand forecast for the state's regulated distribution utilities was developed, by prorating the statewide peak demand forecast in Elliot et al. (2007) based on the regulated distribution utilities' sales as a percentage of total statewide sales. The energy savings projections were derived from peak demand savings based on the ratio of energy-to-peak demand savings associated with energy efficiency programs implemented during 2003-2007 (Frontier Associates, 2008).

Washington: I-937, a voter initiative passed in 2006, requires all utilities with greater than 25,000 customers to "pursue all available conservation that is cost-effective, reliable, and feasible." The Northwest Power and Conservation Council (NPCC)'s 2004 conservation potential study estimated 2,800 average MW of cost-effective and achievable potential through 2025 for the four-state Pacific Northwest region, as a whole. The savings projection estimates the total achievable potential in Washington by pro-rating NPCC's estimate of achievable potential in the Pacific Northwest according to the portion of retail sales occurring in Washington. The total savings potential was annualized by assuming a steady incremental annual savings rate.

Metric 2: Current Energy Savings (kWh, kW, and therms)

Estimates of the energy currently being saved through state-level energy efficiency efforts is an important part of measuring progress. Estimates for energy savings for 2006 are provided for savings in electricity use (kWh), electricity demand (kW), and natural gas use (therms). Due to data limitations, the energy savings estimates currently only represent savings from administered energy efficiency programs and do not reflect energy savings from other state and local efforts such as building energy codes, state-level appliance standards, and local and state lead-by-example initiatives. Further, the energy savings baseline does not include the benefits from national efforts to promote energy efficiency, federal appliance standards, or the autonomous rate of improvement in efficiency across the economy.

For electricity programs, savings estimates are provided on both a cumulative (annual) and incremental (annual) basis for both electricity use and capacity. For natural gas savings only cumulative savings were available through an existing national source. Cumulative and incremental savings are defined as follows:[7]

- **Incremental energy efficiency savings:** The changes in energy use (measured in kWh) and peak load (measured in kW) caused in the current reporting year by new participants in existing efficiency programs and all participants in new efficiency programs. The savings reported here are annualized to indicate the program effects that would have occurred had these participants been initiated into the program on January 1 of that year.
- **Cumulative energy efficiency savings:** The total changes in energy use (measured in kWh and therms) and peak load (measured in kW) caused in the current reporting year by all participants in all efficiency programs. This includes new and existing participants in existing programs (those implemented prior to the current reporting year that were in place during prior reporting year), all participants in new programs (those implemented during current reporting year), and participants in programs terminated since 1992 (those effects continue even though the programs have been discontinued). Energy efficiency programs have a useful life and the net effects of these programs diminish over time. To the extent possible, the cumulative savings consider the useful life of energy efficiency measures by accounting for building demolition, equipment degradation, and program attrition. The effects of new participants in existing programs and all participants in new programs are based on their start-up dates.

In order to represent the most comprehensive data possible, three sources were used to develop the estimates of current energy savings for 2006. Regardless of source, savings are for energy efficiency programs only, excluding savings from low-income programs and other load management efforts such as demand response. The three sources and the purposes for which they were used are as follows:

- **U.S. Energy Information Administration's (EIA) Form EIA-861.** This survey collects information such as NERC region, peak load, generation, electric purchases, sales, revenues, customer counts, and demand-side management programs, green pricing and net metering programs, and distributed generation capacity for each electric utility in the U.S. The electric utility demand-side management programs section includes information about energy efficiency and load management effects and expenditures. This source was used to provide current incremental electricity capacity (kW) savings and cumulative electricity use (kWh) and capacity (kW) savings.
- **ACEEE's The 2008 Energy Efficiency State Scorecard.** For this report, ACEEE conducts a data survey process which captures multiple data sources. Their process includes both telephone surveys and gathering data from published materials, including Form EIA-861, efficiency program annual reports, state regulatory filings, program evaluations, etc. In some states energy savings are from state or third-party administered programs as well as programs administered by investor-owned and publicly-owned utilities. This source was used to provide current incremental electricity use (kWh) savings

Table E-2. 2005 Non-Baseload Output CO_2 Emission Factors by NERC Region

NERC Region Name	NERC Region Acronym	Non-Baseload CO_2 Emission Factor (tons/MWh)
Alaska Systems Coordinating Council	ASCC	0.71
Florida Reliability Coordinating Council	FRCC	0.67
Hawaiian Islands Coordinating Council	HICC	0.85
Midwest Reliability Organization	MRO	1.03
Northeast Power Coordinating Council	NPCC	0.69
Reliability First Corporation	RFC	0.94
SERC Reliability Corporation	SERC	0.86
Texas Regional Entity	TRE	0.56
Southwest Power Pool	SPP	0.78
Western Electricity Coordinating Council	WECC	0.61

Source: Data derived from eGRID2007 Version 1.0 Year 2005 Summary Tables.

