

State of the States 2008: Renewable Energy Generation Trends and the Role of Policy

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National Renewable Energy Laboratory
ASERTTI Annual Meeting
October 13-16, 2008

Overview/Purpose

DOE-WIP funded research to determine the connection between RE development and policy.

NREL Report: TP-670-43021



Project Background: SCEPA

- Identify and quantify impacts of current state EE/RE policies that are:
 - most effective policy types (e.g. RFS, Incentives, decoupling, etc) for achieving particular public policy goals (e.g. local economic growth)
 - most effective variables within policy types (e.g. EERS, RPS, Sales tax exemption, etc.)
- Promote understanding of current best policies to foster broader use by more states
- Engage leading state officials and EE/RE market experts to identify and characterize next generation of innovative policies
- http://www.nrel.gov/applying_technologies/SCEPA.html

State of the States Purpose

- **The initial purpose of this report was to rank states according to their use of the most effective policies promoting renewable-based electricity development: Those states with the most effective policy activity toward development of renewable energy would receive the highest rankings.**
- identify policies (and the specific high-impact elements within them) with the highest impact on the development of renewable energy, and
- award points to states implementing those policies (and policy elements) and rank them along a well-designed, quantifiable scale.

Between there and here

Significant knowledge gaps, so is no ranking. Instead:

Understand the current status of renewable electricity development at the state level

Identify and defining contextual factors that contribute to renewable energy development, which will help in understanding the role of policy as a contextual factor in renewable energy development and,

Collect identifying policies and elements within policies that lead to renewable energy development.

Data and Limitations

Most recent EIA data are from 2006.

- Solar PV data: Data presented are installed capacity for 2007 (IREC)
- EIA data were supplemented with direct contact to territory energy offices.
- “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.

Year 1 Results

- Most Recent Generation
- Generation Trends by Technology
- Factors Influencing Development
- Policy Best Practices
- Connecting Policy and Development
- Resources for more information

Overall Generation

2006 All Renewable Generation

	State	MWh
1	WA	84,510,138
2	CA	71,937,993
3	OR	39,720,153
4	NY	29,951,143
5	ID	11,941,587
6	AL	11,157,527
7	MT	10,654,250
8	TX	8,495,704
9	TN	8,273,774
10	ME	8,252,216

2006 NON HYDRO Generation

	State	MWh
1	CA	23,890,613
2	TX	7,833,733
3	FL	4,372,475
4	ME	3,974,084
5	AL	3,905,741
6	GA	3,442,993
7	MN	3,057,478
8	LA	3,031,027
9	NY	2,606,488
10	WA	2,502,509

Percentage of Generation

2006 All Renewable Generation

	State	% Total State Gen.
1	ID	89.2%
2	WA	78.1%
3	OR	74.5%
4	SD	49.7%
5	ME	49.1%
6	MT	37.7%
7	CA	33.2%
8	VT	27.8%
9	NY	21.1%
10	AK	18.4%

2006 NON HYDRO Generation

	State	% Total State Gen.
1	ME	23.63%
2	CA	11.02%
3	VT	6.35%
4	MN	5.74%
5	IA	5.40%
6	HI	5.34%
7	ID	5.22%
8	NV	4.22%
9	OR	3.51%
10	NM	3.43%

Generation Per Capita

2006 All Renewable Generation

	State	MWh/Capita
1	WA	13.257
2	MT	11.253
3	OR	10.761
4	ID	8.158
5	ME	6.276
6	SD	4.497
7	VT	3.171
8	WY	3.125
9	ND	2.971
10	AL	2.431

2006 NON HYDRO Generation

	State	MWh/Capita
1	ME	3.022
2	WY	1.480
3	AL	0.851
4	IA	0.826
5	VT	0.725
6	LA	0.714
7	CA	0.659
8	NM	0.658
9	AR	0.606
10	MN	0.593

Generation Per GDP

2006 All Renewable Generation

	State	MWH/\$M
1	MN	329.63
2	WA	287.91
3	OR	262.52
4	ID	239.28
5	ME	175.68
6	SD	109.68
7	VT	81.30
8	ND	71.79
9	AL	69.49
10	WY	54.21

2006 NON HYDRO Generation

	State	MWH/\$M
1	ME	84.60
2	WY	25.68
3	AL	24.32
4	IA	19.80
5	VT	18.58
6	AR	18.53
7	MS	18.30
8	NM	16.83
9	MT	16.21
10	LA	15.69

Generation Trends Results

- Hydroelectric provided largest portion of RE development in 2006.
- Wind resource saw largest growth
- Growth in electricity from biomass in southeast
- Renewable energy growth is largely outstripped by economic and population growth
- Number of states with increases in generation from 2001 and 2006,
 - Biomass: 24 states
 - Wind: 23
 - Geothermal: 4
 - Large Scale Solar: 2



Trends Conclusion



- Renewable generation is experiencing overall growth, but high variation regionally and by resource
- Better understanding the role of contextual factors, of which policy is one, driving development is needed
- State policy best practices are design-based, not results-based
- Data on Renewable Energy Generation is lacking in multiple areas

Why Renewable Energy Development?



