U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2008 WEATHERIZATION AND INTERGOVERNMENTAL PROGRAM (WIP) MARKET REPORT

JULY 2009

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Acronyms

ACEEE – American Council for an Energy-Efficient Economy
AIPC – the All-Indian Pueblo Council
ATNI – the Affiliated Tribes on NW Indians (Pacific NW Tribes)
ARRA – American Recovery and Reinvestment Act of 2009
BIA – Bureau of Indian Affairs
DOE – U.S. Department of Energy
DSIRE – Database for Energy Efficiency and Renewable Energy Incentives
DSM – demand-side management
EE – energy efficiency
EECBG – Energy Efficiency and Conservation Block Grants
EERE – DOE Office of Energy Efficiency and Renewable Energy
EIA – Energy Information Administration
FY – fiscal year for the U.S. government (October 1-September 30)
HUD – U.S. Department of Housing and Urban Development
HVAC – heating, ventilation, and cooling system
INL – Idaho National Laboratory
IREC – Interstate Renewable Energy Council
ITCA – the Inter-Tribal Council of Arizona
IRS – Internal Revenue Service
kW – kilowatt
kWh – kilowatt hour
LEED – Leadership in Energy and Environmental Design
LIHEAP – Low Income Home Energy Assistance Program
MAST – Midwest Alliance of Sovereign Tribes
MBtu – million British thermal units
MWh – megawatt hour
NASCSP – National Association for State Community Services Programs
NREL – National Renewable Energy Laboratory
ORNL – Oak Ridge National Laboratory
PBC – public benefits charge (aka societal benefits charge)
PY – program year (April 1- March 31)
RE – renewable energy
RECS – DOE/EIA residential energy consumption survey
REPI – renewable energy production incentive
RPS – renewable portfolio standard
SCTCA – the Southern California Tribal Chairman's Association
SEP – State Energy Program (within the Weatherization and Intergovernmental Program/WIP)
SIP – state implementation plan
TAP – Technical Assistance Project (part of SEP)
TEP – Tribal Energy Program (part of WIP)
TWh – terawatt hour
USGS – United States Geological Survey
WAP – Weatherization Assistance Program (part of WIP)
WIP – Weatherization and Intergovernmental Program

Executive Summary

Background

The **American Recovery and Reinvestment Act of 2009 (ARRA)** appropriated resources to sustain and expand markets for energy efficiency (EE) and renewable energy (RE). Signed into law by President Obama on February 17, 2009, the measure includes $16.8 billion in funding for the **Office of Energy Efficiency and Renewable Energy (EERE)** in the Department of Energy (DOE). These resources are nearly an order of magnitude greater than the EERE appropriation for fiscal year 2008, which was $1.7 billion.

Within EERE, the **Weatherization and Intergovernmental Program (WIP)** will administer the majority of the ARRA dollars. The **Weatherization Assistance Program (WAP)**, an existing WIP effort that assists in increasing the heating and cooling efficiency of residential housing, is slated to receive expanded funding totaling $5 billion. Through another proven vehicle, the **State Energy Program (SEP)**, WIP will distribute $3.1 billion in support of stricter building energy codes and utility incentives for energy efficiency. WIP will also manage the newly designed **Energy Efficiency and Conservation Block Grants (EECBG)**, providing $3.2 billion in funding to facilitate a range of local and state energy-saving activities, including renewable power installations, energy audits, and strategic energy planning.

In addition to direct appropriations for WIP under ARRA, EERE has received $1.2 billion in discretionary project funding that could also impact WIP program markets.

WIP's program markets are situated along the development continuum, and while some are clearly incipient, the majority of the markets are more advanced and to some extent commercialized. The relative maturity of these markets will enable WIP to make a rapid contribution to the economic recovery, in particular through job creation. But WIP's strategic deployment of the ARRA funds will also have more enduring consequences. By developing knowledge, relationships, and capital infrastructure, WIP can positively impact long-term supply and demand within the overall RE and EE marketplace, thereby benefitting the nation for decades to come.

Working across technologies and jurisdictions, WIP seeks to optimize the development of clean energy resources by coordinating financial investments, knowledge, and stakeholder inputs.[1] WIP contributes funding and technical assistance to partners in state and territory governments, local governments, low-income households, Indian tribes, municipal utilities, and international agencies. Excluding international efforts, which are not analyzed in this report, WIP impacts the market for efficiency through the following programs:[2]

- **State Energy Program (SEP)**—provides grants to states to help them carry out their EE and RE programs. Of note, SEP funds the Clean Energy and Air Quality

[1] For more detailed descriptions, follow links on the WIP program Web page; URL: http://apps1.eere.energy.gov/wip/program_areas.cfm

[2] WIP also administers the International Renewable Energy Program (IREP). IREP supports technology transfer for sustainable development and trade in connection with the U.N. Framework Convention on Climate Change and related activities directed by Congress, which typically are not research and development.

Integration Initiative and the Technical Assistance Project (TAP) for State and Local Officials.

- **Energy Efficiency and Conservation Block Grants (EECBG)**—provide states, local governments, Indian tribes, and U.S. territories with grant funds to improve energy efficiency and install renewable energy systems.
- **Tribal Energy Program (TEP)**—offers financial and technical assistance to Indian tribes to help them create sustainable renewable energy installations on their lands.
- **Weatherization Assistance Program (WAP)**—helps low-income households reduce their energy bills by permanently increasing the energy efficiency of their homes. DOE provides funding to states, which manage the day-to-day details of the program. Low-income families receive services from a network of about 970 local weatherization service providers.
- **Renewable Energy Production Incentive (REPI)**—provides financial incentives for renewable energy electricity produced and sold by qualified renewable energy generation facilities.

Structure of this Report

WIP integrates local needs and interests in order to promote markets for energy efficiency and renewable energy. Its activities are integrative across disparate technologies and market boundaries. In order to analyze the historical performance and forward-looking potential of this broad program, this report assesses market developments and outlooks at the following aggregated levels:

- States,
- Cities and Communities,
- Indian Tribes, and
- Low-Income Residential Efficiency.

The analytical goals of the report are to:

- identify market drivers for EE and RE, paying attention to subsidies, taxes, targets and mandates, environmental policy, energy security, and economic development;
- assess efficacy of existing policies;
- discuss challenges and barriers;
- evaluate high-impact measures for overcoming challenges and barriers; and
- forecast future market trends.

States—States are progressing toward their clean energy potential at markedly different rates. The most successful states are combining innovative programmatic approaches with federal, state, and/or ratepayer funding. To date, WIP involvement has focused on funding clean energy projects through SEP and providing technical assistance through TAP.

As the market drivers for clean energy react to the economic downturn, state governments are likely to focus on technologies and behaviors that create the most jobs. Dovetailing with this economic need, the Energy Efficiency and Conservation Block Grants will enable states to rapidly—and flexibly—stimulate employment while pursuing EE and RE strategies. Continued technical support, including research to understand best practices and additional funding for clean energy planning, will also be a critical market determinant.

Cities and Communities—At the locality level, no comprehensive dataset of energy use exists. Various national organizations (e.g., National Association of Counties, ICLEI: Local Communities for Sustainability, U.S. Conference of Mayors) leverage the power of their members to sustain and expand markets. Historically, WIP's primary role in cities and communities has been to offer technical assistance through TAP, implemented at the DOE regional offices and through the National Renewable Energy Laboratory (NREL). Under ARRA, which will direct the lion's share of block grant funding to localities, WIP will have an enhanced ability to stimulate clean energy programs in this market.

Tribes—Energy demand data specific to the 1.5 percent of the U.S. population that lives on tribal lands are not available, at least not in a central location. On the resource side, while studies of solar, wind, and biomass potential on tribal land have been completed, "potential" for other renewable resources has not been assessed. To date, WIP's Tribal Energy Program (TEP) has focused on 91 energy projects to develop an EE and RE pipeline. These projects include strategic planning, feasibility studies, project engineering, and construction and operation. Operating in the market is complicated by the high proportion of low-income households, as well as by the complex task of liaising with the governance entities of more than 500 independent tribes. In addition to continuing the project development pipeline (including project financing) on tribal lands, other opportunities for effecting change in this market include better cataloging of data on energy use and EE/RE-potential, intensive workforce development, and expanded involvement in project planning, building, and, in certain cases, operation.

Low-Income Residential Efficiency—Efficiency data for low-income household (defined by the LIHEAP program as at or below 200 percent of the poverty income guidelines) are collected by the WIP program and by the Energy Information Administration (EIA), which conducts the Residential Energy Consumption Survey (RECS). Low-income household energy use varies primarily by region and climate and follows the patterns set by the larger household market, with space conditioning being the primary energy use. The WIP Weatherization Assistance Program funds the weatherization of low-income homes through a network of 900 local community agencies and organizations. Recent annual funding for low-income EE programs has come from various federal, state, and utility resources and totaled approximately $660 million, according to the FY 2007 survey by the National Association for State Community Services Programs (NASCSP). This level will be vastly expanded as a result of FY 2009 federal regular appropriations, as well as funding under ARRA. The primary opportunities for program expansion include increased infrastructure for distribution of the funding, as well as increased workforce development programs to train local personnel for audits, quality control, and installation and production.

Forecast

WIP investments are expected to bolster EE and RE supply and demand by growing the trained manufacturing and installation workforce, and improving the cost profile and social acceptance of energy efficiency and renewable energy technologies, respectively.

Secular trends should amplify the aforementioned developments. Three of these trends deserve to be highlighted:

- Electricity price increases and increasing price volatility are proven drivers of EE and RE in WIP markets, primarily because low income participants (weatherization market's primary target) and constituents (state policymakers' target) are critically impacted.
- Global interest in reducing carbon emissions will likely also drive the market for EE and RE in relevant markets. Even in the absence of international agreements, local climate action plans (see Cities and Communities section of this report) can be expected to shape market conditions.
- Finally, although energy security concerns are currently overshadowed by economic worries, strategic imperatives are projected to bear heavily on future EE and RE policy determinations.

1 States

1.1 Historical and Current Market and Performance Data

The data used in this section are drawn from the most comprehensive sources available at the time of printing. The EIA catalogues state energy use by sector and end use, and utility scale renewable energy generation by resource. State policies are tracked by the DOE-funded Database for Energy Efficiency and Renewable Energy Incentives (DSIRE) and evaluated with EERE funding by the American Council for an Energy Efficient Economy (ACEEE) and NREL. State investments in EE improvements and RE generation are tracked by the ACEEE and NREL, respectively.

Renewable resource availability is an interdependent function of natural endowments, technology, and cost. Natural endowments vary primarily by geography, whereas technology and cost are chiefly determined by "social" variables, including overall wealth, education levels, financing and ownership structures, and stakeholder buy-in.

Public policy can critically influence technology and cost development. For instance, governments can subsidize research and development that the private sector deems too risky. At more advanced stages of technology development, governments can act to create markets by indirect means, such as education, or directly through strategies such as mandates (e.g., a Renewable Portfolio Standard (RPS) that compels use of certain green technologies even if they are not currently cost-effective at the margin). In emerging as well as developed markets, governments can impose standards and require certifications to reduce liability and transaction costs.[3]

1.1.1 Drivers

Typically, state policymakers are motivated by the expected impacts of increased EE and RE, rather than by deployment goals per se. Expected impacts are usually analyzed in terms of three key drivers:

- **Economic Development—**This driver applies when state policymakers and implementers have an interest in promoting new industries and job creation and in making a positive impact on state revenues. In 2008, *Pennsylvania* applied this driver when Governor Rendell announced an investment of nearly $12 million in 24 innovative, alternative and RE projects through the Pennsylvania Energy Development Authority (PEDA). It is anticipated that these projects will create at least 1,200 full- and part-time jobs and attract nearly $118 million in private investment.

- **Environmental Degradation Mitigation—**This driver applies when state policymakers and implementers have an interest in protecting and improving air quality by decreasing the release of air pollutants, including carbon and carbon equivalent greenhouse gas emissions (GHG). During the 2007 legislative session, the *Iowa* Legislature applied this driver when creating the Iowa Climate Change Advisory Council (ICCAC), consisting of

[3] For a more detailed discussion of these issues, see the EERE Web site; URL: http://apps1.eere.energy.gov/state_energy_program/feature_detail_info.cfm/start=3/fid=87

23 members appointed by the Governor.[4] ICCAC was tasked with developing policy options to reduce Iowa's greenhouse gas emissions. The ICCAC final report includes 56 different policy options to reduce Iowa's GHG emissions. *Louisiana* applies the environmental driver through the ongoing Home Energy Rebate Option Program (HERO) managed by the state's Department of Natural Resources (DNR). HERO offers a cash rebate of up to $2,000 to Louisiana homeowners who renovate their homes to meet a high level of energy efficiency. The program is included as a voluntary measure in the State Implementation Plan (SIP) submitted to EPA to reduce pollutant emissions in the state.

- **Energy Security and Fuel Diversity—**This driver applies when state policymakers and implementers pursue goals for reducing dependence on foreign fuels and increasing self-sufficiency, which in turn, may facilitate growth in local economies and stabilization of energy prices. *Hawaii's* Strategic Industries Division (SID) of the State of Hawaii's Department of Business, Economic Development and Tourism Office applies the energy security driver. Utilizing SEP funds, SID coordinates Hawaii's statutory Energy Emergency Preparedness (EEP) functions and serves as Hawaii's lead organization for management of statewide energy security, including market-related energy disruptions. Additionally, the Hawaii Clean Energy Initiative (HCEI) facilitates fuel diversity via a Bioenergy Master Plan. Homegrown biofuels are intended to assist the state's utilities, independent power producers, and end-users in meeting Renewable Fuels Standard (RFS) targets while reducing biodiesel and ethanol imports.

While most policies are influenced by all three drivers to some degree, individual states and stakeholders have unique goals and values that reflect specific economic, baseline energy, governance, and resource situations.[5] This policy diversity is evidenced below:

[4] Iowa Climate Change Advisory Council, *Final ICCAC Report* (2008); URL: http://www.iaclimatechange.us/capag.cfm

[5] E. Brown and G. Mosey, "Analytic Framework for Evaluation of State Energy Efficiency and Renewable Energy Policies with Reference to Stakeholder Drivers," NREL: Golden, CO, 2008.

Additional State-level Policy Initiatives[6]

2009

Pennsylvania has met its first milestone for producing biodiesel and that has activated a new mandate requiring every gallon of diesel fuel sold to contain at least 2 percent biodiesel within one year. The milestone—production of 40 million gallons on an annualized basis—was achieved in September 2008.

New York Governor David Paterson is calling for a clean energy plan that aims to meet 45 percent of New York State's electricity needs through improved energy efficiency and greater use of renewable energy by 2015. The state's current renewable portfolio standard is 25 percent by 2013. By meeting the new standard, Paterson said, the state could create 50,000 new jobs in the state and establish a workforce for a clean energy economy.

2008

Tennessee Governor Phil Bredesen has signed an executive order that requires all state agencies to use ENERGY STAR® products. The order is a response to recommendations made by the Governor's Task Force on Energy Policy and an effort to "walk the talk" of energy efficiency and conservation.

The **California** Air Resources Board has approved a plan that will lead the state to cut its greenhouse gas emissions to 1990 levels by 2020. The plan combines a cap-and-trade program with many other measures, most of which relate to energy efficiency and renewable energy.

The Public Utilities Commission of **Nevada** has approved a 500-kilovolt transmission line that would transmit power from solar, wind, and geothermal sources within the state to populated areas. The line would be the first link in the proposed Southwest Intertie Project that aims to enable transmission of renewable energy throughout the West.

The **Connecticut** Clean Tech Fund has been established to invest in companies that focus on conserving energy and protecting the environment. Connecticut Innovations, the state's quasi-public authority that invests in technology and innovation development, will administer the fund.

1.1.2 Energy Efficiency Performance

This section summarizes the most current data available on state energy efficiency relative to other states, normalized both by population and by gross state product. **Table 1** summarizes data on per capita energy use by sector and state in 2006, the most recently available data-year, ranked by most efficient per capita.[7]

[6] Excepted from the EERE Web site; URL: http://apps1.eere.energy.gov/state_energy_program/project_briefs_new.cfm/volume=96

[7] 2007 energy data will be available later in 2009.

Table 1. Energy Use Per Capita by State (2006)

Rank	Residential Sector		Commercial Sector		Industrial Sector		Transportation Sector		Total	
	State	000 BTU/ Cap	State	000 BTU/ Cap	State	000 BTU/ Cap	State	000 BTU/ Cap	State	000 BTU/ Cap
1	Hawaii	29	Hawaii	33	District of Columbia	6	District of Columbia	36	New York	203
2	California	43	California	44	New York	24	New York	57	Rhode Island	204
3	New Mexico	55	Vermont	50	Rhode Island	25	Rhode Island	61	Massachusetts	230
4	District of Columbia	57	Rhode Island	52	Massachusetts	31	Connecticut	74	California	233
5	New York	59	Nevada	53	Florida	32	Massachusetts	75	New Hampshire	239
6	Utah	61	New Hampshire	53	Maryland	33	Wisconsin	79	Connecticut	243
7	Arizona	64	Maine	54	Connecticut	34	Michigan	80	Arizona	248
8	New Jersey	66	Indiana	55	New Hampshire	36	New Hampshire	80	Florida	256
9	Rhode Island	66	Idaho	55	Arizona	38	Illinois	83	Maryland	259
10	Massachusetts	67	Pennsylvania	56	Vermont	49	Maryland	83	Hawaii	260
11	Colorado	67	Arizona	56	New Jersey	52	Pennsylvania	83	Vermont	264
12	Texas	68	Mississippi	56	California	54	North Carolina	84	Michigan	297
13	New Hampshire	70	Utah	56	Hawaii	56	Vermont	88	District of Columbia	300
14	Nevada	71	Oregon	57	Missouri	74	Delaware	88	Colorado	301
15	Maryland	71	Massachusetts	57	Virginia	75	Arizona	89	North Carolina	301
16	Wisconsin	72	Arkansas	57	North Carolina	77	Ohio	89	New Jersey	301
17	Oregon	73	Connecticut	58	Oregon	80	Idaho	90	Oregon	302
18	Illinois	73	Ohio	59	Colorado	82	Florida	90	Utah	304
19	Pennsylvania	74	Washington	59	Nevada	83	Colorado	91	Nevada	309
20	Florida	74	Texas	59	South Dakota	83	Oregon	92	Illinois	309
21	Iowa	74	Georgia	59	Michigan	83	California	93	Pennsylvania	317
22	Michigan	75	Kentucky	59	Utah	85	Washington	99	Washington	323
23	Delaware	75	Florida	59	Washington	88	Kansas	99	Wisconsin	327
24	Minnesota	76	South Carolina	59	Illinois	94	West Virginia	100	Missouri	328
25	Washington	77	Illinois	59	Georgia	99	Maine	100	Virginia	334

Table 1. Energy Use Per Capita by State (2006)

Rank	Residential Sector		Commercial Sector		Industrial Sector		Transportation Sector		Total	
	State	000 BTU/ Cap	State	000 BTU/ Cap	State	000 BTU/ Cap	State	000 BTU/ Cap	State	000 BTU/ Cap
26	Vermont	77	Michigan	60	Pennsylvania	105	Nebraska	100	Georgia	338
27	North Carolina	77	Alabama	60	Minnesota	109	Utah	101	Ohio	340
28	Connecticut	77	Colorado	60	Maine	112	Minnesota	102	South Dakota	345
29	Kansas	77	West Virginia	60	Wisconsin	114	Missouri	102	Maine	349
30	Ohio	77	Tennessee	62	Ohio	114	Georgia	102	Idaho	352
31	Virginia	78	Wisconsin	62	New Mexico	118	Nevada	102	New Mexico	353
32	Georgia	78	New Mexico	62	Nebraska	118	Arkansas	103	Delaware	353
33	South Dakota	79	Louisiana	62	Delaware	123	South Carolina	104	Minnesota	354
34	Mississippi	79	Iowa	63	Tennessee	126	Iowa	104	Nebraska	375
35	Indiana	80	North Carolina	63	Idaho	126	Indiana	105	Tennessee	381
36	Arkansas	80	New York	65	Kansas	135	Virginia	106	Kansas	381
37	Montana	81	Missouri	67	South Carolina	151	Tennessee	107	South Carolina	395
38	South Carolina	81	Oklahoma	67	Mississippi	154	Alabama	109	Iowa	407
39	Idaho	81	Delaware	67	Iowa	166	South Dakota	112	Arkansas	408
40	Louisiana	82	Minnesota	67	Arkansas	167	Kentucky	113	Mississippi	420
41	Kentucky	82	New Jersey	70	Oklahoma	170	New Jersey	114	Oklahoma	449
42	Wyoming	82	Kansas	70	Montana	172	New Mexico	118	Montana	454
43	Maine	82	South Dakota	71	Alabama	210	Texas	123	Indiana	455
44	Nebraska	83	Maryland	72	West Virginia	212	Oklahoma	127	West Virginia	459
45	Missouri	84	Montana	73	Indiana	215	Montana	128	Alabama	467
46	Oklahoma	85	Nebraska	74	Kentucky	215	Mississippi	130	Kentucky	469
47	Tennessee	86	Virginia	75	Texas	254	Hawaii	142	Texas	503
48	West Virginia	87	North Dakota	89	North Dakota	318	North Dakota	143	North Dakota	645
49	Alabama	87	Alaska	100	Wyoming	502	Louisiana	182	Louisiana	896
50	Alaska	91	Wyoming	115	Alaska	530	Wyoming	240	Wyoming	938
51	North Dakota	94	District of Columbia	201	Louisiana	570	Alaska	393	Alaska	1,114

Source: Consumption: EIA Table R1. http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/rank_use.html. Population: US Census 2006 Projections.

Table 2 shows energy use by sector and state per million dollars of gross state product (GSP) in 2006.