- **CEE's 2007 report, Energy Efficiency Programs: A $3.7 Billion U.S. and Canadian Industry (Nevius et al., 2008).**[8] This report includes results from CEE surveys. These surveys collect natural gas and electric savings from energy efficiency programs run by CEE members. This source was used to provide current cumulative natural gas use (therms) savings from natural gas efficiency programs. CEE's estimated gas savings for 2006 are from measures installed in 2006, as well as from measures installed as early as 1992 that were still generating savings as of 2006. Compared to the well-established electric programs, gas programs are still in their infancy. Since very few gas programs existed as early as 1992, these programs have had much less time to become established and accumulate savings than electric programs.

Use of these three sources introduces some inconsistencies in terms of the breadth of the programs captured for the different energy savings estimates. For example, Form EIA-861 only captures energy savings from programs run by electric utilities where ACEEE references additional sources to capture state and third-party administered programs. These inconsistencies will be addressed in future efforts.

Metric 3: Current Avoided Emissions of Carbon Dioxide (tons)

Reductions in emissions of carbon dioxide were calculated by applying carbon dioxide emission factors to the energy savings estimates developed under metric two. Carbon dioxide emission factors for electricity use are available from U.S. EPA's Emissions and Generation Resource Integrated Database (eGRID).[9] The emission factors used represent annual, non-baseload electricity generation from eGrid2007 Version 1.0, based on 2005 data. The estimates for avoided carbon emissions were calculated as follows:

- Applying the 2005 state-level eGRID factors to the state-level estimate of incremental electricity use (kWh) savings for 2006 from ACEEE.
- Applying the 2005 eGRID factors at the level of electricity grid regional as determined by the North American Electric Reliability Corporation (NERC)[10] to NERC region estimates of cumulative savings of electricity for 2006. These NERC regional emission factors are provided in Table E-2.

- Applying a national emission factor of 0.0585 tons per MMBtu to cumulative national savings from natural gas energy efficiency programs for 2006.[11]

Metric 4: Current Funding for Energy Efficiency Programs.

Estimates of the current funding for energy efficiency programs is provided for both actual spending in 2006 and 2007 estimated budgets for energy efficiency programs in the United States. These estimates only reflect the funding for administered electricity and natural gas efficiency programs. Similar to energy savings, funding values do not reflect energy savings from other state and local efforts such as building energy codes, state-level appliance standards, and local and state lead-by-example initiatives. Further, current funding does not include the benefits from national efforts to promote energy efficiency, federal appliance standards, or the autonomous rate of improvement in efficiency across the economy.

The source for national efficiency spending differs from the source for the national budget estimate. Similar to the approach to energy savings, funding for low-income programs and other load management efforts such as demand response was not included in these estimates. Both sources capture programs funded by utility ratepayers and system benefit charges. The two sources, the purposes for which they were used, and data they represent are as follows:

- ACEEE's *The 2008 Energy Efficiency State Scorecard* was used to provide actual spending on natural gas and electricity efficiency programs during 2006. For this report, ACEEE conducts a data survey process which captures multiple data sources. Their process includes both telephone surveys and gathering data from published materials, including Form EIA-861, efficiency program annual reports, state regulatory filings, program evaluations, etc. For 2006, ACEEE reports electricity efficiency program spending from 46 states and natural gas program funding from 19 states.
- CEE's *Energy Efficiency Programs: A $3.7 Billion U.S. and Canadian Industry* report was used to provide expected 2007 budgets, as developed in 2006, for both natural gas and electricity natural gas programs. The CEE surveys both members and non-members to aggregate budget estimates. Budget data typically represents authorized amounts approved by a regulatory commission and are not always identical to actual program costs and expenditures in a specific year. Efficiency program administrators track and report budgets using different time periods (i.e. calendar or fiscal years) creating inconsistencies when aggregating the budget survey results. From their 2006 survey, CEE reports 2007 electricity efficiency program budget estimates from 35 states[12] and 2007 natural gas program budget estimates from 20 states.

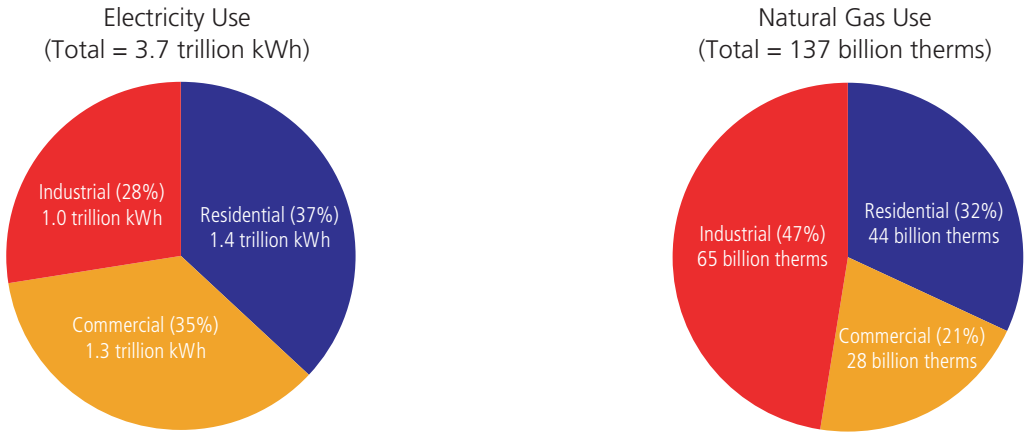
Even though both sources for funding values capture a similar universe of administered energy efficiency program types, actual spending values can not be compared directly to estimated budget values for the same program year. Differences exist between the survey instruments used, states and program administrators reflected in reported values, and time periods addressed by respondents for reported spending.

Metric 5: Current Energy Consumption Across the Building and Industrial Sectors (kWh, therms)

The current energy consumed across each of the key sectors, residential, commercial, and industrial, is also being tracked individually and in total for electricity and natural gas. Sources for this information include:

- Form EIA-861 "Annual Electric Power Industry Report" was used to provide total electricity consumption based on total 2006 retail sales to all customers by sector.
- Form EIA-176 "Annual Report of Natural and Supplemental Gas Supply and Disposition" was used to provide total consumption for natural gas based on

Figure E-1. 2006 U.S. Building and Industrial Energy Use



Sources: Data from Forms EIA-861 and EIA-176.

2006 volumes delivered to residential, commercial and industrial consumers.

The total building and industrial energy consumption for 2006 equals 3.7 trillion kWh of electricity and 137 billion therms of natural gas. Figure E-1 provides a sectoral breakdown of current energy consumption across the building and industrial sectors.

Additional Work

Additional work to improve the measurement of progress under the Action Plan will proceed in two areas:

- Outlining and advancing options for improving the comprehensiveness, consistency, and accuracy of the data used in the approaches outlined above.
- Exploring the development of additional metrics that could not be advanced at this point.

Each of these work areas is described further below.

Improving Data for Existing Metrics

Work will be undertaken to improve the comprehensiveness, consistency, and accuracy of the data used to measure progress under the Vision. Immediate focus will be given to better understanding the key limitations of the data and potential options to address them. Several limitations of the existing data underlying these metrics are discussed throughout Appendix E, with key issues highlighted below:

- Differences exist in data reported for the same programs on energy efficiency surveys and state-level program filings.
- Evaluation methodologies and assumptions used to quantify savings in program filings vary across the country.
- Respondents interpret existing surveys differently, including some of the key definitions such as customer class, program type, program period, and other categories. Further, differences in interpretations of definitions may exist across survey data and program filings for the same programs, especially if completed by different staff within the same organization.
- Existing data is more comprehensive on electricity efficiency efforts than natural gas. Fewer surveys and sources are available on natural gas savings and funding, while fewer program administrators have responded in the past to those natural gas surveys that do exist.

- Work to project energy savings from existing energy savings goals and targets is in its infancy and does not yet capture savings targets from all states with integrated resources plans. Nor does it represent expected savings in electricity capacity and natural gas use.