Table 2. 2006 Energy Use (000 BTU) per Gross State Product ($M2006)										
	Residential Sector		Commercial Sector		Industrial Sector		Transportation Sector		Total	
Rank	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP
1	District of Columbia	377	Hawaii	724	District of Columbia	41	District of Columbia	242	District of Columbia	1,992
2	Hawaii	629	California	909	New York	449	New York	1,065	New York	3,831
3	California	891	Delaware	960	Rhode Island	569	Delaware	1,255	Connecticut	4,142
4	Delaware	1,076	Connecticut	986	Connecticut	582	Connecticut	1,260	Massachusetts	4,411
5	New York	1,102	Nevada	1,065	Massachusetts	603	Rhode Island	1,421	Rhode Island	4,730
6	New Jersey	1,272	Massachusetts	1,096	Maryland	717	Massachusetts	1,434	California	4,833
7	Massachusetts	1,279	Rhode Island	1,205	Florida	809	Maryland	1,806	Delaware	5,045
8	Connecticut	1,314	New York	1,216	New Hampshire	840	Illinois	1,808	New Hampshire	5,584
9	Wyoming	1,408	New Hampshire	1,245	Arizona	989	New Hampshire	1,864	Maryland	5,639
10	Colorado	1,412	Colorado	1,266	New Jersey	1,009	Colorado	1,918	Hawaii	5,662
11	Alaska	1,431	Washington	1,285	California	1,115	California	1,919	New Jersey	5,809
12	Nevada	1,432	Texas	1,288	Hawaii	1,212	North Carolina	1,951	Nevada	6,230
13	New Mexico	1,479	Illinois	1,299	Vermont	1,282	Wisconsin	1,975	Colorado	6,312
14	Texas	1,479	Louisiana	1,301	Virginia	1,550	Pennsylvania	2,028	Florida	6,433
15	Rhode Island	1,535	Vermont	1,320	Nevada	1,666	Nevada	2,067	Arizona	6,449
16	Maryland	1,553	District of Columbia	1,333	Colorado	1,716	Michigan	2,134	Illinois	6,757
17	Virginia	1,604	New Jersey	1,339	Delaware	1,755	Minnesota	2,162	Virginia	6,904
18	Illinois	1,605	Pennsylvania	1,352	North Carolina	1,783	Washington	2,165	Vermont	6,928
19	Utah	1,611	Oregon	1,386	Washington	1,924	New Jersey	2,188	North Carolina	6,981
20	Minnesota	1,618	Minnesota	1,434	Oregon	1,941	Virginia	2,192	Washington	7,050
21	New Hampshire	1,635	Indiana	1,454	Missouri	1,971	Oregon	2,248	Oregon	7,364
22	Washington	1,676	Arizona	1,460	South Dakota	2,040	Ohio	2,269	Minnesota	7,526
23	Arizona	1,676	Georgia	1,460	Illinois	2,045	Florida	2,274	Pennsylvania	7,730
24	Louisiana	1,703	North Carolina	1,461	Michigan	2,233	Vermont	2,307	Michigan	7,979

Table 2. 2006 Energy Use (000 BTU) per Gross State Product ($M2006)

	Residential Sector		Commercial Sector		Industrial Sector		Transportation Sector		Total	
Rank	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP	State	000 BTU/ $M GSP
25	North Carolina	1,786	Ohio	1,486	Utah	2,252	Arizona	2,324	Utah	8,022
26	Oregon	1,789	Florida	1,489	Minnesota	2,312	Nebraska	2,346	Wisconsin	8,140
27	Wisconsin	1,791	Utah	1,489	Georgia	2,443	Kansas	2,475	Georgia	8,359
28	Pennsylvania	1,794	Iowa	1,529	Pennsylvania	2,557	Iowa	2,527	South Dakota	8,495
29	Iowa	1,802	Maine	1,536	Nebraska	2,753	Georgia	2,535	Ohio	8,620
30	Florida	1,861	Wisconsin	1,543	Wisconsin	2,831	Utah	2,670	Missouri	8,692
31	Georgia	1,921	Virginia	1,558	Ohio	2,901	Texas	2,681	Nebraska	8,757
32	Kansas	1,925	Maryland	1,562	New Mexico	3,160	Missouri	2,712	New Mexico	9,469
33	Nebraska	1,934	Alaska	1,568	Maine	3,177	Idaho	2,721	Kansas	9,498
34	South Dakota	1,946	Tennessee	1,589	Tennessee	3,244	Indiana	2,760	Tennessee	9,812
35	Ohio	1,964	Michigan	1,604	Kansas	3,361	Tennessee	2,761	Maine	9,879
36	Michigan	2,008	Idaho	1,664	Idaho	3,803	South Dakota	2,762	Iowa	9,901
37	Vermont	2,019	New Mexico	1,673	Iowa	4,042	Maine	2,836	Idaho	10,623
38	Indiana	2,114	Kentucky	1,694	South Carolina	4,472	South Carolina	3,064	Texas	10,995
39	Tennessee	2,217	Nebraska	1,723	Oklahoma	4,673	Hawaii	3,095	South Carolina	11,680
40	Missouri	2,231	Kansas	1,735	Montana	5,076	Alabama	3,141	Indiana	11,991
41	North Dakota	2,309	Alabama	1,739	Arkansas	5,168	New Mexico	3,157	Oklahoma	12,322
42	Oklahoma	2,325	South Dakota	1,746	Mississippi	5,268	Arkansas	3,188	Arkansas	12,596
43	Maine	2,328	South Carolina	1,756	Texas	5,548	West Virginia	3,219	Montana	13,412
44	Kentucky	2,354	Arkansas	1,762	Indiana	5,664	Kentucky	3,239	Kentucky	13,458
45	Montana	2,382	Missouri	1,778	Alabama	6,090	Oklahoma	3,481	Alabama	13,499
46	South Carolina	2,388	Oklahoma	1,843	Kentucky	6,173	North Dakota	3,532	Mississippi	14,372
47	Idaho	2,436	Mississippi	1,928	West Virginia	6,823	Montana	3,794	West Virginia	14,803
48	Arkansas	2,477	West Virginia	1,948	North Dakota	7,841	Louisiana	3,802	North Dakota	15,883
49	Alabama	2,530	Wyoming	1,963	Alaska	8,310	Wyoming	4,110	Wyoming	16,081
50	Mississippi	2,712	Montana	2,160	Wyoming	8,598	Mississippi	4,464	Alaska	17,476
51	West Virginia	2,813	North Dakota	2,201	Louisiana	11,910	Alaska	6,167	Louisiana	18,716

Source: Consumption: EIA Table R1. http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/rank_use.ht,ml. GSP: 2006 Bureau of Economic Analysis

1.1.3 Renewable Energy Performance

This section includes ranked tables of renewable energy electricity trends at the state level using the most recently available data (2006), as well as selected changes over the five-year period from 2001 to 2006. Renewable energy development is also divided into resources to reflect differing geographic availability of renewable resources. Most data and definitions of renewable energy are from the DOE's statistical data agency, the EIA. Distributed solar capacity data are from the Interstate Renewable Energy Council (IREC), which received funding through the DOE EERE Solar Energy Technologies Program (SETP).[8]

> **Challenges with EIA Renewable Energy Data**
>
> While widely considered to be the most comprehensive dataset, EIA data are not comprehensive, especially when it comes to RE development. Although the agency is constantly working to improve data collection, there are limitations to the dataset used in this report:
>
> - **Lack of Comprehensive Reporting from D.C. and Territories**—Initial analysis for this report included assembling data for the District of Columbia (D.C.) and five primary U.S. territories (American Samoa, Guam, Northern Marianas, Puerto Rico, and the U.S. Virgin Islands). Preliminary energy data for the territories, taken from EIA sources, were insufficient for this analysis in terms of specificity of generation and measurement. In an attempt to supplement these data, personal interviews were conducted with territory energy contacts; however, the data remain insufficient to include territories in this analysis. Refined reporting of territory data in the future could allow for the territories to be included within a state comparison.
> - **Lack of Comprehensive Distributed Resource Data—**The EIA does not collect comprehensive data on distributed solar PV, and only two states report solar resource development. This limited dataset was augmented with data on capacity for distributed PV, as collected by the Interstate Renewable Energy Council (IREC) with funding from the DOE Solar Program. Data for other distribution-energy technologies are also far from complete; these data limitations will be further explored in a later version of this report.

For the purpose of this report, renewable energy is defined as:

- **Biomass**—agricultural crops and residues; dedicated energy crops (herbaceous and tree species); forestry products and residues; residues and byproducts from food, feed, fiber, wood, and materials processing plants [sawdust from sawmills, black liquor (a byproduct of paper making), cheese whey (a byproduct of cheese-making processes), and animal manure]; post-consumer residues and wastes, such as fats, greases, oils, construction and demolition wood debris and other urban wood waste, municipal solid wastes and wastewater, and landfill gases.[9] The specific EIA definition includes landfill gas/MSW biogenic, wood, and derived fuels.[10]
- **Geothermal**—electricity produced centrally from heat in the earth.

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[8] L. Sherwood, "U.S. Solar Market Trends 2007," IREC, August 2008; URL: http://www.irecusa.org/fileadmin/user_upload/NationalOutreachPubs/IREC%20Solar%20Market%20Trends%20August%202008_2pdf

[9] A. Milbrandt, personal communication to E. Brown, September 18, 2008.

[10] U.S. Department of Energy, Energy Information Administration, "Renewable Energy Annual 2006," DOE/EIA-0603, Washington, DC, 2008; URL: http://www.eia.doe.gov/cneaf/solar.renewables/page/rea_data/rea_sum.html. Henceforth cited as EIA 2008.

- **Conventional Hydroelectric**—power from the movement of water. The EIA defines a conventional plant as one in which "all of the power is produced from natural streamflow as regulated by available storage."[11] Pumped storage is not collected and reported under this definition because the EIA considers it to use nonrenewable resources for operation.[12] Low-impact and distributed hydro, which may have a large potential for electricity production,[13] are not included as a result of data limitations.
- **Solar (central)**—electricity that is converted on a large scale from the radiant heat from the sun, such as through concentrated solar power, concentrated PV, or similar technologies.
- **Solar (distributed)**—on- and off-grid distributed solar electric non-central electricity generation resources, including residential, commercial, and industrial applications. Primary technology is photovoltaics (PV).
- **Wind—**the extraction of kinetic energy from the wind for conversion into electricity.

Table 3 displays the EIA-collected data for grid-connected renewable electricity generation for each state in 2006 in total megawatt hours (MWh). The dataset includes generation from biomass, geothermal electricity, non-distributed solar, and wind. Distributed solar data are not included. Considering all renewable resources in the dataset, Washington ranks first with nearly 72 terawatt hours (TWh).

Large-scale hydroelectric generation resources are more developed than most renewable resources and are removed from the dataset in **Table 4**. When hydroelectric resources are not included, California becomes the highest ranked with 24 TWh, and generates more than three times the renewable generation of any other state. Non-hydroelectric renewable generation in Arizona, Missouri, Alaska, and Delaware was less than 100,000 MWh in 2006.

In an effort to address the differences between states in a quantitative way, this report normalizes renewable energy generation according to three parameters: percentage of total in-state electricity generation, state population, and gross state product (GSP). Generation data are from EIA's *Annual Energy Review*.[14] Population data for the states are from the U.S. Department of Commerce Census Bureau. GSP data are compiled from the U.S. Bureau of Economic Analysis.

[11] http://www.eia.doe.gov/glossary/glossary_c.htm
[12] EIA 2008.
[13] http://hydropower.inl.gov/hydrofacts/undeveloped_potential.shtml
[14] EIA, "Annual Energy Review 2007," DOE/EIA-0384, 2008.

Table 3. Total On-Grid Renewable Electricity Generation (2006)

Rank	State	MWh	Rank	State	MWh
1	Washington	84,510,138	**29**	Colorado	2,687,435
2	California	71,937,993	**30**	Oklahoma	2,636,500
3	Oregon	39,720,153	**31**	New Hampshire	2,275,311
4	New York	29,951,143	**32**	Vermont	1,968,575
5	Idaho	11,941,587	**33**	North Dakota	1,894,063
6	Alabama	11,157,527	**34**	West Virginia	1,746,190
7	Montana	10,654,250	**35**	Wyoming	1,602,377
8	Texas	8,495,704	**36**	Mississippi	1,541,083
9	Tennessee	8,273,774	**37**	New Mexico	1,475,532
10	Maine	8,252,216	**38**	Connecticut	1,307,212
11	Arizona	6,846,471	**39**	Alaska	1,231,058
12	Georgia	6,011,830	**40**	Nebraska	1,206,647
13	North Carolina	5,673,914	**41**	Ohio	1,030,831
14	Pennsylvania	5,322,011	**42**	Illinois	1,022,125
15	Florida	4,575,897	**43**	Kansas	1,001,539
16	Michigan	3,972,381	**44**	Utah	952,280
17	Virginia	3,832,692	**45**	New Jersey	952,220
18	Louisiana	3,744,242	**46**	Hawaii	737,729
19	South Carolina	3,643,822	**47**	Indiana	709,829
20	Minnesota	3,629,208	**48**	Missouri	222,117
21	South Dakota	3,545,798	**49**	Rhode Island	154,822
22	Nevada	3,401,337	**50**	Delaware	*
23	Iowa	3,364,068	**50**	American Samoa	*
24	Arkansas	3,252,360	**50**	D.C.	*
25	Kentucky	3,051,091	**50**	Guam	*
26	Wisconsin	3,027,307	**50**	Northern Marianas	*
27	Massachusetts	2,791,473	**50**	Puerto Rico	*
28	Maryland	2,733,517	**50**	Virgin Islands	*

Source: EIA 2008
*Less than 500 kilowatt hours (kWh) total renewable electricity generation, or data unavailable

Table 4. Total Non-hydro Renewable Electricity Generation (2006)

Rank	State	MWh	Rank	State	MWh
1	California	23,890,613	29	Connecticut	763,320
2	Texas	7,833,733	30	Wyoming	759,061
3	Florida	4,372,475	31	New Hampshire	746,401
4	Maine	3,974,084	32	Idaho	699,215
5	Alabama	3,905,741	33	Maryland	629,242
6	Georgia	3,442,993	34	Hawaii	617,642
7	Minnesota	3,057,478	35	Tennessee	525,124
8	Louisiana	3,031,027	36	Montana	524,089
9	New York	2,606,488	37	Kentucky	459,390
10	Washington	2,502,509	38	Vermont	449,910
11	Virginia	2,481,498	39	Ohio	398,895
12	Pennsylvania	2,477,869	40	North Dakota	373,029
13	Iowa	2,454,720	41	Nebraska	313,261
14	Michigan	2,452,028	42	Indiana	220,314
15	Oklahoma	2,012,921	43	Utah	205,497
16	Oregon	1,869,856	44	West Virginia	173,757
17	South Carolina	1,836,874	45	South Dakota	148,965
18	North Carolina	1,834,902	46	Rhode Island	148,913
19	Arkansas	1,701,802	47	Arizona	53,567
20	Mississippi	1,541,083	48	Missouri	22,903
21	Wisconsin	1,348,709	49	Alaska	7,451
22	Nevada	1,343,711	50	Delaware	*
23	Massachusetts	1,278,828	50	American Samoa	*
24	New Mexico	1,277,321	50	D.C.	*
25	Kansas	991,890	50	Guam	*
26	New Jersey	916,784	50	Northern Marianas	*
27	Colorado	896,228	50	Puerto Rico	*
28	Illinois	848,853	50	U.S. Virgin Islands	*

Source: EIA 2008
*Less than 500 kilowatt hours (kWh) total renewable electricity generation, or data unavailable

Percentage of total in-state generation is a normalizing metric intended to reveal a state's progress toward renewable-based electricity development, regardless of population or economic output. **Table 5** presents the renewable percentages including hydroelectric resources, and **Table 6** presents percentages without hydroelectric. When hydroelectric is included, the northwestern states of Idaho, Washington, and Oregon generate at least three-quarters of in-state generation from renewable resources. Large-scale hydroelectric developments are the primary contributors to this generation. Excluding large-scale hydroelectric—in order to focus on developing markets, no state produces more than 25 percent of its electricity from renewable resources, and most states generate less than 5 percent.

Table 5. Percentage of Total State Electricity Generation: All Renewable Resources (2006)

Rank	State	% Total State Gen.		Rank	State	% Total State Gen.
1	Idaho	89.2%		29	New Mexico	4.0%
2	Washington	78.1%		30	Nebraska	3.8%
3	Oregon	74.5%		31	Connecticut	3.8%
4	South Dakota	49.7%		32	Oklahoma	3.7%
5	Maine	49.1%		33	South Carolina	3.7%
6	Montana	37.7%		34	Wyoming	3.5%
7	California	33.2%		35	Michigan	3.5%
8	Vermont	27.8%		36	Mississippi	3.3%
9	New York	21.1%		37	Kentucky	3.1%
10	Alaska	18.4%		38	Rhode Island	2.6%
11	Nevada	10.7%		39	Pennsylvania	2.4%
12	New Hampshire	10.3%		40	Utah	2.3%
13	Tennessee	8.8%		41	Kansas	2.2%
14	Alabama	7.9%		42	Texas	2.1%
15	Iowa	7.4%		43	Florida	2.0%
16	Minnesota	6.8%		44	West Virginia	1.9%
17	Arizona	6.6%		45	New Jersey	1.6%
18	Hawaii	6.4%		46	Ohio	0.7%
19	Arkansas	6.2%		47	Indiana	0.5%
20	North Dakota	6.1%		48	Illinois	0.5%
21	Massachusetts	6.1%		49	Missouri	0.2%
22	Maryland	5.6%		50	Delaware	0.0%
23	Colorado	5.3%		50	American Samoa	0.0%
24	Virginia	5.2%		50	D.C.	0.0%
25	Wisconsin	4.9%		50	Guam	0.0%
26	North Carolina	4.5%		50	Northern Marianas	0.0%
27	Georgia	4.4%		50	Puerto Rico	0.0%
28	Louisiana	4.1%		50	Virgin Islands	0.0%

Source: EIA 2008

Table 6. Percentage of Total State Electricity Generation: Non-hydroelectric Renewable Resources (2006)

Rank	State	% Total State Gen.	Rank	State	% Total State Gen.
1	Maine	23.63%	29	Montana	1.86%
2	California	11.02%	30	South Carolina	1.85%
3	Vermont	6.35%	31	New York	1.83%
4	Minnesota	5.74%	32	Colorado	1.77%
5	Iowa	5.40%	33	Wyoming	1.67%
6	Hawaii	5.34%	34	New Jersey	1.51%
7	Idaho	5.22%	35	North Carolina	1.47%
8	Nevada	4.22%	36	Maryland	1.29%
9	Oregon	3.51%	37	North Dakota	1.21%
10	New Mexico	3.43%	38	Pennsylvania	1.13%
11	Virginia	3.40%	39	Nebraska	0.99%
12	New Hampshire	3.38%	40	Tennessee	0.56%
13	Louisiana	3.33%	41	Utah	0.50%
14	Mississippi	3.33%	42	Kentucky	0.47%
15	Arkansas	3.26%	43	Illinois	0.44%
16	Oklahoma	2.85%	44	Ohio	0.26%
17	Massachusetts	2.80%	45	West Virginia	0.19%
18	Alabama	2.77%	46	Indiana	0.17%
19	Rhode Island	2.50%	47	Alaska	0.11%
20	Georgia	2.49%	48	Arizona	0.05%
21	Washington	2.31%	49	Missouri	0.02%
22	Connecticut	2.20%	50	Delaware	*
23	Wisconsin	2.19%	50	American Samoa	*
24	Kansas	2.18%	50	D.C.	*
25	Michigan	2.18%	50	Guam	*
26	South Dakota	2.09%	50	Northern Marianas	*
27	Texas	1.96%	50	Puerto Rico	*
28	Florida	1.95%	50	Virgin Islands	*

Source: EIA 2008

Normalizing for population, renewable resource use is highest in the northwestern states, with Washington, Montana, and Oregon exceeding 10 MWh of generation per person (**Table 7**). This performance is driven by large-scale hydroelectric resources. When those are excluded, Maine has the highest renewable generation per person at 3 MWh/capita, thanks in large part to wood and wood-waste generation, while the vast majority of states generate less than 1 MWh per capita (**Table 8**).

Table 7. Renewable Electricity Generation (2006): MWh/Capita

Rank	State	MWh/Capita		Rank	State	MWh/Capita
1	Washington	13.257		**29**	North Carolina	0.640
2	Montana	11.253		**30**	Hawaii	0.577
3	Oregon	10.761		**31**	Colorado	0.564
4	Idaho	8.158		**32**	Wisconsin	0.543
5	Maine	6.276		**33**	Mississippi	0.532
6	South Dakota	4.497		**34**	Virginia	0.502
7	Vermont	3.171		**35**	Maryland	0.488
8	Wyoming	3.125		**36**	Massachusetts	0.434
9	North Dakota	2.971		**37**	Pennsylvania	0.429
10	Alabama	2.431		**38**	Michigan	0.393
11	California	1.985		**39**	Connecticut	0.374
12	Alaska	1.817		**40**	Utah	0.369
13	New Hampshire	1.734		**41**	Kansas	0.363
14	New York	1.553		**42**	Texas	0.363
15	Nevada	1.365		**43**	Florida	0.253
16	Tennessee	1.362		**44**	Rhode Island	0.146
17	Arkansas	1.158		**45**	Indiana	0.113
18	Iowa	1.132		**46**	New Jersey	0.110
19	Arizona	1.110		**47**	Ohio	0.090
20	West Virginia	0.965		**48**	Illinois	0.080
21	Louisiana	0.882		**49**	Missouri	0.038
22	South Carolina	0.842		**50**	Delaware	*
23	New Mexico	0.760		**50**	American Samoa	*
24	Oklahoma	0.737		**50**	D.C.	*
25	Kentucky	0.726		**50**	Guam	*
26	Minnesota	0.704		**50**	Northern Marianas	*
27	Nebraska	0.684		**50**	Puerto Rico	*
28	Georgia	0.644		**50**	Virgin Islands	*

Source: EIA 2008

Table 8. Non-hydroelectric Renewable Electricity Generation (2006): MWh/Capita

Rank	State	MWh/Capita		Rank	State	MWh/Capita
1	Maine	3.022		29	Connecticut	0.218
2	Wyoming	1.480		30	North Carolina	0.207
3	Alabama	0.851		31	Pennsylvania	0.200
4	Iowa	0.826		32	Massachusetts	0.199
5	Vermont	0.725		33	South Dakota	0.189
6	Louisiana	0.714		34	Colorado	0.188
7	California	0.659		35	Nebraska	0.178
8	New Mexico	0.658		36	Rhode Island	0.140
9	Arkansas	0.606		37	New York	0.135
10	Minnesota	0.593		38	Maryland	0.112
11	North Dakota	0.585		39	Kentucky	0.109
12	New Hampshire	0.569		40	New Jersey	0.106
13	Oklahoma	0.563		41	West Virginia	0.096
14	Montana	0.554		42	Tennessee	0.086
15	Nevada	0.539		43	Utah	0.080
16	Mississippi	0.532		44	Illinois	0.066
17	Oregon	0.507		45	Indiana	0.035
18	Hawaii	0.483		46	Ohio	0.035
19	Idaho	0.478		47	Alaska	0.011
20	South Carolina	0.424		48	Arizona	0.009
21	Washington	0.393		49	Missouri	0.004
22	Georgia	0.369		50	Delaware	*
23	Kansas	0.360		50	American Samoa	*
24	Texas	0.335		50	D.C.	*
25	Virginia	0.325		50	Guam	*
26	Michigan	0.243		50	Northern Marianas	*
27	Florida	0.242		50	Puerto Rico	*
28	Wisconsin	0.242		50	Virgin Islands	*

Source: EIA 2008

Normalizing for economic context provides further insights into renewable electricity generation. **Tables 9** and **10** normalize generation using gross state product (GSP), a traditional measure of state economic output. Ceteris paribus, states with relatively small economic output are advantaged by this approach. To rank higher, more economically productive states would need to generate a larger amount of renewable-based electricity.

Table 9. Renewable Generation per Gross State Product (MWh/$M, 2006 GSP)

Rank	State	MWH/$M	Rank	State	MWH/$M
1	Montana	329.63	29	North Carolina	15.15
2	Washington	287.91	30	Minnesota	14.84
3	Oregon	262.52	31	Wisconsin	13.32
4	Idaho	239.28	32	Hawaii	12.65
5	Maine	175.68	33	Colorado	11.66
6	South Dakota	109.68	34	Maryland	10.60
7	Vermont	81.30	35	Pennsylvania	10.43
8	North Dakota	71.79	36	Michigan	10.43
9	Alabama	69.49	37	Virginia	10.38
10	Wyoming	54.21	38	Utah	9.74
11	California	41.65	39	Kansas	8.97
12	New Hampshire	40.43	40	Massachusetts	8.27
13	Arkansas	35.41	41	Texas	7.97
14	Tennessee	34.76	42	Florida	6.41
15	West Virginia	31.37	43	Connecticut	6.40
16	Alaska	29.95	44	Rhode Island	3.39
17	Arizona	29.45	45	Indiana	2.85
18	New York	29.31	46	Ohio	2.23
19	Nevada	28.73	47	New Jersey	2.10
20	Iowa	27.14	48	Illinois	1.73
21	South Carolina	24.42	49	Missouri	0.98
22	Kentucky	20.90	50	Delaware	0.00
23	Oklahoma	19.58	51	American Samoa	0.00
24	New Mexico	19.44	51	D.C.	0.00
25	Louisiana	19.39	51	Guam	0.00
26	Mississippi	18.30	51	Northern Marianas	0.00
27	Nebraska	15.94	51	Puerto Rico	0.00
28	Georgia	15.84	51	Virgin Islands	0.00

Source: EIA 2008

Table 10. Non-hydroelectric Renewable Generation per Gross State Product (MWh/$M, 2006 GSP)

Rank	State	MWH/$M	Rank	State	MWH/$M
1	Maine	84.60	29	North Carolina	4.90
2	Wyoming	25.68	30	Pennsylvania	4.86
3	Alabama	24.32	31	South Dakota	4.61
4	Iowa	19.80	32	Nebraska	4.14
5	Vermont	18.58	33	Colorado	3.89
6	Arkansas	18.53	34	Massachusetts	3.79
7	Mississippi	18.30	35	Connecticut	3.74
8	New Mexico	16.83	36	Rhode Island	3.26
9	Montana	16.21	37	Kentucky	3.15
10	Louisiana	15.69	38	West Virginia	3.12
11	Oklahoma	14.95	39	New York	2.55
12	North Dakota	14.14	40	Maryland	2.44
13	Idaho	14.01	41	Tennessee	2.21
14	California	13.83	42	Utah	2.10
15	New Hampshire	13.26	43	New Jersey	2.02
16	Minnesota	12.50	44	Illinois	1.44
17	Oregon	12.36	45	Indiana	0.89
18	South Carolina	12.31	46	Ohio	0.86
19	Nevada	11.35	47	Arizona	0.23
20	Hawaii	10.59	48	Alaska	0.18
21	Georgia	9.07	49	Missouri	0.10
22	Kansas	8.88	50	Delaware	*
23	Washington	8.53	51	American Samoa	*
24	Texas	7.35	51	D.C.	*
25	Virginia	6.72	51	Guam	*
26	Michigan	6.44	51	Northern Marianas	*
27	Florida	6.13	51	Puerto Rico	*
28	Wisconsin	5.94	51	Virgin Islands	*

Source: EIA 2008

Resource availability is critically important to the economically feasible development of renewable resources because transporting resources can be a major expense. While fossil fuels are routinely transported from resource-rich locations to areas of high electricity demand before conversion to electricity, moving resources for renewable electricity generation is usually not an option (e.g., hydro, wind, solar) or not economical over long distances (e.g., biomass). Past and present subsidies also affect state-by-state performance. Subsidies are not necessarily driven by resource availability, sometimes leading to the development of suboptimal resources within the jurisdiction of the subsidy.

While the impact of hydroelectric generation on state rankings underscores the importance of understanding local and regional conditions, the data presented above do not systematically control for resource or subsidy availability.

Separating RE data by technology can reveal key technology trends, for instance rapid growth in wind energy development has driven total renewable energy growth during the past five years. By capturing resource preference, these data speak—albeit, in mediated fashion—to issues of resource and subsidy availability.

The following tables present rate-of-change data for generation by state and individual resource, with the exception of solar due to the insufficiency of data.[15] For each resource, this section includes a ranking for 2006 generation in MWh, as well as "most improved" 2001-2006 tables for:

- Total Generation
- Percentage of Total In-State Generation
- Generation per Capita
- Generation per Gross State Product.

This "most improved" ranking system intends to identify states that excel at in-state resource development, even if those accomplishments are overlooked when mixed in with all states and all resources.

Biomass

Overall biomass generation in 2006 is listed in **Table 11.** California generated the most biomass-based electricity in 2006, followed by 18 other states that produced more than 1 million MWh from biomass-based electricity. Eight states and all of the territories either did not report generation or reported none. Recent developments of biomass-based electricity, as shown in the following 2001-2006 data tables, occur in the central and southern United States, where there is a wealth of resource.[16]

Table 12 presents state trends for improvement in total electricity generation (in MWh) from biomass, 2001 to 2006. Kentucky experienced the largest increase in total electric generation from biomass during this period, followed by Nebraska and South Carolina. All other states with documented generation from biomass sources increased generation by less than 100 percent or demonstrated negative growth during this period. Reductions in production of bioenergy may be the result of economic or resource availability challenges, transition of resources to other uses, closure of old technology facilities, or increasingly stringent environmental regulations.

Table 13 lists states based on the rate of change of the percentage of total in-state generation from biomass sources from 2001 to 2006. Nineteen of the 44 states listed show positive improvements for this metric, with Kentucky experiencing a substantially larger increase in biomass-based electricity use than any other state.

[15] See EIA 2008.

[16] A. Milbrandt, "A Geographic Perspective on the Current Biomass Resource Availability in the United States," NREL: Golden, CO, 2005; URL: http://www.nrel.gov/docs/fy06osti/39181.pdf

In **Table 14**, states are listed based on the increase of biomass-based electricity generation per capita from 2001 to 2006. Of the 20 states that experienced an increase for this metric, Kentucky increased generation per capita at an unprecedented rate of more than 4,700 percent. Twenty-three states experienced a decrease in per capita electricity generation from biomass sources.

Table 15 lists the states based on improvement in electricity generated from biomass per GSP from 2001 to 2006. Kentucky leads the states, with six other states making positive improvements during the period.

Table 11. Biomass Generation (2006)

Rank	State	MWh	Rank	State	MWh
1	California	5,691,806	23	New Hampshire	746,402
2	Florida	4,372,476	24	Maryland	629,242
3	Maine	3,974,084	25	Illinois	594,282
4	Alabama	3,905,741	26	Idaho	529,598
5	Georgia	3,442,993	27	Tennessee	470,526
6	Louisiana	3,031,027	28	Kentucky	459,390
7	Virginia	2,481,498	29	Vermont	439,222
8	Michigan	2,449,816	30	Ohio	384,495
9	Pennsylvania	2,116,762	31	Hawaii	325,692
10	New York	1,951,116	32	Oklahoma	300,480
11	South Carolina	1,836,874	33	Indiana	220,314
12	North Carolina	1,834,902	34	Rhode Island	148,913
13	Arkansas	1,701,802	35	Iowa	136,899
14	Mississippi	1,541,083	36	Montana	88,119
15	Washington	1,464,859	37	Nebraska	52,014
16	Massachusetts	1,278,829	38	Arizona	40,433
17	Wisconsin	1,247,333	39	Colorado	30,692
18	Texas	1,163,217	40	Missouri	22,807
19	Minnesota	1,002,531	41	New Mexico	21,885
20	Oregon	938,637	42	Utah	14,889
21	New Jersey	900,793	43	Alaska	6,663
22	Connecticut	763,320	44	North Dakota	3,544
Source: EIA 2008					

Table 12. Most Improved Total Biomass Electricity Generated, 2001 2006 [17]

Rank	State	% Change
1	KY	4,709%
2	NE	211%
3	SC	101%
4	IN	69%
5	UT	54%
6	RI	44%
7	MT	35%
8	OK	30%
9	IA	22%
10	OR	19%
11	VT	19%
12	NM	17%
13	VA	16%
14	TX	15%
15	GA	14%
16	WA	14%
17	AR	13%
18	LA	10%
19	MS	8%
20	WI	5%
21	AZ	4%

Table 13. Most Improved Percentage of Total In State Electricity Generation Generated from Biomass, Change from 2001 2006 [15]

Rank	State	% Change
1	KY	4,545%
2	NE	199%
3	RI	81%
4	SC	80%
5	IN	59%
6	UT	34%
7	MS	24%
8	VA	17%
9	MT	16%
10	ME	13%
11	IA	9%
12	TX	7%
13	LA	7%
14	NM	6%
15	OK	2%
16	AR	2%
17	MD	2%
18	OR	1%
19	WI	0%
	GA	-2%
	MI	-3%

Table 14. Most Improved Biomass Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
1	KY	4,553%
2	NE	203%
3	SC	88%
4	IN	64%
5	RI	43%
6	UT	37%
7	MT	29%
8	OK	26%
9	IA	20%
10	VT	17%
11	LA	16%
12	OR	12%
13	NM	10%
14	VA	9%
15	AR	8%
16	WA	7%
17	MS	6%
18	TX	5%
19	GA	3%
20	WI	2%
	MD	-3%

Table 15. Most Improved Biomass Electricity Generation per GSP, Change from 2001 2006 [15]

Rank	State	% Change
1	KY	3,693%
2	NE	136%
3	SC	58%
4	IN	32%
5	UT	11%
6	RI	11%
	MT	-6%
	VT	-8%
	OK	-9%
	IA	-10%
	GA	-10%
	WA	-12%
	OR	-13%
	VA	-13%
	MI	-14%
	AR	-16%
	MS	-16%
	WI	-16%
	TX	-17%
	NM	-21%
	NC	-21%

[17] According to EIA data, there was no biomass generation in Alaska from 2001 through 2005, although biomass generation was reported for 2006. For this reason, Alaska is not included in the most improved rankings as the baseline year is the same as the year for which the most recent biomass generation data is available and, as a result, the states rate of change could not be measured. West Virginia generated electricity from biomass sources in 2001 but not in 2006, and, therefore, is not included in the biomass tables above.

Table 12. Most Improved Total Biomass Electricity Generated, 2001 2006 [17]

Rank	State	% Change
22	NC	3%
23	CA	2%
24	MD	1%
	ID	-1%
	MI	-2%
	ME	-3%
	AL	-7%
	OH	-11%
	FL	-13%
	IL	-18%
	PA	-20%
	NY	-25%
	MN	-26%
	HI	-29%
	NJ	-31%
	NH	-31%
	MA	-39%
	TN	-43%
	CO	-52%
	ND	-54%
	CT	-57%
	MO	-63%
	DE	*

Source: EIA 2008

Table 13. Most Improved Percentage of Total In State Electricity Generation Generated from Biomass, Change from 2001 2006 [15]

Rank	State	% Change
	NC	-3%
	CA	-7%
	VT	-8%
	AZ	-11%
	WA	-13%
	AL	-17%
	OH	-18%
	NY	-24%
	IL	-24%
	FL	-26%
	PA	-28%
	ID	-31%
	NJ	-32%
	MN	-33%
	HI	-34%
	TN	-42%
	MA	-48%
	NH	-53%
	ND	-55%
	CO	-56%
	CT	-62%
	MO	-68%
	DE	*

Source: EIA 2008

Table 14. Most Improved Biomass Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
	CA	-3%
	MI	-3%
	NC	-5%
	ME	-5%
	AL	-10%
	ID	-10%
	AZ	-11%
	OH	-11%
	IL	-20%
	PA	-21%
	FL	-22%
	NY	-25%
	MN	-29%
	HI	-32%
	NJ	-32%
	NH	-34%
	MA	-39%
	TN	-46%
	ND	-54%
	CO	-56%
	CT	-58%
	MO	-65%
	DE	*

Source: EIA 2008

Table 15. Most Improved Biomass Electricity Generation per GSP, Change from 2001 2006 [15]

Rank	State	% Change
	ME	-23%
	CA	-23%
	LA	-24%
	MD	-24%
	AZ	-26%
	OH	-28%
	ID	-29%
	AL	-31%
	IL	-34%
	PA	-36%
	FL	-40%
	NY	-40%
	MN	-43%
	NJ	-45%
	NH	-46%
	HI	-49%
	MA	-49%
	TN	-57%
	CO	-63%
	CT	-65%
	ND	-68%
	MO	-71%
	DE	*

Source: EIA 2008

1.1.3.1 Hydroelectric Generation

The EIA dataset containing hydroelectric resources is limited to conventional hydroelectric, as are these tables. Hydroelectric generation (MWh) in 2006 is shown in **Table 16.** Geographically large states and states with large resources dominate the top of the overall generation rankings. Twenty-nine states generated more than 1 million MWh from hydro resources in 2006 – the most electricity generated out of all renewable resources.

Table 16. Hydroelectric Generation (2006)

Rank	State	MWh	Rank	State	MWh
1	Washington	82,007,629	**29**	Alaska	1,223,607
2	California	48,047,380	**30**	Iowa	909,348
3	Oregon	37,850,297	**31**	Nebraska	893,386
4	New York	27,344,655	**32**	Wyoming	843,316
5	Idaho	11,242,372	**33**	Utah	746,783
6	Montana	10,130,161	**34**	Louisiana	713,215
7	Tennessee	7,748,650	**35**	Texas	661,971
8	Alabama	7,251,786	**36**	Ohio	631,936
9	Arizona	6,792,904	**37**	Oklahoma	623,579
10	Maine	4,278,132	**38**	Minnesota	571,730
11	North Carolina	3,839,012	**39**	Connecticut	543,892
12	South Dakota	3,396,833	**40**	Indiana	489,515
13	Pennsylvania	2,844,142	**41**	Florida	203,422
14	Kentucky	2,591,701	**42**	Missouri	199,214
15	Georgia	2,568,837	**43**	New Mexico	198,211
16	Maryland	2,104,275	**44**	Illinois	173,272
17	Nevada	2,057,626	**45**	Hawaii	120,087
18	South Carolina	1,806,948	**46**	New Jersey	35,436
19	Colorado	1,791,207	**47**	Kansas	9,649
20	Wisconsin	1,678,598	**48**	Rhode Island	5,909
21	West Virginia	1,572,433	**49**	Delaware	*
22	Arkansas	1,550,558	**49**	American Samoa	*
23	New Hampshire	1,528,910	**49**	D.C.	*
24	North Dakota	1,521,034	**49**	Northern Marianas	*
25	Michigan	1,520,353	**49**	Virgin Islands	*
26	Vermont	1,518,665	**49**	Mississippi	*
27	Massachusetts	1,512,645	**49**	Guam	*
28	Virginia	1,351,194	**49**	Puerto Rico	*

Source: EIA 2008

Table 17 lists states based on improvement in total hydroelectric power generation from 2001 to 2006. Northeastern states saw the most growth in hydroelectricity during this period, although the mature status of the market results in fewer large growth states.

Northeastern states may also rank high on this list because of relatively small market penetration in 2001 as compared to 2006. Northwestern state generation also increased in this time period, possibly as a result of efficiency gains in generation or expansion of facilities.

Table 18 lists states based on the rate of change of the percentage of total generation from hydroelectric sources, 2001 to 2006. Twenty-eight states reported increases in percentage of electricity generated from hydroelectric resources.

In **Table 19**, states with hydroelectric generation are listed based on the rate of change in hydroelectric generation per capita during the five years from 2001 to 2006. In general, generation increases kept pace with population growth.

Table 20 ranks states based on improvement in hydroelectric generation per GSP from 2001 to 2006. Some growth states experienced an increase in hydroelectric generation per GSP during this period at a lower rate than the increase in total generation, indicating that economic growth outstripped hydroelectric production increases during these five years.

Table 17. Most Improved Total Hydroelectric Electricity Generated, 2001 2006

Rank	State	% Change
1	MA	115.32%
2	NJ	96.86%
3	CT	89.92%
4	CA	88.11%
5	RI	88.01%
6	MD	77.80%
7	PA	72.37%
8	VT	71.75%
9	WV	65.18%
10	ME	61.74%
11	ID	55.64%
12	NH	54.34%
13	MT	53.17%
14	WA	49.83%
15	NC	47.90%
16	SC	47.45%
17	UT	46.89%
18	FL	37.71%
19	VA	33.22%

Table 18. Most Improved Percentage of Total In State Electricity Generation Generated from Hydroelectric, Change from 2001 2006

Rank	State	% Change
1	RI	136.34%
2	NJ	92.71%
3	ME	88.17%
4	MA	81.70%
5	MD	78.18%
6	CA	72.32%
7	CT	66.97%
8	PA	54.86%
9	WV	44.09%
10	NC	38.78%
11	VA	35.11%
12	VT	32.87%
13	SC	32.44%
14	MT	31.42%
15	UT	27.63%
16	NY	19.83%
17	FL	17.52%
18	WA	15.00%
19	TN	14.29%

Table 19. Most Improved Hydroelectric Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
1	MA	114.43%
2	NJ	92.98%
3	RI	87.44%
4	CT	86.34%
5	CA	79.17%
6	PA	70.77%
7	MD	70.59%
8	VT	69.39%
9	WV	64.28%
10	ME	58.04%
11	NH	47.94%
12	MT	46.59%
13	WA	40.80%
14	ID	40.44%
15	SC	38.35%
16	NC	36.79%
17	UT	30.52%
18	VA	25.38%
19	FL	24.68%

Table 20. Most Improved Hydroelectric Electricity Generation per GSP, Change from 2001 2006

Rank	State	% Change
1	MA	78.93%
2	NJ	57.68%
3	CT	53.54%
4	RI	44.73%
5	CA	41.69%
6	PA	37.38%
7	VT	33.56%
8	MD	32.86%
9	WV	28.70%
10	ME	27.84%
11	NH	21.44%
12	SC	15.91%
13	WA	15.24%
14	NC	12.80%
15	ID	11.12%
16	MT	6.49%
17	UT	5.35%
18	OH	0.50%
	DE	0.00%

Table 17. Most Improved Total Hydroelectric Electricity Generated, 2001 2006

Rank	State	% Change
20	OR	32.14%
21	OH	23.72%
22	IL	20.30%
23	CO	19.84%
24	HI	19.19%
25	NY	18.46%
26	ND	14.19%
27	TN	11.55%
28	IA	7.60%
	DE	0.00%
	Amer. Sam.	0.00%
	D.C.	0.00%
	N. Mar	0.00%
	VI	0.00%
	MS	0.00%
	GU	0.00%
	PR	0.00%
	SD	-1.02%
	GA	-1.06%
	LA	-2.60%

Table 18. Most Improved Percentage of Total In State Electricity Generation Generated from Hydroelectric, Change from 2001 2006

Rank	State	% Change
20	OH	13.23%
21	ND	12.16%
22	IL	12.06%
23	OR	11.60%
24	CO	10.80%
25	HI	9.64%
26	ID	8.68%
27	NH	5.45%
28	SD	2.71%
	DE	0.00%
	Amer. Sam.	0.00%
	D.C.	0.00%
	N. Mar.	0.00%
	VI	0.00%
	MS	0.00%
	GU	0.00%
	PR	0.00%
	MI	-3.28%
	IA	-3.82%
	WY	-5.39%

Table 19. Most Improved Hydroelectric Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
20	OR	24.30%
21	OH	22.96%
22	IL	17.85%
23	NY	17.20%
24	ND	13.99%
25	HI	13.59%
26	CO	11.48%
27	IA	6.06%
28	TN	5.67%
29	LA	2.39%
	DE	0.00%
	Amer. Sam	0.00%
	D.C.	0.00%
	N. Mar.	0.00%
	VI	0.00%
	MS	0.00%
	GU	0.00%
	PR	0.00%
	MI	-3.58%
	SD	-4.74%

Table 20. Most Improved Hydroelectric Electricity Generation per GSP, Change from 2001 2006

Rank	State	% Change
	Amer. Sam.	0.00%
	D.C.	0.00%
	N. Mar.	0.00%
	VI	0.00%
	MS	0.00%
	GU	0.00%
	PR	0.00%
	VA	-0.15%
	IL	-2.78%
	OR	-3.13%
	FL	-4.00%
	NY	-6.28%
	CO	-7.41%
	HI	-14.51%
	MI	-14.56%
	TN	-15.37%
	ND	-19.82%
	IA	-20.22%
	GA	-21.94%
	SD	-26.80%

Table 17. Most Improved Total Hydroelectric Electricity Generated, 2001 2006

Rank	State	% Change
	MI	-2.66%
	WY	-4.07%
	AK	-9.07%
	AZ	-10.90%
	AL	-13.22%
	IN	-14.22%
	NM	-16.48%
	NV	-18.14%
	WI	-18.37%
	NB	-20.53%
	MN	-31.25%
	KY	-32.78%
	AR	-39.15%
	TX	-44.85%
	KS	-62.25%
	OK	-73.40%
	MO	-81.96%

Source: EIA 2008

Table 18. Most Improved Percentage of Total In State Electricity Generation Generated from Hydroelectric, Change from 2001 2006

Rank	State	% Change
	LA	-5.84%
	AK	-8.12%
	NV	-12.96%
	GA	-15.18%
	IN	-19.43%
	WI	-22.18%
	AL	-22.80%
	AZ	-23.26%
	NE	-23.50%
	NM	-24.67%
	K	-35.08%
	MN	-37.34%
	AR	-44.96%
	TX	-48.71%
	KS	-62.89%
	OK	-79.19%
	MO	-84.35%

Table 19. Most Improved Hydroelectric Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
	WY	-7.76%
	GA	-10.81%
	AK	-15.00%
	AL	-15.62%
	IN	-16.63%
	WI	-20.77%
	NM	-21.35%
	NE	-22.58%
	AZ	-23.39%
	NE	-31.19%
	MN	-33.53%
	KY	-34.97%
	AR	-41.73%
	TX	-49.72%
	KS	-63.00%
	OK	-74.24%
	MO	-82.56%

Table 20. Most Improved Hydroelectric Electricity Generation per GSP, Change from 2001 2006

Rank	State	% Change
	LA	-32.58%
	IN	-32.74%
	WI	-34.64%
	AL	-35.86%
	AZ	-36.62%
	WY	-38.53%
	NE	-39.70%
	AK	-41.14%
	NM	-43.49%
	MN	-46.52%
	NV	-46.56%
	KY	-46.99%
	AR	-54.33%
	TX	-60.56%
	KS	-70.79%
	OK	-81.37%
	MO	-85.43%

1.1.3.2 Geothermal

Data collection on geothermal is limited to large-scale generation in this dataset; and, therefore, there is no direct geothermal data included. In 2006, the reported geothermal electricity generation occurred in four states (**Table 21).**

Table 21. Geothermal Generation (2006)

Rank	State	MWh
1	California	12,821,434
2	Nevada	1,343,711
3	Hawaii	212,276
4	Utah	190,608
Source: EIA 2008		

Table 22 lists states based on improvement in total geothermal power generation from 2001 to 2006. According to the EIA data, only four states generated electricity from geothermal resources during this period. This is not a comprehensive list of states with resources, but only of those states with reported generation. Of these states, Utah experienced the greatest increase during the period with nearly 25 percent more MWh generated in 2006 than in 2001.