Exploring New Metrics

The Action Plan Leadership Group will continue to explore additional metrics that may be useful in measuring progress towards all cost-effective energy efficiency. Two metrics that could not be advanced at this point, but were considered by the Work Group, include the cost-effectiveness of energy efficiency program delivery and energy productivity. More information on these two potential metrics and next steps follows:

- **Cost-effectiveness of energy efficiency program delivery.** The efficiency programs represented in the estimates for current energy savings and current program funding were pursued because they were determined to be cost-effective at the state level using state level cost and benefit information. It is not clear that a national estimate of the cost-effectiveness of energy efficiency programs is a useful addition to these state level analyses, given important differences in economic factors such as energy costs across the country. Further, different approaches and assumptions are currently used at the state level for estimating costs and benefits savings which also raises questions as to the meaning of a national estimate. This area will continue to be explored to determine if a national level metric is possible or useful for future Vision measuring progress updates.
- **Energy Productivity ($GDP/MMBtu).** The energy productivity metric was proposed to provide an important long-term perspective for measuring progress under the Vision. Changes in energy productivity may reflect a broader set of energy efficiency actions. Such broader efforts include energy codes, appliance standards, state lead-by-example programs, national energy efficiency efforts, customer-side energy efficiency investments, and market transformation effects. Given the complexity and variety of existing approaches to this metric, the Action Plan Leadership Group is currently scoping out future work that would assist in understanding how such a metric could be used appropriately to measure progress under the Vision.

Notes

1. The initial national values for avoided emissions of carbon dioxide assume 2005 emission factors to 2006 energy use savings. Projected energy savings captures goals and targets in place by the end of 2007.
2. The 14 states for which projections where developed for the energy savings from their long-term electricity goals are consistent with the states identified as having established savings goals and/or targets under implementation goal 1, See Appendix D for the methodology for measuring progress at the state level for each of the 10 implementation goals.
3. Virginia is not included in the savings projects since the 2007 Virginia legislation that set a 10 percent energy savings target for electric utilities in 2022 is not yet binding. Virginia may be added to energy projections in the future as the details for implementing this legislation are worked out.
4. In Pennsylvania, energy efficiency qualifies as a resource under Tier 2 of its Alternative Resource Portfolio Standard, along with large hydroelectric power, clean coal, municipal solid waste, and various other generation resources. LBNL estimates sufficient large hydroelectric generation exists to fully meet Pennsylvania's Tier 2 standard for the indefinite future. Pennsylvania therefore is excluded from the savings projections since the portfolio standard will not have any significant impact on energy efficiency savings.
5. Due to the scope of the source study used, a comprehensive review of utility resource plans is not included in the baseline. Further, some states with long-term resource planning requirements are captured in Metric 1 through their other energy efficiency savings goals.
6. LBNL is currently engaged in an analysis of future energy efficiency savings expected to be achieved as a result of EEPS and RPS policies enacted in the U.S. Publication of this work is expected in early 2009. Some of LBNL's existing work on projecting energy efficiency savings from goals and targets is captured in their Reading the Tea Leaves: How Utilities in the West Are Managing Carbon Regulatory Risk in their Resource Plans, prepared at the request of the Western Interstate Energy Board (http://eetd.lbl.gov/ea/emp/rplan-pubs.html).
7. Definitions for cumulative and incremental savings are based on Form EIA-861.

8. The Consortium for Energy Efficiency (CEE) is a consortium of energy efficiency program administrators in the U.S. and Canada. Only CEE information for the United States is captured in the Vision baseline values for national benefits.

9. eGRID is a comprehensive inventory of environmental attributes of all U.S. electricity generating plants that provide power to the electric grid and report data to the U.S. government. eGRID contains air emissions data for nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon dioxide (CO_2), mercury (Hg), and new this year, methane (CH_4) and nitrous oxide (N_2O). For more on eGRID, visit is available at <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>.

10. A map of NERC regions is available at on the eGRID2007 Version 1.0 Year 2005 Summary Tables at <http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2007V1_0_year05_SummaryTables.pdf>.

11. The national emission factor for natural gas is based on the natural gas carbon content coefficient in the U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006 (EPA, 2008).

12. In addition to state-level electricity efficiency program budgets, CEE also reports estimated budgets for the Bonneville Power Administration and Northwest Energy Efficiency Alliance.

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