Table 23 lists states based on the rate of change of the percentage of total generation from geothermal sources from 2001 to 2006. Of the four states with geothermal power generation, only Nevada and Utah made positive gains in increasing the percentage of in-state generation from geothermal sources during these five years.

In **Table 24**, the states with geothermal generation are listed based on the rate of change in geothermal generation per capita during the five years from 2001 to 2006. Of the four states with measured geothermal-based electricity generation, Utah experienced the largest increase while geothermal electricity generation per capita in Hawaii and Nevada decreased.

Table 25 ranks states based on improvement in geothermal generation per GSP from 2001 to 2006. All four states experienced a decrease in geothermal electricity generation per GSP during this period, indicating that economic growth outstripped geothermal electricity production increases during these five years.

Table 22. Most Improved Total Geothermal Electricity Generated, 2001 2006

Rank	State	% Change
1	UT	25%
2	NV	12%
3	CA	5%
4	HI	3%

Source: EIA 2008

Table 23. Most Improved Percentage of Total In State Electricity Generation Generated from Geothermal, Change from 2001 2006

Rank	State	% Change
1	NV	19%
2	UT	8%
	CA	-4%
	HI	-5%

Source: EIA 2008

Table 24. Most Improved Geothermal Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
1	UT	11%
2	CA	0%
	HI	-2%
	NV	-6%

Source: EIA 2008

Table 25. Most Improved Geothermal Electricity Generation per GSP, Change from 2001 2006

Rank	State	% Change
	UT	-10%
	CA	-21%
	HI	-26%
	NV	-27%

Source: EIA 2008

1.1.3.3 Distributed Solar

EIA does not report data on capacity from distributed solar electricity production, primarily PV. However, recent literature provides on- and off-grid capacity installation estimates by state for 2007, and these are shown in **Table 26.** [18] No comprehensive state generation information was found in a literature review, so the reader is cautioned not to compare these distributed PV numbers to other renewable resource data without applying appropriate conversions. At more than 328 MW, California leads other states in PV capacity, with nearly three times the installed capacity of the next five states combined. All but six states have less than 5 MW installed.

Table 26. Distributed Solar (On- and Off-Grid) by State (2007)

Rank	State	Capacity (MWdc)
1	California	328.8
2	New Jersey	43.6
3	Arizona	18.9
4	Nevada	18.8
5	New York	15.4
6	Colorado	14.6
7	Massachusetts	4.6
8	Hawaii	4.5
9	Texas	3.2
10	Connecticut	2.8
10	Oregon	2.8
12	Illinois	2.2
13	Florida	2.0
14	Washington	1.9
15	Wisconsin	1.4
16	Delaware	1.2
17	Ohio	1.0
18	Pennsylvania	0.9
19	Maryland	0.7
19	North Carolina	0.7
19	Vermont	0.7
22	Rhode Island	0.6
23	D.C.	0.5
23	Minnesota	0.5
23	Montana	0.5
23	New Mexico	0.5
27	Michigan	0.4
27	Tennessee	0.4
29	Maine	0.2
29	Utah	0.2
29	Virginia	0.2
32	Iowa	0.1
32	Mississippi	0.1
32	New Hampshire	0.1

[18] Sherwood, "Solar Market Trends."

1.1.3.4 Wind

Renewable electricity generation from wind has increased dramatically between 2001 and 2006 as a result of market and policy changes, as well as technology development, resource availability, and increasing volatility in traditional fossil markets. In addition to expansion of generation in states, 11 states that had no wind-based generation in 2001 developed generation by 2006. **Table 27** lists the year in which the first data are available for these states. This method allows states with new development to be acknowledged for successes in creating an environment to promote early wind development and support the paradigm shift from fossil to renewable technologies. Nevertheless, the percentage method exaggerates small absolute strides achieved in states that had minimal or even no generation capability in 2001.

Table 27. First Year of EIA-Recorded Wind Generation[19]

State	Year
Tennessee	2002
Washington	2002
West Virginia	2002
Illinois	2003
New Mexico	2003
North Dakota	2003
Oklahoma	2003
Ohio	2005
Idaho	2006
Montana	2006
New Jersey	2006
Source: EIA 2008	

To balance the impression, **Table 28** ranks overall generation from wind in 2006 by states reporting wind generation.

Three states (Idaho, Montana, and New Jersey) began reporting wind generation in 2006. The achievements of these states should not be ignored; but, because there is no base-year generation with which to compare the 2006 data, they are not listed in the "most-improved" tables. However, they are likely to be "most-improved" in newer datasets.

[19] States not listed in **Table 25** either had wind generation in or previous to 2001, or did not have wind generation in either 2001 or 2006.

Table 28. Wind Generation Reported to EIA by State (2006)

Rank	State	MWh
1	Texas	6,670,515
2	California	4,882,801
3	Iowa	2,317,821
4	Minnesota	2,054,947
5	Oklahoma	1,712,441
6	New Mexico	1,255,436
7	Washington	1,037,651
8	Kansas	991,890
9	Oregon	931,219
10	Colorado	865,536
11	Wyoming	759,061
12	New York	655,371
13	Montana	435,970
14	North Dakota	369,485
15	Pennsylvania	361,108
16	Nebraska	261,247
17	Illinois	254,571
18	West Virginia	173,757
19	Idaho	169,617
20	South Dakota	148,965
21	Wisconsin	101,376
22	Hawaii	79,674
23	Tennessee	54,598
24	New Jersey	15,991
25	Ohio	14,401
26	Vermont	10,688
27	Michigan	2,212
28	Alaska	788

Source: EIA 2008

Table 29 lists states by the rate of change in total wind generation from 2001 to2006. South Dakota and Nebraska experienced the largest increase in total generation, while Vermont and Alaska were the only two states experiencing a decrease in wind generation during this period.

Table 30 lists states based on the rate of change of the percentage of total in-state generation from wind sources, 2001 to 2006. Twenty-three states increased the portion of total in-state electricity generated by wind during the period. Of these, South Dakota showed the most improvement, with an increase of more than 170-fold.

Table 31 lists the states based on the rate of change in wind generation per capita from 2001 to 2006. Of the 23 states that increased wind generation per capita, South Dakota and Nebraska experienced substantially larger increases than all other states. Two states, Vermont and Alaska, experienced a decrease in wind generation per capita.

Table 32 lists the states based on improvement in wind generation per GSP from 2001 to 2006. Twenty-three states increased generation per capita during this period, with South Dakota experiencing the largest increase at more than 12,000 percent. Per capita wind generation in both Vermont and Alaska decreased during this period.

Table 29. Most Improved Total Wind Electricity Generated, 2001 2006[20]

Rank	State	% Change
1	SD	17,003%
2	NE	9,833%
3	HI	3,649%
4	PA	3,132%
5	NY	3,091%
6	OK	3,071%
7	KS	2,390%
8	WV	1,831%
9	CO	1,679%
10	IL	1,314%
11	TN	1,265%
12	OR	951%
13	MI	690%
14	NM	586%
15	ND	526%
16	TX	462%
17	IA	375%
18	WA	149%

Table 30. Most Improved Percentage of Total In State Electricity Generation from Wind, Change from 2001 2006

Rank	State	% Change
1	SD	17,647%
2	NE	9,462%
3	HI	3,349%
4	NY	3,128%
5	PA	2,803%
6	OK	2,623%
7	KS	2,348%
8	WV	1,850%
9	CO	1,545%
10	TN	1,297%
11	IL	1,290%
12	OR	788%
13	MI	685%
14	ND	535%
15	NM	503%
16	TX	422%
17	IA	325%
18	WA	136%

Table 31. Most Improved Wind Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
1	SD	16,360%
2	NE	9,577%
3	HI	3,473%
4	PA	3,102%
5	NY	3,057%
6	OK	3,002%
7	KS	2,341%
8	WV	1,821%
9	CO	1,555%
10	IL	1,297%
11	TN	1,204%
12	OR	889%
13	MI	683%
14	NM	561%
15	ND	522%
16	TX	412%
17	IA	368%
18	WA	137%

Table 32. Most Improved Wind Electricity Generation per GSP, Change from 2001 2006

Rank	State	% Change
1	SD	12,549%
2	NE	7,437%
3	HI	2,589%
4	PA	2,476%
5	NY	2,424%
6	OK	2,336%
7	KS	1,827%
8	WV	1,462%
9	CO	1,275%
10	IL	1,124%
11	TN	998%
12	OR	671%
13	MI	593%
14	NM	419%
15	ND	414%
16	TX	302%
17	IA	252%
18	WA	96%

[20] For states in which wind generation began after 2001, the first year in which the EIA reports wind generation in that state is used to create the baseline to determine the most-improved rankings. The baseline years for each state are listed here and in **Table 25**: baseline year 2002—TN, WA, WV; baseline year 2003—IL, NM, ND, OK; baseline year 2005—OH. The three states with wind generation beginning in 2006 (ID, MT, NJ) are not included in the most-improved rankings for wind, because their baseline year is the same as the year in which the most recent data for wind generation is available and, as a result, the respective rates of change could not be measured.

Table 29. Most Improved Total Wind Electricity Generated, 2001 2006[20]

Rank	State	% Change
19	MN	129%
20	WY	108%
21	WI	40%
22	CA	40%
23	OH	11%
	VT	-12%
	AK	-17%

Source: EIA 2008

Table 30. Most Improved Percentage of Total In State Electricity Generation from Wind, Change from 2001 2006

Rank	State	% Change
19	MN	109%
20	WY	105%
21	WI	34%
22	CA	28%
23	OH	12%
	AK	-16%
	VT	-32%

Source: EIA 2008

Table 31. Most Improved Wind Electricity Generation Per Capita, Change from 2001 2006

Rank	State	% Change
19	MN	122%
20	WY	100%
21	WI	36%
22	CA	33%
23	OH	11%
	VT	-13%
	AK	-22%

Source: EIA 2008

Table 32. Most Improved Wind Electricity Generation per GSP, Change from 2001 2006

Rank	State	% Change
19	MN	78%
20	WY	33%
21	WI	12%
22	OH	5%
23	CA	5%
	VT	-32%
	AK	-46%

Source: EIA 2008

1.1.3.5 Overall Trends in Renewable Energy

Hydroelectric resources provided the largest portion of renewable energy development in the United States in 2006. However, the share of hydroelectric is shrinking due to growth of developing renewable energy resources and maximization of the larger-scale hydroelectric resources.

Between 2001 and 2006, wind resource achieved the largest growth in renewable generation nationwide.

Growth in electricity from biomass is primarily occurring in the southeastern areas of the United States, coincident with resource availability.

Renewable energy growth during this period was generally outstripped by economic growth as measured by gross state product (GSP) and population growth.

Between 2001 and 2006,

- 24 states increased electricity generation from biomass resources;
- 23 states show increases in wind electricity production;
- 4 states increases geothermal electricity production; and
- 2 states increased large-scale solar electricity production.

In general, the EIA dataset is considered the most comprehensive source for electricity generation information in the United States, and it is the primary source for trends information in this report (with noted exceptions). There are a number of challenges in collecting renewable electricity generation at the state level, but those are not the focus here. Instead, the strength of the dataset as a nationwide comparable source regarding definitions and data collection techniques are the reasons for its use.

Solar PV data presented in this section are not from the EIA. Data are installed capacity for 2007, as collected by IREC.

Data on renewable-based electricity generation in the U.S. territories is limited. EIA data were supplemented with direct conversations with territory energy offices. Unfortunately, the authors received no additional data. .

Significant market changes between 2006 and 2008 are expected to have an impact on renewable energy generation and will be reported in later versions of this report.

"Most Improved" rankings provide information on the largest growth rates between 2001 and 2006, leading to heavier weighting of states that began the development of the particular renewable resource in that time frame. The purpose is to acknowledge the challenge of early-stage development. The analysts are considering alternative and additional methods for future reports.

1.2 Status of State Energy Efficiency and Renewable Energy Policies and Programs

This section provides an overview of the current status of EE and RE state policy implementation.

1.2.1 State Energy Efficiency Policy Status

State energy efficiency policies and programs are listed in **Table 33.** Policies in energy efficiency fall into three primary categories:

- **Regulation—**These types of policies place minimum standards throughout the state. In the case of energy efficiency in buildings, these policies include energy codes (as subsets of building codes) and minimum equipment standards. Minimum building energy codes are established by the federal government and are implemented by localities, unless the state implements a statewide program. Statewide programs ease implementation and inspection training burdens and can increase code compliance, leading to increased energy savings. To date, 34 states have implemented statewide commercial building codes at various levels, based on nationally-recognized code standard setting organizations. Of these, 3 have adopted the most stringent (ASHRAE 90.1-2007), 23 have adopted the next most stringent (2006 IECC/ASHRAE 90.1-2004), and 8 have adopted the bottom two tiers of stringency (2003 IECC/ASHRAE 90.1-2001 and 2001 IECC/ASHRAE 90.1-1999 – the federally mandated minimum).

- **Governing by Example (or Leading by Example)—**These policies, in the form of legislation as well as executive and administrative orders, take advantage of direct jurisdiction over state-owned and -operated buildings. Generally speaking, these goals or mandates are time-staged efforts to increase energy efficiency levels over time. The benefits of these programs accrue both to the government in the form of cost savings and to the public in the form of market development for energy efficient technologies, which, in turn, may lead to reduced prices through increased economies of scale.

- **Financial/Economic Incentives—**These policies further remove cost barriers to efficient technologies, which have resulted from the failure of the market to appropriately value the benefits of energy efficiency (e.g., increased comfort, reduced environmental impact). . .

Table 33. Summary of Start Years and Sector Focus within State Energy Efficiency Regulations, Led by Example Activities and Financial Incentives Relating to Buildings (January 2009)

State	Regulation			Governing by Example	Financial/Economic Incentives					
	Statewide Building Codes**		Equip Stand.		Project or product related subsidies (rebates)	Tax Incentives				Grants
	Comm.	Res.				Personal	Property	Corporate	Sales	
AL				2006					2006, R	
AK										
AS										
AZ			2008	2005		2001-2010, R				
AR	2003IECC/ ASHRAE90.1 -2001	2003 IECC		2005						
CA	ASHRAE90.1 -2007	2006 IECC	2007	2007						
CO				2005/ 2007						2008, M
CT	2003IECC/ ASHRAE90.1 -2001	2003 IECC	2007	2007						
DC		1998-2001 IECC	2008	2004						
DE	2001IECC/ ASHRAE90.1 -1999 or eq (EPCA)	1998-2001 IECC		2004						
USA			2005	2005		2006-2009, R		2005		

Table 33. Summary of Start Years and Sector Focus within State Energy Efficiency Regulations, Led by Example Activities and Financial Incentives Relating to Buildings (January 2009)

State	Regulation			Governing by Example	Financial/Economic Incentives					
	Statewide Building Codes**		Equip Stand.		Project or product related subsidies (rebates)	Tax Incentives				Grants
	Comm.	Res.				Personal	Property	Corporate	Sales	
FL	ASHRAE90.1 -2007	1998-2001 IECC		1974						
GA	2006IECC/ ASHRAE90.1 -2004	2006 IECC						2008	2008, R	
GU										
HI		Pre-1998 IECC		2008						
ID	2006IECC/ ASHRAE90.1 -2004	2006 IECC				unknown, R				
IL	2006IECC/ ASHRAE90.1 -2004			2005						
IN		Pre-1998 IECC		2008		2009-2010, R,C		2007		
IA	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2008						
KS				2007						
KY	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2005		2009-2015, R		2009	2008, I	

Table 33. Summary of Start Years and Sector Focus within State Energy Efficiency Regulations, Led by Example Activities and Financial Incentives Relating to Buildings (January 2009)

State	Regulation			Governing by Example	Financial/Economic Incentives					
	Statewide Building Codes**		Equip Stand.		Project or product related subsidies (rebates)	Tax Incentives				Grants
	Comm.	Res.				Personal	Property	Corporate	Sales	
LA	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2007	2002					
ME	2006IECC/ ASHRAE90.1 -2004			2003	unknown					
MD	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2004	1992		2001-2011, R,C	2004, R	2001		
MA	ASHRAE90.1 -2007	2006 IECC	2008	2007		1979-, R		1979		
MI	2001IECC/ ASHRAE90.1 -1999 or eq (EPCA)	2006 IECC		2007		2009-2011, R		unknown		
MN		Pre-1998 IECC		2005						
MS										
MO				1993		2008-2009, R			2009, R	
MT	2003IECC/ ASHRAE90.1 -2001	2003 IECC				unknown, R		unknown		

Table 33. Summary of Start Years and Sector Focus within State Energy Efficiency Regulations, Led by Example Activities and Financial Incentives Relating to Buildings (January 2009)

State	Regulation: Statewide Building Codes**		Regulation	Governing by Example	Financial/Economic Incentives					
	Comm.	Res.	Equip Stand.		Project or product related subsidies (rebates)	Tax Incentives: Personal	Tax Incentives: Property	Tax Incentives: Corporate	Tax Incentives: Sales	Grants
NE	2003IECC/ ASHRAE90.1 -2001	2003 IECC								
NV	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2007	2008			2007, C			
NH	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2005						
NJ	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2008	2002	Energy Star homes and appliances (expired)					
NM	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2007		2007-, R, C		2007		
NY	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2006	2001	NYSERDA new construc.*	2001-2009, C,M		2001		
NC	2006IECC/ ASHRAE90.1 -2004	2003 IECC		2007	Steam Trap Rebate		1977, R		2008, R	
ND		Pre-1998 IECC								
Nor. Mar.										

Table 33. Summary of Start Years and Sector Focus within State Energy Efficiency Regulations, Led by Example Activities and Financial Incentives Relating to Buildings (January 2009)

State	Regulation			Governing by Example	Financial/Economic Incentives					
	Statewide Building Codes**		Equip Stand.		Project or product related subsidies (rebates)	Tax Incentives				Grants
	Comm.	Res.				Personal	Property	Corporate	Sales	
OH		2003 IECC		2007			2007, A			
OK		1998-2001 IECC		2008		2005-, R,C				
OR	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2008	2008		1977-2015, R		1980		
PA	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2004						
PR										
RI	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2008	2008						
SC	2006IECC/ ASHRAE90.1 -2004	Pre-1998 IECC		2007		2009-2019, R			2 (2009), R	
SD		Pre-1998 IECC		2008						
TN		Pre-1998 IECC		2008						
TX	2003IECC/ ASHRAE90.1 -2001	1998-2001 IECC		2001					2007, R	
UT	2006IECC/ ASHRAE90.1 -2004	2006 IECC		2006						

Table 33. Summary of Start Years and Sector Focus within State Energy Efficiency Regulations, Led by Example Activities and Financial Incentives Relating to Buildings (January 2009)

State	Regulation			Governing by Example	Financial/Economic Incentives					
	Statewide Building Codes**		Equip Stand.		Project or product related subsidies (rebates)	Tax Incentives				Grants
	Comm.	Res.				Personal	Property	Corporate	Sales	
VT	2006IECC/ ASHRAE90.1 -2004	1998-2001 IECC	2008		Efficiency Vermont*				2008,R	
VI					EERE Program*					
VA	2006IECC/ ASHRAE90.1 -2004			2007			2008, A		2008, R	
WA	2006IECC/ ASHRAE90.1 -2004	2006 IECC	2008	2005						
WV	2003IECC/ ASHRAE90.1 -2001	2003 IECC							2008, R	
WI	2006IECC/ ASHRAE90.1 -2004	Pre-1998 IECC		2006	Focus on Energy*					
WY										

Source: Database of State Incentives for Renewables and Efficiency (DSIRE): Glossary Web Page: http://www.dsireusa.org/glossary/glossary.cfm?&CurrentPageID=8&ENERGY EFFICIENCY=1&RENEWABLE ENERGY=1. Accessed July 2008; and Building Codes Assistance Project. 2009. What are building codes? Webpage. URL: http://www.bcap-energy.org/node/28. Accessed February 12, 2009.
Year indicates first year of policy implementation
Letter indicates sector of application as follows:
R=residential, C=commercial, A=All, M=Manufacturing, C=Commercial, eq=equivalent
*these rebate programs apply within the state but are not state run
** Minimum code is listed. More recent codes are generally more stringent. Blank states in these columns do not implement statewide energy codes for buildings.

1.2.2 State Renewable Energy Policy Status

State policies targeting renewable energy development are summarized in **Table 34**. The quantity of renewable energy policies is not correlated with increased renewable energy generation overall. However, significant correlation is found between states with a higher proportion of market preparation policies than technology accessibility policies, indicating that removing regulatory barriers has a quantifiable effect on renewable energy resource development.[21]

Table 34. Summary of States with Renewable Energy Policies and Selected Best Practices (Including Market-Transformation Categories) as of June 2008

	Market Preparation Policies										Technology Accessibility Policies									
State	Contractor Licensing	Equipment Certification	Generation Disclosure	Interconnection	Land Access	Line Extension Analysis	Net metering	PBF w/ RE	RPS	Vol. & Man. Green Power	Corp. Tax Incentives	Grants	Loans	Pers. Tax Incent.	Prop. Tax Incent.	Rebates	RE Prod. Incent.	Sales Tax Incent.	Sum Market Preparation	Sum Technology Access.
AL										•		•	•	•					1	3
AK					•					•			•	NA				NA	2	3
Amer Sam.																			0	0
AZ	•	•		•	•	•	•		•	•	•			•	•			•	8	4
AR							•			•									2	0
CA	•		•	•	•		•	•	•	•			•	•	•	•	•		8	5
CO				•	•	•	•		•	•									6	0
CT	•						•	•	•			•	•		•	•		•	4	5
D.C.				•					•			•							2	1
DE							•	•	•	•		•				•		NA	4	3
FL	•	•		•	•		•			•	•	•		NA		•		•	6	5
GA					•					•	•			•				•	2	3
GU																			0	0
HI	•				•				•	•	•	•	•	•					4	4
ID					•					•		•	•	•	•			•	2	5
IL			•	•				•	•	•					•	•			5	2
IN					•					•					•	•			2	2
IA			•		•		•	•	•	•	•	•	•	•	•			•	6	6
KS					•								•		•				1	2
KY					•		•			•	•			•				•	3	3
LA							•			•	•		•	•	•				2	4
ME			•		•		•		•			•	•			•			4	3
MD			•	•	•		•		•		•		•	•	•	•		•	5	6

[21] Brown and Busche, "State of the States."

MA				•	•		•	•	•	•	•	•	•	•	•	•		•	6	7
MI	•									•		•			•				2	2
MN		•	•		•			•	•	•			•		•	•	•	•	6	5
MS										•			•						1	1
MO					•		•			•	•		•						3	2
MT					•		•		•	•	•		•	•	•			NA	4	5
NE					•					•			•					•	2	2
NV	•		•		•		•		•	•				NA	•	•			6	3
NH					•		•		•				•	NA				NA	3	3
NJ			•	•	•		•		•				•			•		•	5	3
NM					•	•	•		•	•	•			•				•	5	3
NY			•	•	•		•		•		•	•	•	•	•	•	•	•	5	8
NC				•	•				•	•	•		•	•	•		•		4	5
ND					•						•			•	•				1	3
N. Mar.																			0	0
OH			•		•		•	•	•	•	•	•			•			•	6	4
OK										•	•		•						1	2
OR	•		•	•	•		•	•	•	•	•	•	•	•	•	•		NA	8	7
PA				•			•		•			•	•						3	2
PR		•													•			•	1	2
RI			•		•			•	•		•			•	•			•	4	4
SC										•	•	•	•	•		•	•	•	1	7
SD										•				NA	•				1	2
TN					•					•		•	•	NA	•				2	4
TX						•			•	•	•		•	NA	•				3	4
UT	•				•					•	•			•				•	3	3
VT				•			•	•		•	•	•	•			•		•	4	5
VI					•							•				•			1	2
VA					•		•												2	0
WA			•	•	•				•	•							•	•	5	2
WV										•									1	0
WI					•			•	•	•		•			•	•			4	3
WY							•			•						•			2	1

Source: Brown and Busche, "State of the States."
Note: All policies are noted if in implementation at the state level, except for interconnection and net metering, which are only included if they meet minimum best practices as defined by the Network for New Energy Choices.[22]

[22] For full methodology for selection, see Brown and Busche, "State of the States."

1.2.3 Energy Efficiency Program Spending

State investment in EE programs is primarily done through public benefit funds and utility spending on energy efficiency programs (**Table 35**). [23]

Table 35. Summary of 2006 State Level Investment in Energy Efficiency* Ranked by Percentage of State Revenues		
State	2006 Total Spending* ($1,000)	Spending as Percent of Utility Revenues
Vermont	$15,806	2.4%
Washington	$113,288	2.2%
Oregon	$63,318	2.0%
Idaho	$20,422	1.8%
Iowa	$52,241	1.7%
Rhode Island	$17,178	1.6%
Connecticut	$69,600	1.5%
Massachusetts	$125,000	1.5%
Wisconsin	$73,285	1.3%
New Hampshire	$17,540	1.1%
Utah	$16,800	1.1%
California	$357,000	1.1%
New York	$224,897	1.1%
Minnesota	$48,109	1.0%
New Jersey	$83,177	0.9%
Montana	$8,309	0.9%
Maine	$11,000	0.8%
Nevada	$24,000	0.7%
District of Columbia	$8,500	0.7%
Hawaii	$12,900	0.6%
Florida	$67,000	0.3%
Arizona	$16,400	0.3%
Ohio	$28,757	0.2%
Colorado	$8,000	0.2%
Texas	$57,800	0.2%
Kentucky	$5,944	0.1%
Michigan	$10,000	0.1%
South Carolina	$5,882	0.1%
Georgia	$10,000	0.1%
South Dakota	$619	0.1%
Tennessee	$5,480	0.1%
North Dakota	$513	0.1%
New Mexico	$1,000	0.1%
Indiana	$3,731	0.1%
Nebraska	$866	0.1%
Missouri	$2,175	0.0%
North Carolina	$3,800	0.0%

[23] M. Eldridge et al, "ACEEE State Scorecard for Energy Efficiency," ACEEE, 2008.

Table 35. Summary of 2006 State Level Investment in Energy Efficiency* Ranked by Percentage of State Revenues		
State	2006 Total Spending* ($1,000)	Spending as Percent of Utility Revenues
Illinois	$3,222	0.0%
Pennsylvania	$3,808	0.0%
Alaska	$162	0.0%
Kansas	$336	0.0%
Mississippi	$436	0.0%
Alabama	$459	0.0%
Maryland	$90	0.0%
Virginia	$84	0.0%
Oklahoma	$16	0.0%
Arkansas	$0	0.0%
Delaware	$0	0.0%
Louisiana	$0	0.0%
West Virginia	$0	0.0%
Wyoming	$0	0.0%
Total	$1,598,950	0.5%

*Utility spending is on "ratepayer-funded energy efficiency" programs, or energy efficiency programs funded through charges included in customer utility rates or otherwise paid via some type of charge on customer bills. This includes both utility-administered programs and "public benefits" programs administered by other entities. We do not include data on separately funded low-income programs, load management programs, or energy efficiency research and development.

Source. M. Eldrige et al., "ACEEE State Scorecard."

1.2.4 Renewable Energy Program Spending

To a lesser extent, renewable energy programs are supported by public benefit funds with targeted renewable energy spending (**Table 36**).

Table 36. Estimated 2007 Renewable Energy PBF Per Capita Spending ($/Capita)

New Jersey	11.77
Vermont	10.63
California	9.13
Connecticut	6.87
Delaware	4.10
Massachusetts	3.89
Oregon	3.25
Minnesota	3.10
Rhode Island	2.07
Wisconsin	0.99
Illinois	0.43
Ohio	0.28

Source: Brown and Busche, "State of the States."

1.2.5 *Case Studies: Advanced and Innovative State Policies and Programs*

1.2.5.1 Coordinating Policy and Spending: Efficiency Vermont

Initiated in 2000 by legislative action, the charter of the Vermont Public Benefits Charge (PBC) intends to help energy users within the state save energy on money on their monthly bills by providing expertise, assistance, and incentives to overcome many of the market and non-market barriers to energy efficiency. 'Efficiency Vermont' is an independent, non-profit firm contracted by the Vermont Public Service Board to implement the PBC. Efficiency Vermont administers the state's energy efficiency program, providing technical assistance and a wide range of rebates and incentives for energy efficiency technologies. These technologies range from advanced lighting and HVAC systems to refrigeration units.

By contracting Efficiency Vermont as an independent service provider, the state of Vermont has been able to better implement its state rebate program, which is administered by the organization. With this industry-leading structure for service provision and rebate policies, Vermont has delivered impressive results on its energy efficiency goals. Since its initiation in 2000, Efficiency Vermont has helped reduce energy costs in the state of Vermont by over $31 million. In 2006 alone, Efficiency Vermont helped more than 38,000 Vermont residents with energy efficiency investments, resulting in:

- $5.7 million in annual electric, fuel and water savings;
- 56,000,000 kilowatt-hours (kWh) of annual electric savings;
- A 10,000 kilowatt (kW) reduction in summer peak and a 9,000kW reduction in winter peak capacity requirements;
- A 415,300 ton reduction in greenhouse gases over the lifetime of the installed measures; and
- A savings of three million gallons of propane, 218 million cubic feet of natural gas, 0.6 million gallons of oil and 409 million gallons of water over the lifetime of the installed measures.[24]

Moreover, according to the organization, its work to date should "save Vermonters more than 10 million gallons of propane, 1,504 million cubic feet of natural gas, 7 million gallons of oil, 2.3 billion gallons of water and 2.65 million tons of carbon dioxide over the lifetime of the installed measures."[25]

From 2000 to 2006, the energy efficiency service provider helped save more than 307 million kilowatt hours (kWh) of electricity – savings that will continue to grow over the lifetime of the efficiency investments. Vermont's summer peak load has been lowered by more than 43 MW, while the winter load has fallen by more than 51 MW since the inception of the program in 2000.[26] These savings can help increase the reliability of the existing electricity grid, relieving stress on certain areas while reducing the need for costly upgrades to existing infrastructure in areas with a growing load.

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[24] http://www.efficiencyvermont.com/pages/Common/AboutUs/
[25] Ibid.
[26] Ibid.

Services like those offered by Efficiency Vermont also help strengthen the state's economy, since the dollars saved from energy efficiency savings are more likely to be spent in state than those that would have been used to purchase the fuel that would have been consumed without the increased efficiency. Efficiency Vermont estimates that the cumulative lifetime economic value of energy efficiency investments in the state of Vermont to date totals over $313 million. Furthermore, by coordinating, streamlining, and optimizing the implementation of the multiple energy efficiency programs in the state, Efficiency Vermont provides cost-additional savings to its stakeholders.

1.2.5.2 State Feed-in Tariffs

In recent years, states are implementing feed-in-tariffs, offering a fixed payment to the investor to recoup renewable energy development costs (Figure 1). [27]

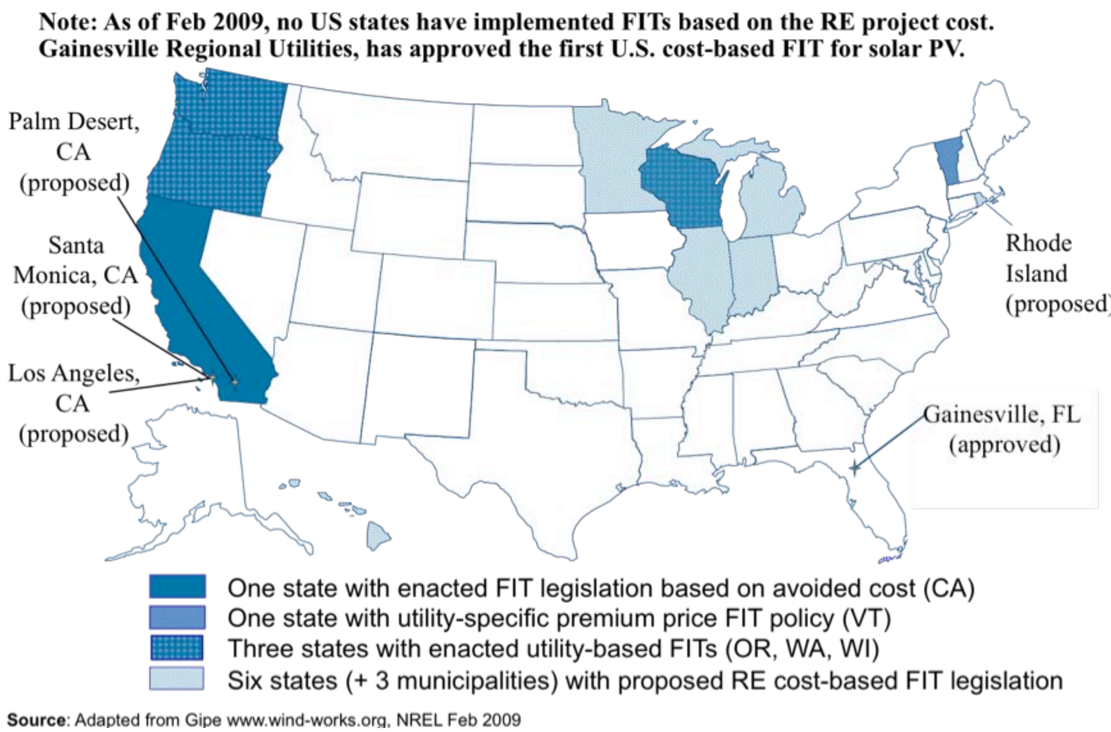

Figure 1. Feed-in tariff activity in the United States (Couture et al.)

1.3 Federal Role

EERE plays multiple roles in approaching the state sector, in order to capture all the opportunity of various state agencies and interests.

1.3.1 The State Energy Program (SEP)

The State Energy Program (SEP) was established in the 1970s. In 1999, federal and state stakeholders developed a revised strategic plan (SEP Plan 1999) that prioritized three goals:

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[27] T. Couture, T., K. Cory, and C. Kreycik, "Feed-in Tariffs in the United States: Design Options," NREL: Golden, CO, 2009 (forthcoming).

- Maximize energy, environmental, and economic (EEE) benefits through increased collaboration at the federal, state, and community level;

- Increase market acceptance of energy efficiency and renewable energy technologies, practices, and products; and

- Use innovative approaches to reach market segments and meet policy goals not typically addressed by market-based solutions.[28]

EERE provides financial assistance to states through the SEP program, both through formula grants and special project funding. Formula grants are distributed based on a formula that considers population and energy use and are contingent on the state completing an energy emergency plan and committing to procuring energy efficient equipment in state buildings. States must match 20 percent of the formula grant in order to receive the federal portion.

Table 37 presents the state-by-state formula grant funding from 1999 to 2007. Overall, the SEP formula grants have provided over $350 million dollars between 1999 and 2007 (real dollars). States combine these dollars with their own and private funding to leverage the investment at a rate of $3.58 investment for every dollar of federal investment (see Figure 2).

Table 37. DOE/EERE/WIP Dollar Value of Formula Grants to States 1999-2007 ($ in thousands)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
AK	$247	$251	$292	$353	$353	$342	$351	$264	$364	$2,817
AL	$514	$522	$604	$726	$724	$707	$708	$543	$735	$5,783
AR	$399	$405	$462	$558	$559	$540	$544	$424	$563	$4,454
AS	$159	$162	$189	$230	$230	$227	$227	$170	$235	$1,829
AZ	$456	$465	$537	$651	$657	$645	$659	$500	$689	$5,259
CA	$2,137	$2,167	$2,496	$3,024	$3,034	$2,977	$2,953	$2,269	$3,060	$24,117
CO	$506	$514	$581	$683	$687	$678	$685	$540	$712	$5,586
CT	$491	$497	$553	$641	$641	$633	$634	$514	$652	$5,256
DC	$211	$214	$246	$295	$295	$290	$290	$223	$302	$2,366
DE	$221	$225	$260	$313	$313	$309	$310	$236	$322	$2,509
FL	$1,100	$1,116	$1,283	$1,552	$1,563	$1,539	$1,564	$1,193	$1,632	$12,542
GA	$711	$724	$833	$1,012	$1,018	$996	$1,010	$769	$1,058	$8,131
GU	$165	$169	$197	$239	$240	$235	$235	$177	$245	$1,902
HI	$231	$234	$271	$326	$326	$322	$324	$246	$337	$2,617
IA	$470	$476	$537	$625	$624	$612	$617	$494	$635	$5,090
ID	$256	$261	$303	$366	$367	$360	$361	$274	$372	$2,920
IL	$1,401	$1,417	$1,570	$1,796	$1,794	$1,797	$1,769	$1,456	$1,811	$14,811
IN	$796	$806	$907	$1,060	$1,059	$1,042	$1,048	$837	$1,082	$8,637
KS	$421	$427	$484	$570	$569	$557	$560	$442	$581	$4,611
KY	$536	$543	$620	$735	$734	$722	$726	$567	$747	$5,930

[28] SEP Plan1999, available at SEP Web site, http://apps1.eere.energy.gov/state_energy_program/pdfs/plan_final.pdf

Table 37. DOE/EERE/WIP Dollar Value of Formula Grants to States 1999-2007 ($ in thousands)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
LA	$629	$643	$760	$897	$895	$895	$872	$657	$905	$7,153
MA	$755	$763	$847	$974	$974	$967	$958	$786	$983	$8,007
MD	$610	$618	$694	$808	$809	$804	$802	$642	$831	$6,618
ME	$299	$304	$346	$407	$407	$403	$400	$314	$411	$3,291
MI	$1,188	$1,201	$1,332	$1,525	$1,519	$1,486	$1,491	$1,229	$1,524	$12,495
MN	$712	$721	$800	$916	$917	$903	$911	$745	$936	$7,561
MO	$654	$663	$747	$872	$871	$849	$863	$688	$888	$7,095
MS	$375	$381	$441	$535	$534	$519	$524	$400	$540	$4,249
MT	$243	$247	$284	$342	$342	$348	$335	$257	$346	$2,744
NC	$736	$748	$854	$1,016	$1,020	$1,004	$1,016	$787	$1,053	$8,234
ND	$230	$234	$270	$324	$323	$317	$321	$246	$331	$2,596
NE	$320	$324	$370	$437	$436	$428	$432	$338	$446	$3,531
NH	$277	$282	$320	$379	$379	$373	$374	$294	$385	$3,063
NJ	$966	$976	$1,088	$1,253	$1,254	$1,240	$1,232	$1,005	$1,265	$10,279
NM	$293	$298	$345	$414	$414	$406	$412	$314	$425	$3,321
NMI	$158	$161	$188	$229	$229	$226	$226	$170	$235	$1,822
NV	$269	$274	$321	$394	$397	$391	$394	$294	$413	$3,147
NY	$1,943	$1,964	$2,151	$2,448	$2,447	$2,428	$2,404	$2,014	$2,456	$20,255
OH	$1,324	$1,338	$1,491	$1,728	$1,720	$1,669	$1,674	$1,370	$1,709	$14,023
OK	$461	$468	$535	$632	$632	$621	$633	$491	$649	$5,122
OR	$425	$432	$496	$587	$519	$576	$577	$450	$595	$4,657
PA	$1,345	$1,357	$1,508	$1,722	$1,717	$1,753	$1,706	$1,394	$1,746	$14,248
PR	$386	$414	$467	$547	$543	$539	$543	$433	$563	$4,435
RI	$257	$261	$297	$352	$353	$346	$346	$272	$356	$2,840
SC	$454	$461	$534	$640	$641	$627	$636	$486	$661	$5,140
SD	$224	$228	$262	$314	$313	$309	$310	$238	$321	$2,519
TN	$620	$630	$720	$851	$852	$833	$848	$660	$878	$6,892
TX	$1,819	$1,864	$2,182	$2,653	$2,668	$2,611	$2,663	$1,984	$2,782	$21,226
UT	$321	$326	$376	$450	$451	$445	$448	$344	$464	$3,625
VA	$729	$739	$837	$988	$990	$977	$983	$774	$1,019	$8,036
VI	$167	$175	$205	$255	$258	$243	$247	$184	$259	$1,993
VT	$224	$228	$261	$309	$309	$305	$305	$238	$315	$2,494
WA	$589	$596	$689	$830	$831	$810	$806	$620	$826	$6,597
WI	$740	$749	$834	$956	$955	$939	$947	$773	$967	$7,860
WV	$367	$371	$420	$489	$487	$479	$482	$383	$497	$3,975
WY	$213	$217	$253	$307	$307	$301	$304	$228	$316	$2,446
USA	$33M	$33M	$38M	$45M	$45M	$44M	$44M	$35M	$45M	$361M

Source: SEP Program

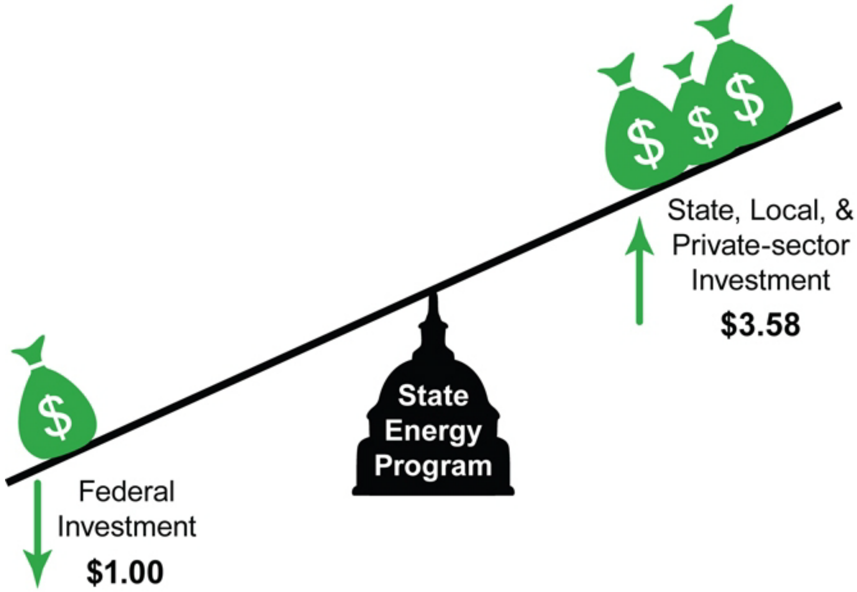

Figure 2. SEP program federal funding leveraging (Source: SEP Web site).

Special project grants are competitive grants for which states can apply. The grants for these special projects depend on annual funding allocation and can be used in the following categories:[29]

- **Buildings**—These types of projects include revisions of building codes, training for enforcement, and evaluation of impacts of changes, as well as rebuild America, greening of schools and other public buildings.
- **Industry**—These projects generally provide for the development of workforce training programs and help develop understanding of energy-intense industries, agriculture energy projects, and the impact of energy efficiency on economic development.
- **Electric Power and Renewable Energy**—These projects include a wide variety of renewable technologies efforts, including site-specific feasibility studies and grid-level integration studies.
- **Energy Education**. —These projects include energy efficiency and renewable energy curriculum development and information dissemination.
- **Policy, Planning and Energy Security**—These projects include analysis on policy and program options (e.g., green power programs), on the ground energy planning efforts, as well as data collection and analysis on energy consumption and production data at the state level.
- **Transportation**—These projects include studying and implementing high efficiency and renewable energy transportation technology, as well as transportation demand management system and telecommuting impacts.

[29] A full summary is available in a searchable database; URL: http://apps1.eere.energy.gov/state_energy_program/search_projects.cfm

Table 38 shows the funding from 1995 to 2005 for special projects through the SEP program.

Table 38. Special Project Grants through DOE/EERE/WIP State Energy Program Funding ($ in thousands)

St	Year									Total
	1997	1998	1999	2000	2001	2002	2003	2004	2005	
AK	$125	$0	$55	$75	$30	$210	$100	$0	$0	$595
AL	$134	$70	$250	$86	$60	$90	$95	$0	$275	$1,060
AR	$100	$63	$175	$37	$75	$80	$0	$107	$97	$735
AS	$0	$96	$0	$86	$35	$0	$0	$0	$0	$217
AZ	$110	$86	$185	$616	$575	$294	$687	$280	$500	$3,333
CA	$1,150	$1,075	$1,250	$1,690	$1,770	$1,540	$3,475	$2,127	$2,159	$16,237
CO	$100	$345	$983	$248	$682	$603	$431	$653	$361	$4,406
CT	$130	$225	$125	$345	$133	$385	$370	$170	$282	$2,165
DC	$40	$141	$143	$110	$368	$200	$150	$232	$0	$1,383
DE	$200	$25	$0	$0	$15	$277	$0	$0	$0	$517
FL	$193	$230	$592	$499	$280	$576	$322	$405	$262	$3,359
GA	$100	$267	$365	$270	$374	$377	$187	$499	$425	$2,864
GU	$50	$0	$0	$0	$50	$25	$0	$0	$0	$125
HI	$403	$304	$353	$190	$300	$456	$213	$129	$250	$2,598
IA	$350	$605	$335	$680	$658	$430	$360	$570	$261	$4,250
ID	$208	$30	$533	$419	$350	$459	$430	$175	$490	$3,093
IL	$200	$250	$400	$254	$248	$371	$200	$280	$960	$3,163
IN	$105	$250	$363	$150	$499	$431	$140	$137	$240	$2,316
KS	$269	$259	$312	$195	$141	$134	$150	$165	$100	$1,724
KY	$100	$115	$293	$207	$252	$255	$20	$115	$20	$1,377
LA	$160	$278	$130	$295	$47	$0	$20	$20	$20	$970
MA	$100	$90	$508	$291	$784	$325	$248	$556	$700	$3,602
MD	$150	$506	$280	$220	$300	$319	$355	$276	$340	$2,746
ME	$139	$266	$516	$220	$350	$115	$393	$476	$175	$2,649
MI	$262	$148	$118	$200	$99	$490	$286	$120	$272	$1,995
MN	$104	$250	$277	$118	$188	$800	$439	$708	$444	$3,327
MO	$50	$121	$100	$400	$100	$40	$220	$178	$0	$1,209
MS	$110	$162	$200	$98	$280	$150	$260	$367	$164	$1,791
MT	$141	$75	$150	$50	$150	$155	$104	$0	$140	$965
NC	$50	$100	$0	$0	$534	$359	$575	$330	$270	$2,218
ND	$77	$20	$31	$80	$50	$43	$100	$0	$100	$500
NE	$356	$550	$157	$190	$131	$255	$99	$32	$225	$1,995
NH	$296	$0	$158	$448	$358	$507	$110	$40	$0	$1,917
NJ	$149	$52	$258	$150	$328	$176	$220	$130	$0	$1,462
NM	$95	$100	$425	$573	$459	$378	$578	$691	$100	$3,398
NMI	$0	$12	$0	$0	$0	$0	$0	$0	$0	$12
NV	$110	$100	$0	$286	$85	$185	$305	$373	$0	$1,444
NY	$774	$922	$858	$885	$822	$1,049	$702	$565	$1,200	$7,777
OH	$565	$473	$597	$346	$581	$550	$468	$723	$400	$4,703

Table 38. Special Project Grants through DOE/EERE/WIP State Energy Program Funding ($ in thousands)

St	Year									Total
	1997	1998	1999	2000	2001	2002	2003	2004	2005	
OK	$50	$100	$112	$150	$300	$0	$163	$189	$0	$1,065
OR	$401	$480	$854	$329	$330	$420	$209	$50	$421	$3,492
PA	$50	$259	$375	$500	$372	$478	$266	$469	$154	$2,923
PR	$100	$100	$0	$100	$0	$60	$34	$0	$0	$394
RI	$166	$772	$580	$180	$315	$230	$250	$74	$351	$2,918
SC	$100	$116	$99	$244	$234	$366	$157	$591	$290	$2,195
SD	$0	$0	$0	$0	$0	$0	$124	$0	$0	$124
TN	$46	$80	$0	$252	$0	$406	$73	$20	$460	$1,337
TX	$271	$220	$349	$666	$978	$1,075	$875	$1,124	$1,214	$6,772
UT	$280	$655	$728	$1,327	$529	$537	$193	$133	$539	$4,921
VA	$40	$222	$325	$361	$50	$443	$258	$544	$415	$2,658
VI	$0	$0	$0	$0	$35	$22	$0	$0	$0	$57
VT	$230	$225	$355	$200	$290	$50	$176	$417	$100	$2,042
WA	$239	$542	$945	$741	$590	$905	$774	$472	$616	$5,826
WI	$530	$186	$673	$615	$605	$695	$388	$537	$470	$4,700
WV	$237	$250	$220	$200	$200	$200	$100	$150	$100	$1,657
WY	$0	$100	$39	$80	$65	$305	$425	$0	$150	$1,164
USA	$10,494	$12,969	$17,131	$16,951	$17,433	$19,278	$17,278	$16,399	$16,510	$144,442
Source: SEP Program										

1.3.2 The Technical Assistance Program (TAP)

Through the TAP program, EERE provides states access to the network of National Laboratories for quick turnaround assistance. This program is available to state and local officials with well-defined questions relating to energy. An expert responds to the state in about a week. A summary of the types and frequency of requests appears in **Table 39.** Since the tracking of the program began in 2004, about 226 TAPs have been or are currently being completed. On average, TAPs are funded at $5,700 per question for a total programmatic investment of $1.2 million over 5 years.

While the TAP program depends on states to request assistance and does not approach states directly, it has been active in every state except Mississippi. **Table 40** provides TAP funding by state over time. The TAP program grew modestly (nine percent annual average growth) between 2004 and 2008. There has been a recent rapid interest in the program as evidenced by January 2009 requests totaling half of all 2008 requests.

Table 39. TAP Request Counts from 2004-2009 by Category

Category of TAP request	Count of Requests 2004-2009
RPS, RFS, or efficiency portfolio standards	43
Use of clean energy technologies for air pollutant and greenhouse gas emissions reduction	42
State and regional energy efficiency and renewable energy assessment and planning	39
Use of renewables on public lands and facilities	35
Systems benefit charge (SBC) or other utility rate payer funded utility energy efficiency or renewable energy program	26
Multiple Categories	10
Other	8
Use of renewable energy and energy efficiency technologies for disaster relief, mitigation, or planning	4
Sustainable community and building design	3
Clean Energy project financing incentives and mechanisms	1
Source: TAP database, maintained at NREL	

Table 40. DOE/WIP Technical Assistance Program Funding by State and Calendar Year

State(s)	Year						Grand Total
	2004	2005	2006	2007	2008	2009	
AK	$5,000				$5,000		$10,000
AK, AZ, CA, CO, HA, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY				$10,000			$10,000
AL		$4,925	$4,919				$9,844
AR					$5,000		$5,000
AZ		$882		$5,000		$15,000	$20,882
AZ, CA, CT, IL, MA, MN, NJ, NM, NY, OH, OR, PA, RI, WA, WI				$10,000			$10,000
CA			$19,450	$26,000	$74,237		$119,687
CO		$4,966	$12,768	$40,000	$40,562		$98,296
CO, MT, NE				$5,000			$5,000
CT	$8,000	$11,053	$15,716				$34,769
DC, MD, VA			$15,000				$15,000
DE		$5,000					$5,000
FL	$5,440					$15,000	$20,440
GA	$2,466	$7,527					$9,993
HI	$5,000	$10,000				$15,000	$30,000
IA	$12,768	$11,721		$9,000	$9,442	$15,000	$57,931
IL		$4,010	$5,000		$5,000		$14,010
IN			$9,167	$5,000	$7,000		$21,167
KS						$8,000	$8,000
KY	$4,980	$5,585	$11,530				$22,095

Table 40. DOE/WIP Technical Assistance Program Funding by State and Calendar Year

State(s)	Year						Grand Total
	2004	2005	2006	2007	2008	2009	
LA	$14,448		$11,062	$10,000			$35,510
MA	$12,108	$5,000		$600	$15,000		$32,708
MD	$5,000		$7,343		$0		$12,343
MD, DC, NJ, PA					$10,000		$10,000
ME	$4,812	$5,000		$5,000			$14,812
MI	$5,000	$28,813	$1,791			$21,000	$56,604
MN	$11,800		$6,976	$5,000			$23,776
MO			$16,142				$16,142
MT	$5,000	$5,450			$5,000		$15,450
NC	$4,661	$9,788		$7,500	$10,000		$31,949
ND		$5,737					$5,737
NH	$4,552	$0					$4,552
NJ	$17,082		$9,481	$10,000			$36,563
NM		$5,304			$7,000		$12,304
NV	$10,690						$10,690
NY	$5,341	$7,896	$9,951	$5,000	$13,000		$41,188
OH	$9,691		$8,324	$5,000	$3,598		$26,613
OK	$2,500			$5,000			$7,500
OR	$5,190		$15,100	$10,000			$30,290
PA	$9,733	$11,160	$14,990		$5,000		$40,883
RI		$4,960					$4,960
SC, VA, GA				$15,000			$15,000
SD	$1,233						$1,233
TN	$8,221	$4,999			$200		$13,420
TX	$3,313	$11,530	$4,661	$29,940	$5,000		$54,444
UT	$10,441		$6,051	$16,000	$10,000	$15,000	$57,492
VA		$8,695	$2,955				$11,650
VI				$5,000	$10,000		$15,000
WA, OR, ID, MT, AK, HI			$7,695				$7,695
WI		$637	$8,995	$5,000		$15,000	$29,632
WV	$5,000			$5,000			$10,000
Grand Total	$199,470	$180,637	$225,067	$249,040	$240,039	$119,000*	$1,213,253

Source: TAP Program via NREL.
*Only January 2009 included
Note: Multiple state TAPs are not tracked on investment specific to the state.

2 Cities and Communities

2.1 Market and Performance Data

2.1.1 Drivers

The drivers for local interest in clean energy are similar to state-level drivers. Like state drivers for energy efficiency and renewable energy, local drivers focus on maximizing the value of investment, especially in terms of economic development, including reduction of consumer energy bills; energy security; and environmental factors.

Beyond the specific local drivers for clean energy, state and federal drivers have a large impact on local development and implementation of clean energy. For example, stringent statewide energy codes provide a baseline for localities to enforce and can have a significant efficiency improvement over what would be in place at the local level in the absence of state action. (See the state section for an overview of statewide building codes). While statewide minimums and policies have the potential to have large impacts on local energy efficiency and renewable energy use, the laws must be developed leaving space for individual needs and attributes of localities.

Finally, because local policymakers are generalists covering many areas of local government, they depend heavily on the experiences of other localities. Fortunately, a large number of regional or national affiliations have emerged and offer information exchange at the local level. The following associations and groups (as well as others not listed here) may have a large impact on the development of local policy through centralization of policy and program impacts in other localities: U.S. Conference of Mayors, National League of Cities, Local Governments for Sustainability (ICLEI), and the National Association of Counties.

Comprehensive and centralized locality energy data are not available. Individual cities and localities participate in regional or national partnerships to promote sustainability, increase clean energy use, or holistically approach environmental challenges. The organizations are increasingly creating baseline energy use catalogues, which will provide more robust data in the future.

2.2 Status of Local Policies and Programs

Table 41 shows that 25 of the 28 local climate action plans surveyed for this report contain a specific citywide emission reduction goal. Please note that not all of the plans have been passed or approved.). Local climate action plan goals range from a 7 percent target reduction by 2012 and a 100 percent reduction by 2020 to a more common long-term reduction of 80 percent by 2050. Ten cities have set a goal of *at least* an 80 percent emissions reduction, most of them by 2050. Three city climate plans, specifically Houston, Austin, and Sacramento, do not contain a specific reduction goal of citywide emissions.

Table 41. Emission Reduction Goals Organized by Ambition of Goal

Community	Baseline Year	Target Reduction	Target Year
Eugene, OR*	1990	7% **100%**	2010 **2020**
Northfield, MN	2005	15% 50% **100%**	2013 2028 **2033**
Takoma Park, MD	1990	**80%**	**2010**
Seattle, WA	1990	7% **80%**	2012 **2050**
Portland, OR	1990	10% **80%**	2010 **2050**
Chicago, IL	1990	25% **80%**	2020 **2050**
Berkeley, CA	2000	33% **80%**	2020 **2050**
Aspen, CO	2004	30% **80%**	2020 **2050**
Fort Collins, CO	2005	20% **80%**	2020 **2050**
Gunnison Valley, CO	2005	20% 30% **80%**	2020 2030 **2050**
Salt Lake City, UT	NA	Cut emissions 3%/year for 10 yrs 70%	2040
San Jose	NA	Cut per/capita energy use by 50%	2023
Carbondale, CO	2004	25%	2012
Sonoma County, CA	1990	25%	2015
San Francisco, CA	1990	10% 20%	2010 2012
Ann Arbor, MI	2000	20%	2015
Tucson, AZ	2005	25%	2030
San Diego, CA	1990	15%	2015
Minneapolis, MN	2005	12% 20%	2012 2020
New York City, NY	2005	30%	2030

Alexandria, VA	2005	10% 20%	2012 2020
Denver, CO	1990	10%	2012
Albuquerque, NM	1990	7%	2012
Boulder, CO	1990	7%	2012
Edmonds, WA	1999	10%	2019

*Eugene's goals are based on recommendations made by the Sustainable Business Initiatives Task Force commissioned by the mayor and city council. A climate action plan has not yet been conceived.

2.2.1.1 Municipal Sector

Nearly all of the communities plan to demonstrate leadership by increasing energy efficiency and use of renewable energy in municipal buildings. Three of the communities require that 100 percent of energy used in municipal buildings come from renewable energy, or be offset by purchasing credits to reflect carbon neutrality of the municipal sector by a specific year (i.e., 2010, 2012, and 2030). Several cities require that a certain percentage of municipal energy come from renewable energy (e.g., 30 percent by 2010). Several cities seek to improve energy efficiency through building requirements for all new buildings within city limits, while four cities plan to require LEED certification[30] (or other green-building certification) for all new municipal buildings. Chicago and New York City both plan to implement an energy-monitoring system for all city buildings.

Eight communities express specific quantitative goals for decreasing emissions from municipal buildings, with varying base-line years and percentage reduction targets ranging from a 20 percent reduction to a 100 percent reduction from 2010 to 2020.

The majority of municipalities plan to decrease emissions from city vehicles (often referred to as "fleets") by setting mandates for the use of alternative fuels or by setting restrictions on fossil fuel use. For example, Austin, Texas, plans to make their entire city fleet carbon neutral through the use of electric power and alternative fuels, while Houston plans to replace 50 percent of their light-weight fleet with hybrids. Takoma Park, Maryland, plans to replace its entire fleet with hybrids. San Jose, California; Albuquerque, New Mexico; and Seattle, Washington, plan to transition their entire fleet to alternative fuels by 2023, 2030, and no time frame, respectively. Berkeley, California, plans to convert its entire diesel fleet into a bio-diesel fleet; and San Francisco intends to have a zero-emission, carbon-neutral city fleet by 2020. Several cities plan on updating their public transportation grid, offering more routes and more options for commuters and city travelers. Chicago plans to invest $1.5 billion in rail infrastructure improvements and increase the efficiency of freight and passenger rail service throughout the region

2.2.1.2 Power Plants

Several cities plan to update their power plants. Minneapolis plans to convert three coal fired power plants to natural gas plants. Chicago plans to update existing coal fired power plants to drastically increase their efficiency. New York City plans on decoupling the profit of power

[30] Leadership in Energy and Environmental Design certification program developed by the U.S. Green Building Council.

plants from volume of energy consumed, and eventually setting up a carbon market by selling, giving, or auctioning carbon credits to generators by the end of 2009.

2.2.1.3 Commercial/Business and Residential Sector

Two climate action plans stand out with regard to green construction and green retrofitting of commercial and/or residential buildings – Portland's plan for new construction and Chicago's plan for retrofitting existing buildings. With regard to new commercial and multi-family construction, Portland plans to impose a "fee-bate" penalty for conventional construction, grant a waiver for moderate green improvements, and offer a reward for high-performance green buildings. The city also plans to create performance targets for new construction of single-family homes, leaving the possibility open for a similar "fee-bate" if the target is not reached. In addition, Portland will require existing commercial buildings to disclose energy performance information, and will offer instruction, direction, or incentives with regard to energy efficiency improvements.

Chicago plans to embark upon an extensive program that will assist in retrofitting 65,000 residential units, 9,000 commercial and institutional buildings, and 200 industrial buildings each year. The program will also assist property managers and major tenants weatherize, improve energy efficiency, and decrease waste in rented buildings and units.

Chicago is also a partner in the new Clinton Climate Initiative's Energy Efficiency Building Retrofit Program. This program brings together one of the world's largest energy service companies, five of the world's largest banks, and 17 of the world's largest cities in a program to reduce the energy consumption in existing buildings. The program provides both cities and private building owners with access to financing in order to retrofit their buildings and upgrade them to more energy efficient products. Subsequent energy savings could reach upwards of 50 percent. Two of Chicago's largest and most prominent buildings, the Sears Tower and the Merchandise Mart, have already set an example by participating in the program.

Overall, six communities specifically mention retrofitting program goals for either commercial or residential buildings. Austin plans to make all new single family homes zero-net-energy-capable by 2015, while Albuquerque plans to require that all new buildings within city limits obtain carbon neutrality by 2030. Four communities plan to update their building and/or energy conservation codes. Three communities plan to require LEED certification for all new buildings within city limits, while several others mentioned incentivizing green-building. San Francisco was the only city to include a requirement for the newly constructed small buildings to obtain at least a 75 on the Green Point Scale. Gunnison Valley seeks to establish Smart Growth Planning Standards for new construction. Nearly all of the climate action plans mention a desire to incentivize green building, improve energy efficiency, or retrofit and weatherize commercial and residential buildings. Several plans also include efforts to increase the amount of recycling and diverted waste that buildings produce – most suggest 20 to 40 percent waste diversion by 2012.

2.2.1.4 Climate Initiatives

In 2000, Takoma Park approved by resolution a goal of decreasing GHG emissions to 80 percent below 1990 levels by 2010. The city sought to achieve this goal by passing a set of sustainable building guidelines; reducing energy consumption in city-owned buildings by 30 percent;

ascertaining 5 percent of municipal energy from wind; transitioning their vehicle fleet to include 18 percent hybrids or alternative fuel use vehicles; and instituting a curb-side recycling program. However, unforeseen obstacles prevented them from fully realizing their plans.

A substantial part of the Takoma Park action plan relied on the development of a municipally-owned electric utility that would substantially reduce emissions by supplying an electric load from cleaner sources than coal. Members of Takoma Park's task force apparently attempted to set this up, but this plan was never fully realized. Though the grounds for this setback need to be investigated more thoroughly, initial reports indicate three main factors for failed plan: 1) legislative barriers prevented the implementation of a street lighting program and a green power group purchasing program; 2) market barriers blocked expansion of the city's recycling program; and 3) political barriers foiled a waste reduction program. Other obstacles included lack out outreach or advertising for certain programs and simple inaction on the part of local government officials.

By contrast, Portland appears to have had *relative* success in achieving a portion of its goals. In 2001, Portland and Multnomah County adopted a plan to reduce local GHG emissions to 10 percent below 1990 levels by 2010. However, in light of increasingly ominous climate predictions and reports, Portland changed the goal to reduce emissions to 80 percent below 1990 levels by 2050. In 2007, local GHG emissions were at the same levels as 1990, despite population growth of 18 percent over the same time period, which means that per capita emissions decreased by 17 percent since 1990. Currently, 12 percent of the city's municipal electricity purchases come from renewable sources, and negotiations are under way to set up a wind facility near the city.

As contributory factors to the reduction of emissions, all diesel vehicles and equipment that use Portland's fueling stations are currently fueled by B20 bio-diesel. In addition, a 75 percent growth in public transit use has been realized since 1990 due in large part to a light rail expansion. The city also maintains a recycling rate of 53 percent.

In addition, Portland also touts the construction of nearly 40 high-performance green buildings, the establishment of the Energy Trust of Oregon that provides consistent funding for energy efficiency and renewable energy programs, the planting of over 750,000 trees and shrubs since 1996, and the weatherization of 10,000 multi-family units and more than 800 homes in two years.

In 1999, Fort Collins committed to reducing 2010 emissions to 30 percent below predicted emissions, which, at the time, were forecast to be 160 percent higher than 1990 levels. The city realized moderate success in implementing various programs. While the amount of $C0_2$ avoided was about 9 to 10 percent of the business-as-usual predictions, reductions could not keep pace with overall emissions growth. Net emissions continued to rise, and by 2005, Fort Collins had already surpassed the 2010 target threshold. Consequently, they developed a new task force with new goals of reducing emissions 10 percent below 2005 levels by 2020 and 80 percent by 2050. In 2006, per capita emissions dropped below 2005 per capita emissions, but per capita emissions have risen as population has grown.

In 2003, Albuquerque committed to reducing emissions by 7 percent below 1990 levels by 2012. Apparently, the city has performed well thus far and has strengthened its goal, which now aims to decrease emissions by 40 percent below 2004 levels by 2014. Wind energy currently supplies 20 percent of the electricity used by the city government.

In 2005, Seattle committed to reducing emissions by 7 percent below 1990 levels by 2012, and by 80 percent by 2050. In 2007, the city issued a progress report indicating that it is on track to meet the initial goal of a 7 percent reduction. In 2005, emissions were 8 percent below 1990 levels. Seattle attributes the success to a variety of factors, including the development of over 100 green buildings, expanded public transit options, increased public transit ridership, and climate-friendly policies at City Light, the nation's first zero net emissions public utility.

2.3 Federal Role

A range of available programs support federal-state/local partnerships toward the clean energy transition. **Table 42** summarizes currently known programs with a focus on partnerships and the State and Local jurisdictional sector.

Table 42. Selection of Federal Programs with State and Local Governments

Program Title	Details
Department of Energy/Energy Efficiency and Renewable Energy	
Weatherization & Intergovernmental Program (WIP)	Provides funding and technology assistance to state and local governments, Indian tribes and international agencies to spur the development and adoption of renewable energy and energy efficiency technology through a multitude of programs (e.g., State Energy Program, Weatherization Assistance Program).
Wind Powering America	Promotes wind development, specifically in rural areas and in markets that are stalled, by providing information, analyses and other tools to communities throughout the country.
Solar America Initiative	Focuses on R&D and market transformation through industry partnerships, with the goal of getting PV cost-competitive by 2015. The Solar America Cities Program is a part of the initiative.
Hydrogen, Fuel Cells & Infrastructure Technologies Program (HFCIT)	Supports R&D activities to improve performance and reduce the costs of these technologies.
Clean Cities	Through partnerships between government agencies and industry, this program seeks to reduce the consumption of petroleum in the transportation sector by 2.5 billion gallons by 2020 via replacement, reduction, and elimination strategies.
EnergySmart Schools	Provides state and local agencies assistance for school construction and renovation to reduce school energy use and costs and improve the learning environment for students.
Green Power Network	Provides consumers with information regarding green power options and policies affecting green power markets.
Department of Energy/Environmental Protection Agency	
Energy Star	Promotes efficiency through product and systems-based labeling.

National Action Plan for Energy Efficiency	Promotes private-public partnerships between state agencies, electric utilities, consumers, energy providers, and environmental organizations to promote national commitment to energy efficiency measures through identifying and addressing market barriers.
Department of Energy/Office of Electricity	
State and Regional Policy Assistance	Provides states and regions with technical assistance, often in the form of grants, to regions-based groups, like WGA, for policy implementation and market solutions to improved demand response, energy efficiency, renewable energy and transmission issues.
Department of Transportation	
Congestion Mitigation and Air Quality Improvement Program	Provides financial assistance to state DOTs and other transit agencies for reducing criteria air pollutants from the transportation sector in NAAQS non-attainment and former non-attainment areas.
Environmental Protection Agency	
Clean Energy-Environment State Partnership Program	Assists states in adopting policies and programs promoting clean energy to improve environmental quality and public health.
U.S. Department of Agriculture	
Rural Development Program	Supports the development and improvement of renewable energy biomass projects through loans and grants to businesses, utilities, and other actors.

2.4 Market and Performance Projections

No quantitative analysis of future trends is currently available for local communities, but a qualitative assessment is possible.

In the current economic climate, increasing energy efficiency and renewable energy at the local level will be difficult, absent federal support. Fortunately, changes in federal government funding activities for local governments both through the American Recovery and Reinvestment Act of 2009 and the proposed FY 2010 budget are expected to encourage local action in pursuit of clean energy, with a specific focus on creating jobs.

The proposed expansion in federal funding will challenge WIP to grow its oversight and educational capabilities. An expanded infrastructure for funding delivery and tracking will be necessary. But the need for technical assistance may prove even more critical. Indeed, with the new federal emphasis on EE and RE, localities with little experience in clean energy planning, development, and technology and policy implementation may impose significant new educational demands on WIP. Finally, more robust feedback loops can help EERE program administrators identify and communicate best practices. Success in all these areas is likely to benefit from improved knowledge creation and management, including increased research into policy evaluation and the development of uniform and comprehensive energy baseline methodologies.

3 Tribes

3.1 Market Data

There are 562 federally recognized Indian tribes and Alaska native villages and corporations. Of these organizations, 225 are located in Alaska and 337 are located in the contiguous 48 states.[31] Hawaiian natives have yet to be federally recognized. The recognized tribes, villages, and corporations comprise 1.5 percent of the U.S. population.[32] This translates to about 1.4 million households, with about 3 percent of households having less than 80 percent of the national median family income.[33]

From 2002 to 2007, the Tribal Energy Program (TEP) within WIP provided funds to 91 energy projects.[34] These projects have focused on establishing an EERE project development pipeline including: 1) Strategic Planning, 2) Feasibility Studies, 3) Project Engineering, and 4) Construction and Operation. **Figure 3** shows the annual funding and awards. **Figure 4** shows the split of projects along the development timeline and the distribution of activities among strategic planning and the EERE technology portfolio.

In April 2000, EIA published a report "Energy Consumption and Renewable Energy Development Potential on Indian Lands," in which it observed that "14.2 percent of Indian households on reservations had no access to electricity, as compared to only 1.4 percent of all

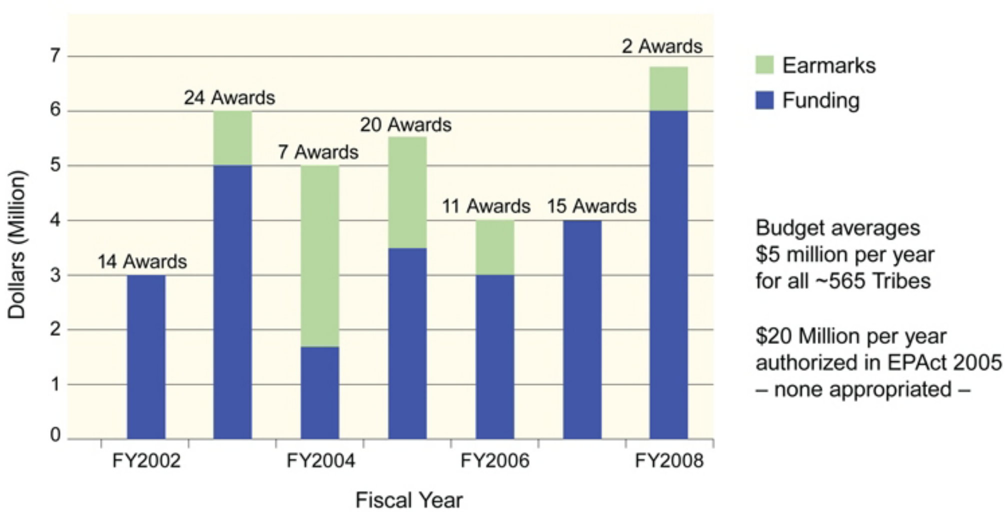

Figure 3. Tribal Energy Program annual funding and awards

[31] DOI, Bureau of Indian Affairs, "Tribal Leaders Directory—Winter 2008;" see http://www.doi.gov/bia/TLD-Final.pdf
[32] See U.S. Census, http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/010849.html
[33] http://www.hud.gov/offices/pih/ih/codetalk/onap/ihbgformula/fy08estsum.xls
[34] EERE, "Renewable Energy Development on Tribal Lands," DOE/GO-102007-2526, December 2007, http://www.nrel.gov/docs/fy08osti/42354.pdf

U.S. households."[35] This comparison was based on the 1990 Census. While the 2010 Census will likely show modest improvement, the sheer number of independent Nations, with no inherent framework for aggregation, creates a large administrative challenge with primary responsibility residing in the Department of Interior and the Bureau of Indian Affairs (BIA). The DOE Tribal Energy Program has attempted to work with the BIA with mixed success.

Tribes need to be viewed both as a "market" in need of EERE technologies and as a location for the deployment of renewable energy technologies on the "supply side."

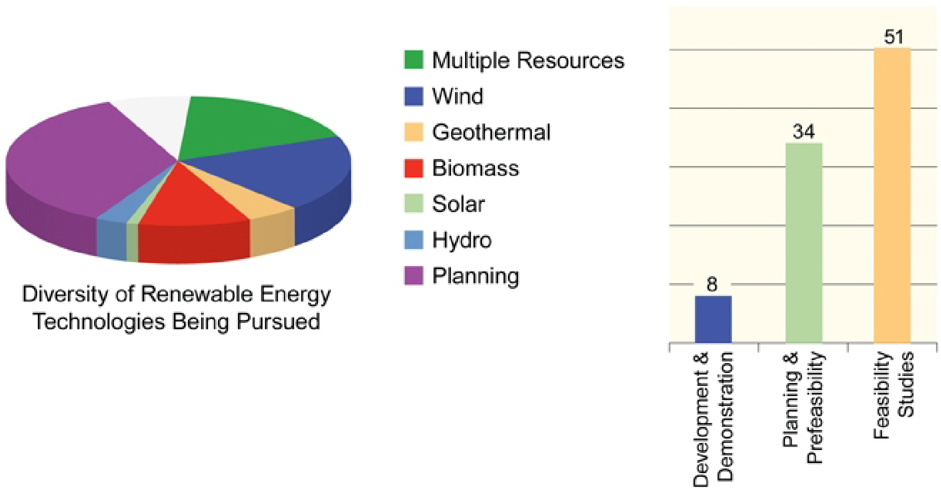

Figure 4. Tribal project development pipeline and areas of focus

Poverty levels throughout Indian Country will limit the "market" for EERE technologies in these low-income communities without federal subsidies. On the Navajo Nation in Arizona, there are approximately 15,000 homes that remain without modern electric services. This is due to the remote location and the corresponding cost of conventional power distribution. One of the oldest Tribal utilities in the U.S. is the Navajo Tribal Utility Authority (NTUA), which serves much of the Navajo Nation. With the initial funding, and with support from EERE's Tribal Energy Program (TEP), NTUA has developed expertise in supplying PV and PV-wind hybrid power systems. Unfortunately, the resources to complete the installation of these systems—and to meet the needs of the thousands of homes—are still lacking.

On the "supply side," tribal lands hold significant renewable energy resource potential spanning the entire renewable-generation and fuel portfolio (wind, solar, geothermal, hydropower, and biomass resources). The wind, solar, and biomass resources have been quantified and are presented below. Aggregate geothermal and hydropower resources have not been analyzed. Hydropower aggregation would be fairly straight-forward with support of the Idaho National Laboratory (INL). However, large hydropower facilities built in the West, particularly along the Columbia River system, have been the source of long-standing animosity due to the severe

[35] http://www.eia.doe.gov/cneaf/solar.renewables/ilands/ilands.pdf

impact of the dams on indigenous subsistence food resources, most notably, salmon. Geothermal estimates are complicated by lack of resources among federal agencies including the U.S. Geological Survey (USGS) and the Bureau of Indian Affairs (BIA).

3.1.1 Key Tribal Energy Efficiency and Renewable Energy Drivers

The key issue on tribal lands regarding energy efficiency and renewable energy opportunity development include:

- lack of training and skill development in building and maintaining systems;
- lack of strategic energy planning and capacity development among Tribal leadership; and
- distrust of "outside intervention." Although some tribes that have become completely integrated into the larger economy, there are more traditional tribes that continue to resist "outside influences" on their culture and lifestyle.

A significant number of tribes are interested in supporting commercial production of renewable energy resources on tribal lands but have been constrained by recent tax-based incentive programs. Tribes, like municipal governments, are tax-exempt. Over the past several years, tax incentives, both investment (ITC) and production (PTC) tax incentives have been restricted to entities with a tax liability to encourage private industry to invest in and develop renewable energy projects. Without a tax liability to take advantage of the incentive, the economics of renewable energy projects on tribal lands are not likely to spur development. The major financing advantages provided by the PTC, ITC, and accelerated depreciation policies provided to corporations have literally left tax-exempt entities (including tribes) in a non-competitive situation even if they have access to renewable resources.

Alternative financing structures exist to assist tax exempt entities in receiving partial or all economic benefit from the tax incentives, including third-party ownership (with the third party taking advantage of the credits and passing the savings on), but the added transaction costs and uncertainty regarding Internal Revenue Service (IRS) rulings tend to discourage project development. Efforts are further hampered by the current financial downturn.

3.1.2 Energy Efficiency and Renewable Energy Market Potential and Performance

Since lower incomes are more common within the tribal population, tribes do not mirror the overall economy. With the increase of gaming on tribal lands, a few tribes close to population centers have increased overall tribal wealth and have declined further assistance from the BIA. However, this is a small minority of the population.

Lack of comprehensive cataloging does not, however, indicate a lack of potential and possible performance.[36] **Figures 5-7** illustrate potential renewable energy resources on tribal lands.

[36] Indian Country's fossil and uranium resources are significant, and economic and institutional pressures on Tribes to allow commercial/corporate extraction of these resources have been—and continue—to be significant. Tribal responses to the mining of these resources have been mixed, ranging from hostile (Navajo uranium) to open-for-discussion (Navajo: coal; and Crow: coal). A history of significant health impacts on Tribal members (uranium mining on Navajo) and visions of significant financial windfalls (coal mining on several reservations) are key factors shaping this debate.

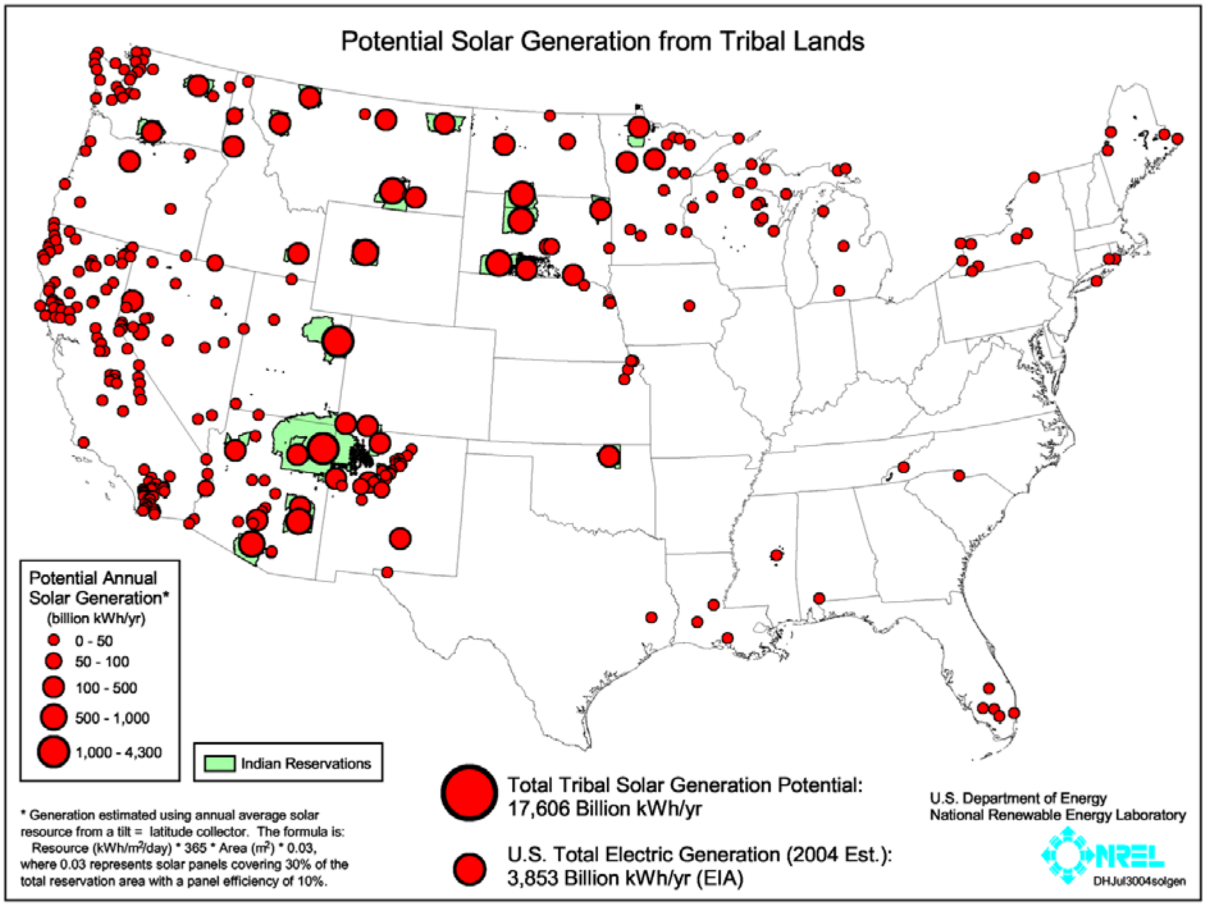

Figure 5. Solar potential on tribal lands

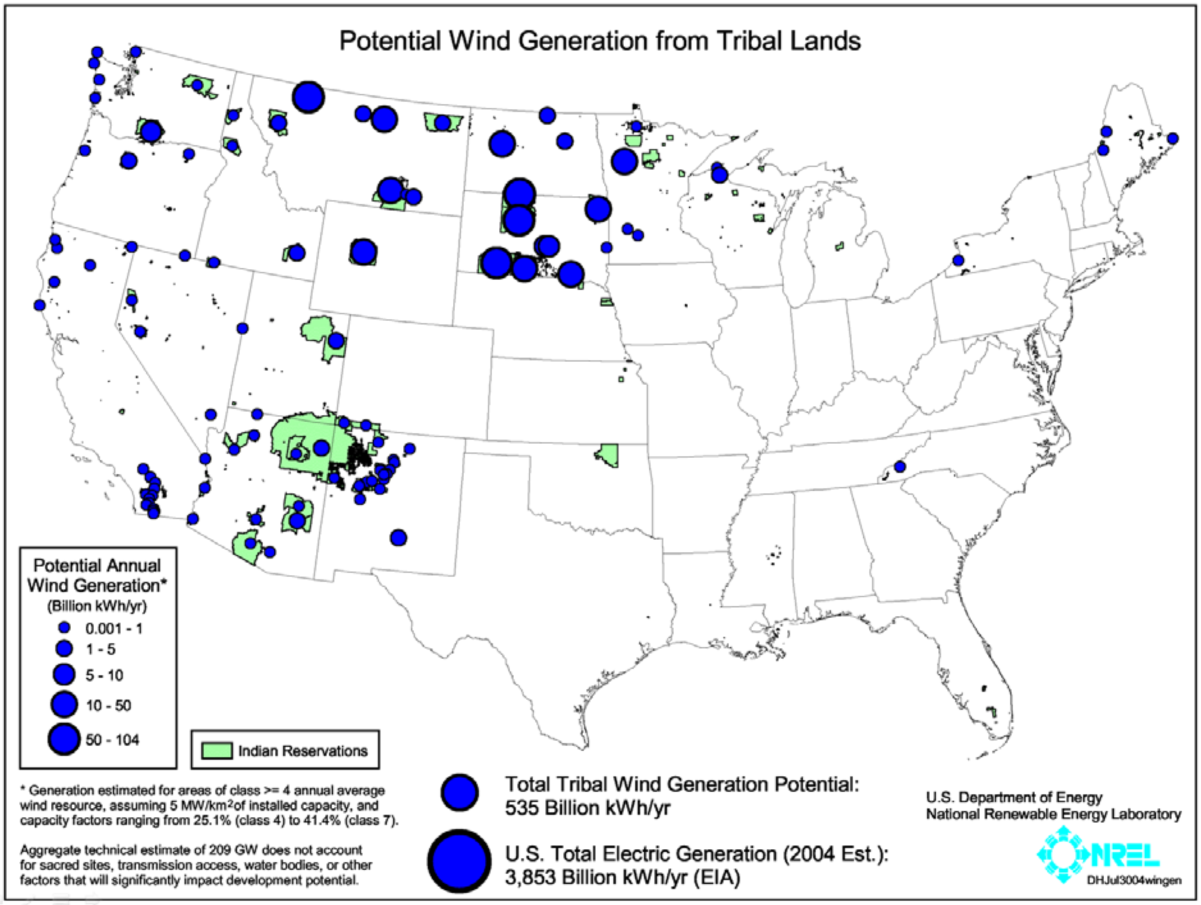

Figure 6. Wind potential on tribal lands

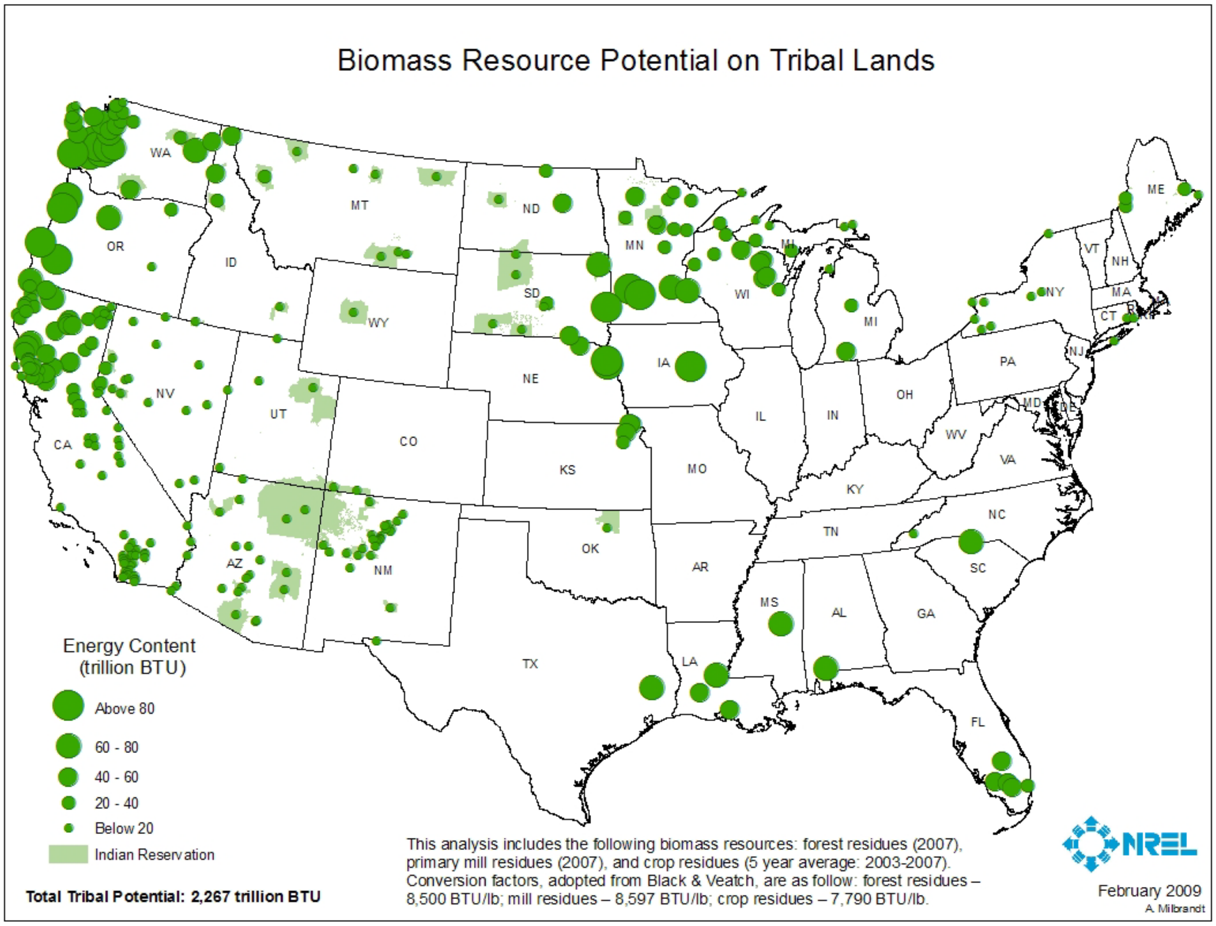

Figure 7. Biomass potential on tribal lands

3.2 Policy and Program Data

The "status" of tribal policies and programs spans the entire spectrum from being hostile to being proactive regarding energy development and, in particular, EERE development.

There are regional groupings of tribes that have formed to facilitate local cooperation among regional members, including:

ATNI – the Affiliated Tribes on NW Indians (Pacific NW Tribes)
SCTCA – the Southern California Tribal Chairman's Association
ITCA – the Inter-Tribal Council of Arizona
AIPC – the All Indian Pueblo Council
MAST – the Midwest Alliance of Sovereign Tribes

Several other groupings work together to address common regional needs and present a common message to the numerous federal agencies with which they must communicate.

3.3 Federal Role

DOE must understand that it is the "newcomer" regarding interactions with Indian Country. Interior/BIA, EPA, HUD/ONAP, HHS, and others have a very long history with Indian Country that long pre-dates DOE's relatively new interest.

EERE programs provide a significant impact by placing money in the hands of tribal managers to build internal capacity leading to projects owned, and operated by the local tribes. Given available resources, EERE/TEP has been very effective in building a project pipeline and trust-relationship within Indian Country. So far EERE has invested in only a fraction of the 562 tribes, but an effective pipeline of projects has been developed. A list of funded projects, peer-reviews, tribal progress, and project results is available on the TEP Web site: www.eere.energy.gov/tribalenergy.

3.4 Historical Funding, FY 2010 Funding Request, and Program Expansion

The FY 2010 appropriation for tribal energy activities is $6 million. This is in line with FY 2009 and FY 2008 actual appropriations.

4 Low-Income Residential Efficiency

4.1 Market Data

With limited discretionary spending by the households themselves, residential energy efficiency in the low-income market for is driven by public spending from a variety of sources ().[37] Recent annual funding from various federal, state, and utility resources for low-income energy efficiency totals approximately $660 million (FY 2007 NASCSP Survey), a level that will be vastly expanded as a result of FY 2009 federal regular appropriations, as well as funding under ARRA. This section focuses its attention on the following elements:

- the energy-related characteristics of the households in the low-income sector;
- the resources committed to low-income energy efficiency;
- the structure of the weatherization assistance network that provides the vast majority of the low-income efficiency investment; and
- some of the challenges faced by the network in meeting the energy efficiency needs of low-income households.

Energy-Related Characteristics of Low-Income Households

There are a number of ways to define the number of households in the low-income market sector. Most of these are based on household income standards defined by various federal programs. For example, eligibility for many programs at the Department of Housing and Urban Development (HUD) is defined as household income at or below 80 percent of the local area median. The Department of Health and Human Services Low Income Home Energy Assistance Program (LIHEAP) has historically defined eligibility to be household income at or below 150

[37] This section is derived from unpublished working documents of the National Association for State Community Services Programs and U.S. DOE Weatherization Assistance Program Briefing Book.

percent of the Federal Poverty Income Guidelines or 60 percent of state median income, whichever is higher. The Department of Energy Weatherization Assistance Program now defines eligibility as household income at or below 200 percent of the Poverty Income Guidelines or HHS LIHEAP eligibility. For purposes of this analysis, the LIHEAP guidelines are employed. This is consistent with the DOE Energy Information Administration's Residential Energy Consumption Survey (RECS), which is currently considered the most reliable energy data regarding household energy use.[38]

According to the latest RECS, 38.6 million out of 111 million households in the United States are federally eligible for LIHEAP. Within this low-income population, 16.6 million households are categorized as having income below the poverty level. The low-income household population is generally geographically distributed in roughly the same proportions as the non-low-income population, with approximately 21 percent in the Northeast, 24 percent in the Midwest, 36 percent in the South, and 19 percent in the West.

This large eligible population comprises a broad range of households in terms of income levels, housing characteristics, and program participation. Over 58 percent of the participating households include at least one paid worker, while approximately 21 percent receive food stamps. Nearly 66 percent of the eligible households live in single-family or mobile homes and over half own their homes.

Low-income consumers have a similar profile to other consumers in terms of the primary heating fuel they use, with a slightly higher proportion than the general population using propane for this purpose. The largest single heating fuel type is natural gas, with approximately 48 percent of low-income households employing this fuel. Electricity is used for heating by 32 percent of these households. Home heating oil is the heating fuel for 8percent of low-income families; and propane is employed for heating by 5 percent.

As **Figure 8** demonstrates, the concentration of heating fuel usage varies substantially by region. Most of the home heating oil is used by low-income households in the Northeast; whereas electricity is the dominant heating source in the South, and natural gas predominates in the Midwest. This has important implications for the average level of residential expenditures and energy burdens in the various parts of the country. Home heating oil and propane prices per MBtu are higher and have risen more sharply than that of other fuels; and residential electricity prices in the Northeast part of the country tend to be well above the national average. The overwhelming predominance of natural gas as the primary heating fuel in the Midwest makes low-income households in that part of the United States extremely sensitive to events in the natural gas markets.

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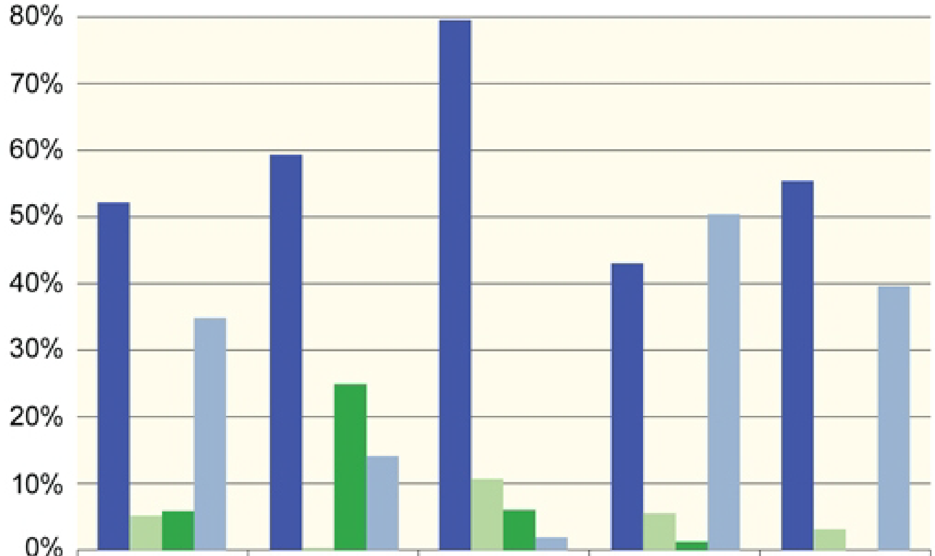
[38] Most statistics in this study are based on the recently released public use files of 2005 RECS with energy prices adjusted to EIA projected FY 2009 residential energy price projections. Certain data is based on the previous RECS for 2001. See http://www.eia.doe.gov/emeu/recs/contents.html.



	U.S.	Northeast	Midwest	South	West
Natural Gas	53.4%	59.1%	79.6%	42.2%	56.7%
Propane	5.4%	0.4%	11.4%	6.4%	3.7%
Fuel Oil	6.0%	26.2%	6.5%	1.3%	0.0%
Electricity	35.2%	14.4%	2.4%	50.1%	39.6%

Source: DOE/EIA Residential Energy Consumpsion Survey for 2001

Figure 8. Primary heating fuel for low-income households

Low-income households have lower average residential energy usage and lower residential energy bills as compared to non-low-income population. This difference, however, is not in proportion to household income. For FY 2009, the average residential energy expenditure for low-income households is estimated at $1,876 – about 80 percent of the residential energy expense of non-low-income household, which is estimated at $2,325. The income of low-income households, as provided in the 2005 RECS and adjusted for inflation, was estimated at $18,624 compared to $71,144 for non-low-income households. The group energy burden of low-income households, defined as average residential energy expense for all low income households divided by average income, is therefore estimated to be 10 percent of income for low-income households compared to 3.3 percent for non-low-income households (see energy-efficiency graph below). Households that actually receive energy payment assistance, estimated at just over 5 million households in RECS in 2005, had an even higher energy burden of 11.5 percent of income (see **Figure 9**).

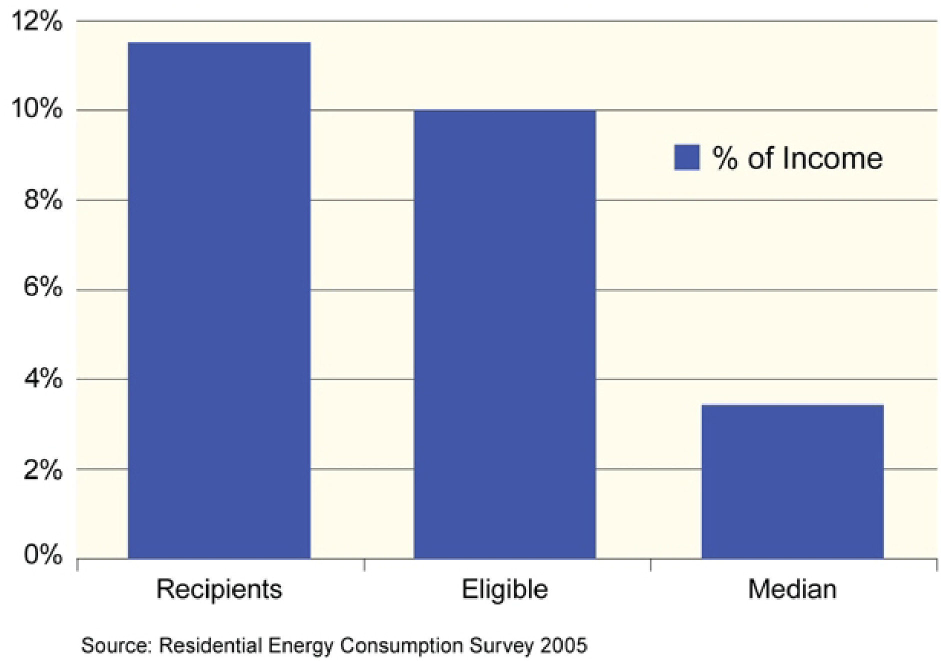


Figure 9. Energy burden by income group, 2008-2009

Average weather-adjusted energy consumption for low-income households in 2005 was 84 MBtu compared to 102 MBtu for the non-low-income households. However, energy intensity, that is to say, Btu consumption per square foot of heated space, showed the reverse pattern. For eligible households, consumption per square foot averaged 90.2 Btu, whereas for non-low-income households the average was 69 Btu per square foot. This reflects the relative inefficiency of the low-income housing stock compared to that of other households. Whereas 24 percent of low-income households reported inadequate insulation in their homes, 15 percent of non-low-income households reported this condition.

A review of the average MBtu consumption for low-income households by housing type reveals that households living in large apartment buildings have lower average consumption than those in most other building types. Households located in large apartment buildings consume an average of 56.4 MBtu compared to 99 MBtu for households located in single family homes. It important to note that average consumption per square foot is far higher in the small multi-family housing stock than it is in other building types. The average consumption was 139 Btu per square foot for these homes compared to 81 Btu per square foot for single-family homes and 83 Btu per square foot for apartments in large buildings. This highlights a potential efficiency opportunity in the small multi-family housing stock.

The RECS data indicate substantial energy efficiency opportunities in the low-income housing stock in terms of both heating systems and refrigerators if one uses the age of the equipment as a rough proxy for inefficiency. Nearly 40 percent of the refrigerators in the low-income households were original installations or over ten years old as compared to just 32 percent in the non-low-income households. A similar differential is evident for heating systems, with 65 percent of low-income heating units either original equipment or 10 years old or greater as compared to 53 percent for non-low-income households (**Table 43**).

Table 43. Age of Heating Systems and Refrigerators by Program Eligibility

Age of Equipment	Refrigerators Low-Income	Refrigerators Non-Low-Income	Heating Systems Low-Income	Heating Systems Non-Low-Income
Under 2 Years	16.5%	17.4%	9.7%	11.4%
2-4 Years	19.3%	21.1%	10.9%	13.8%
5-9 Years	24.6%	29.5%	14.3%	21.7%
10-19 Years	22.9%	23.3%	19.2%	25.4%
20 Years or more	6.1%	5.2%	25.6%	19.7%
As old as home	10.6%	3.5%	20.3%	8.0%
Source: RECS 2005				

As one examines the energy bills of eligible low-income households, several features stand out. Households that employ fuel oil as their primary heat source have the highest energy bills, followed by those that heat with propane. The average energy bill for the former was estimated at $3,218 last year, while that of the latter was $2,678. This compares with $1,927 for households heating with natural gas and $1,376 for households heating with electricity. Please see **Figure 10** for details of heating and total residential energy expenditures by primary heating fuel.

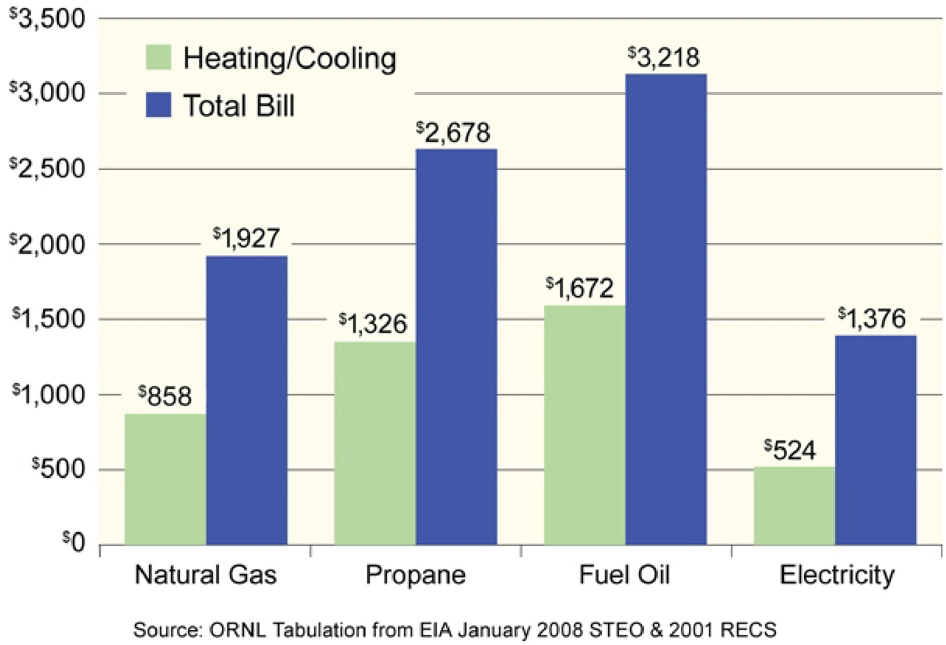


Figure 10. Expected energy expenditures for 2007-2008 for low-income households by primary heating fuel

Given the concentration of low-income households heating with fuel oil in the Northeast, it is no wonder that the average energy expenditure projected for low-income households for FY 2009 is $2,413, which is higher than in any other region. Low-income households in the Midwest, where less expensive natural gas predominates, have a projected FY 2009 energy expenditure of $1,850; and households in the South, where heating loads are lower, have a projected FY 2009 energy expenditure of $1,855. Low-income households living in the West have a projected average expenditure of $1,428.

4.2 Policy: State and Federal Measures

Resources Committed To Low-Income Energy Efficiency

The passage of ARRA promises a large increase in revenues committed to the Low-Income Weatherization Assistance Program, specifically, $5 billion over FY 2009 and FY 2010. This is in addition to other funding currently available, including 1) $250 million of supplemental funding for FY 2009 provided in the continuing resolution that is funding most of the federal government as of this date; 2) an estimated $400-$450 million in transfers at state discretion from the LIHEAP program; and 3) a reported regular appropriation of $200 million incorporated into the final FY 2009 appropriation.

Historically, weatherization activities at the state and local levels have received funding from the energy efficiency streams of resources, namely the DOE appropriation; transfers from the LIHEAP program; and resources generated from utility ratepayers through systems benefits charges and demand side management (DSM) programs. The National Association for State Community Services Programs, which represents many weatherization grants and does an annual resource survey of them, has identified the following recent trends in resources:

- During the past ten years, DOE funding has fluctuated from a high of $242.5 million in PY 2006 to a low of $109.8 million in PY 1996. Petroleum Violation Escrow funding, once a main stream of program funding, has now disappeared from most state budgets.
- The regulations governing the LIHEAP allow for "up to 15% of a state's allocation to be used for WAP," and up to 25 percent is allowable with a waiver from HHS. The amount of LIHEAP funds dedicated to the WAP is usually in direct proportion to the national appropriation of these funds by Congress and the distribution of emergency LIHEAP funds by the President. In 2007, states received $2.161 billion in LIHEAP and the related emergency contingency funds. The transfer of $255,868,133 to WAP in 2007 represents 11.8 percent of the national LIHEAP allocation. It is reasonable to assume that, as LIHEAP appropriations rise and fall, so will the representative amounts transferred to WAP.
- Funding from utility ratepayers and other sources have steadily increased and reached a 15-year highpoint in PY 2007, with approximately $200,191,844 in funds anticipated for weatherization-related activities. The growth of this funding source has been achieved through intervention in electric and gas restructuring efforts of state and local entities, the implementation of landlord participation programs within the states, and the development of relationships with other state offices to locate companion funds to offset WAP activities. In many states, the intervention of experts in rate cases and other hearings resulted in the creation of system benefit programs that included WAP-related initiatives. State and local WAP offices continue to seek leverage opportunities with landlords, state-funded companion programs, and other publicly and privately funded projects to increase funding and improve the selection of services available to low-income families through the weatherization state and local network.

The following table provides a historical overview of the main streams of low-income efficiency funding over time.

State Weatherization Assistance Program Funding Survey
Total - All Funds

Funding Source	1987		1988		1989		1990		1991		1992		1993	
DOE	$158,629,963	31%	$159,015,116	31%	$160,191,893	34%	$161,619,995	36%	$194,246,382	47%	$188,921,672	48%	$183,385,023	47%
LIHEAP	$175,376,535	34%	$131,083,140	26%	$106,149,678	22%	$117,952,918	26%	$124,536,491	30%	$127,298,435	32%	$134,090,055	34%
PVE	$160,378,135	31%	$204,965,586	40%	$198,418,859	42%	$157,771,520	35%	$79,216,357	19%	$56,983,197	15%	$48,257,584	12%
Other	$16,602,572	3%	$13,586,191	3%	$7,790,401	2%	$11,027,279	2%	$11,891,267	3%	$18,791,946	5%	$28,005,190	7%
TOTAL	$510,987,205	100%	$508,650,033	100%	$472,550,831	100%	$448,371,712	100%	$409,890,497	100%	$391,995,250	100%	$393,737,852	100%

Funding Source	1994		1995		1996		1997		1998		1999		2000	
DOE	$206,399,750	43%	$207,416,165	48%	$109,764,329	35%	$119,336,027	36%	$125,777,259	37%	$134,280,576	35%	$136,833,867	31%
LIHEAP	$207,755,213	43%	$157,736,315	37%	$132,560,673	43%	$138,462,506	42%	$139,733,667	41%	$168,937,178	44%	$193,052,820	44%
PVE	$29,234,151	6%	$20,843,259	5%	$23,098,842	7%	$28,809,879	9%	$20,365,296	6%	$20,814,506	5%	$15,053,888	3%
Other	$38,650,702	8%	$45,269,997	10%	$44,880,306	14%	$43,561,027	13%	$55,760,865	16%	$64,027,593	16%	$93,934,170	21%
TOTAL	$482,039,816	100%	$431,265,736	100%	$310,304,150	100%	$330,169,439	100%	$341,637,087	100%	$388,059,854	100%	$438,874,745	100%

Funding Source	2001		2002		2003		2004		2005		2006		2007 Est.	
DOE	$155,774,210	31%	$222,872,844	39%	$222,636,448	37%	$223,920,902	37%	$228,703,039	36%	$238,044,625	32%	$204,369,058	31%
LIHEAP	$228,315,289	45%	$211,770,703	37%	$219,474,943	37%	$225,698,196	37%	$247,350,505	39%	$324,759,456	44%	$255,868,133	39%
PVE	$5,374,518	1%	$6,559,317	1%	$5,535,811	1%	$2,605,043	0%	$6,166,469	1%	$1,923,600	0%	$2,041,132	0%
Other	$116,741,487	23%	$124,268,520	22%	$151,394,390	25%	$150,286,811	25%	$157,697,188	25%	$176,680,380	24%	$200,191,844	30%
TOTAL	$506,205,504	100%	$565,471,384	100%	$599,041,592	100%	$602,510,952	100%	$639,917,201	100%	$741,408,061	100%	$662,470,167	100%

Figure 11. State Weatherization Assistance Program funding survey

4.2.1 Structure of Weatherization Program Network

WAP is the largest residential energy conservation program in the nation and operates in all 50 states, the District of Columbia, the U.S. Territories and on several Native American reservations. WAP is already a successful public/private partnership using federal, state, local, utility, and private funds. The expansion of WAP to meet the goals of ARRA will put tens of thousands of people to work and create investments into local economies around the country. The WAP network expansion, or "ramp-up," will include 1) the hiring and training of a work force throughout the country to perform the energy improvements; 2) the procurement of the necessary vehicles; 3) tools and equipment to outfit the crews and contractors; and 4) the oversight responsibilities at the federal, state, and local levels to protect the resources and ensure that only the highest quality work is performed and accepted.

4.2.2 Service Delivery Network

The grantees for WAP funds are the state governments, the District of Columbia, certain Indian tribes and the U.S. territories (referred to as "states"). Each state designates a department within the government to operate WAP. These departments vary throughout the country and include housing, community development, public welfare, energy offices, environment, and commerce agencies. Each state has established a local service delivery network comprised of organization that can provide WAP in specific geographic areas. There are 900 local agencies throughout the nation: 700 community action agencies and 200 units of local government or other non-profits. Community action agencies have preference under the authorizing legislation for the program. This network covers every political jurisdiction in the country.

4.3 Challenges and Barriers to Program Expansion

4.3.1 Production and Labor Force

In the 2008 PY (April 1, 2008 to March 31, 2009), WAP planned to employ more than 8,000 people working directly for local agencies or private contractors hired by the network, and another 13,000 people involved in the management and the provision of related services to the program, such as training, materials, equipment manufacturing, and technical assistance. These WAP professionals will weatherize more than 150,000 buildings this year using a combination of direct hire crews who work for the local agencies and private contractors hired to weatherize homes. In-house crews perform approximately 50 percent of the annual production and private contractors perform the remaining 50 percent.

4.3.2 Energy Auditing/Inspection

Successful field operations are contingent on the performance of competent, accurate and useful energy audits on candidate homes. WAP uses a sophisticated auditing technique that requires diagnostic equipment and observation protocols to determine the most cost effective services to be provided in each home. The auditor must also identify areas where the family's health and safety must be protected and determine the best methods for abating those conditions. A trained energy auditor can perform about two audits per day. However, time is required for write-ups and follow-up to determine accuracy, develop job work orders, etc. This means an auditor can usually perform about ten audits per week with other duties assigned. Considering holidays, vacation, sick leave, training, and other time requirements, an auditor's workload standard is about 350 audits per year. Currently there are about 1,000 full- or part-time trained auditors in the network. These personnel include program managers, auditors, and quality control staff.

WAP requires that auditors who evaluate homes 1) possess specialized skills based on an understanding of building science and state-of the-art tools that diagnose building energy loss sources, inefficient indoor air movement and safety hazards; and 2) comprehend investment/work order “audit” or decision tools. In order to meet the “core competency” requirements for the job, an energy auditor must have six to eight months of formal training, including supervised field work and classroom instruction before being able to work independently.

4.3.3 Quality Control Inspections

Auditors, crews, and contractors use an array of equipment to determine current conditions of the home, perform the work in a professional manner, and test to ensure that only the highest quality work is accepted. Every home must receive a quality control inspection before the unit can be considered complete. The quality control staff is trained to conduct a series of tests to ensure that targets were met during the work phase. Each quality control staff can perform an average of three inspections per day, or 525 per year, based on productive time available each week. Currently, the network has approximately 900 full- or part-time trained inspectors in the field, including program managers, energy auditors, and specific quality control staff.

4.3.4 Production Staff

The technologies being used by crews in the field include: blower door directed air infiltration reduction; furnace efficiency testing including draft and smoke tests; furnace repair and replacement; health and safety protocols to abate dangerous conditions in the home; lead safe work practices to eliminate contamination in older homes; air quality tests for carbon monoxide and other environmental pollutants; dense pack sidewall insulation; attic and floor insulation; water heater energy use reduction; and among others.

The crew size, the location of the work force, the complexity of the tasks to be performed, and the funding available determine the amount of labor required to meet established production goals. Typically, a two- or three-person crew adequately trained in advanced weatherization technologies can complete the average home in approximately 2.5 business days (accounting for travel, scope of work, health and safety requirements, and building condition). This workload standard is generally used to calculate the labor force needed by a local agency to complete its annual production goals. To complete the 150,000 homes during the 2008 PY, the network will employ approximately 2,150 full- and part-time crews with a labor force of more than 5,700. It costs approximately $50,000 to outfit a crew to perform weatherization services, including the purchase of a vehicle, blower door, insulating machine, generator, testing equipment, power tools, hand tools, and other accessories. For these staff to become proficient at installing weatherization measures, a combination of classroom and on-the-job training is usually recommended. It can take a crew six to eight weeks to become skilled at completing their work in the home. The hiring, training, and outfitting of crews will be the major responsibility of local WAP managers for the first six months of the ramp-up period.

Weatherization and Intergovernmental Program (WIP) Web Sites

U.S. Department of Energy Weatherization and Intergovernmental Program (WIP)
apps1.eere.energy.gov/wip/

Energy Efficiency and Conservation Block Grants
www.eecbg.energy.gov/

State Energy Program
apps1.eere.energy.gov/state_energy_program/

Weatherization Assistance Program
apps1.eere.energy.gov/weatherization/

Tribal Energy Program
apps1.eere.energy.gov/tribalenergy/

Renewable Energy Production Incentive
apps1.eere.energy.gov/repi/

Technical Assistance Project
apps1.eere.energy.gov/wip/tap.cfm

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On the Cover

Weatherization programs help low-income households reduce their energy bills by ensuring that they have proper insulation.

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