Interaction Complications

- the absolute presence or absence of one factor can make moot the other factors.
- The second complication is that the interaction is not linear, but includes a number of feedback mechanisms.
- Indeed, quantifying the impacts of these factors is challenging, and there are limits to the value of generalizing.
- Determining that complications of quantifying these context factors' interactions are too challenging denies the potentially valuable insight of quantitative understanding of the connection between the influencing factors and development.

The Role of Policy

What good is policy?

- Developing technologies.
- Creating and facilitating markets.
- Levelizing cost.
- Removing institutional barriers.
- Informing.

Policies and Best Practices

Table 31. Summary of States with Renewable Energy Policies and Selected Best Practices (Including Market-Transformation Categories)

State	Market Preparation Policies										Technology Applicability Policies					Sum Market Preparation	Sum Technology Access					
	Contractor Licensing	Equipment Generation	Generation Disclosure	Interconnection	Land Access	Line Extension Analysis	Net Metering	PPF w/ RE	RPS	Vol. & Min. Green	Power	Corp. Tax Incentives	Grants	Loans	Perms. Tax Incentives			Property Tax Incentives	Rebates	RE Prod. Incentives	State Tax Incentives	
AL																				1	3	
AK															NA					NA	3	3
Amer. Sam.																					0	0
AZ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	8	4
AR						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2	0
CA	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	8	5
CD	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	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
MA	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6	7
MI	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2	2
MN	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6	5

- Results table: what state has what policy?
- Best practices: interconnection and net metering only in this version
- Report has full literature review of current best practices work

Overall Role of Policy Results

- Interconnection policies meeting best practices are correlated with increased 1) renewable energy capacity and 2) generation overall, as well as individually with higher 3) biomass, 4) hydroelectric, and 5) PV capacity.
- Renewable portfolio standard (RPS) in a state is significantly correlated to higher wind-based electricity generation.
- Line-extension analysis policies are correlated with higher wind capacity and generation.
- Production incentives at the state level, while a small sample (n=6), are significantly correlated to higher renewable electric capacity and generation, as well as all individual resource categories.
- Do more policies mean more renewables? No.

Overall Conclusions/Next Steps

- Renewable energy growing in contribution to generation – better weighting of recent growth?
- Policy existence is correlated to increased renewable generation
 - impact of best practices?
 - Alternative/additional policies?
- Complicated contextual factors contribute to development – need better understanding of interaction
- Where are the resources for policymakers?



Thank You! Questions?

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Additional Slides and Resources

Resources: Funding

- **Grants.gov** lists funding opportunities from all federal agencies at a single online portal. www.Grants.gov
- The **EERE Financial Opportunities** home page is the main portal to all information related to types of EERE financial assistance available, how to apply, and the funding and awards process. <http://www1.eere.energy.gov/financing/>
- The **Industrial Technologies Program Save Energy Now States** initiative provides funding to state energy offices, state economic development entities, regional energy efficiency groups, utilities, academic institutions, and not-for-profits to reach more industrial customers and increase energy efficiency through the delivery of tools and resources. The core issues, markets, constraints, and opportunities for doing business and addressing energy and environmental needs are local. As such, it will take local organizations and entities to truly impact change. http://www1.eere.energy.gov/industry/financial/solicitations_active.html
- The following programs provide DOE funding to states, local governments, and Indian tribes based on yearly allocations by Congress. They are managed through the EERE Weatherization and Intergovernmental Program.
- The **State Energy Program** dispenses annual grants to states for their energy efficiency and renewable energy programs and competitive grants for innovative state and regional initiatives. www1.eere.energy.gov/energy_efficiency/state_energy_program
- The **Weatherization Assistance Program** provides funding and guidance to states to administer their weatherization programs for low-income families. States and local weatherization-services providers can find all of the information needed to administer the program from the Weatherization Assistance Program Technical Assistance Center. www1.eere.energy.gov/energy_efficiency/wa
- The **Tribal Energy Program** offers financial and technical assistance to Indian tribes through government-to-government partnerships for energy and economic development projects. www1.eere.energy.gov/energy_efficiency/tribal



Resources: Cross-cutting

- The **Technical Assistance Project (TAP)** for state and local officials provides quick, short-term access to experts at DOE national laboratories for technical assistance with their renewable energy and energy efficiency policies and programs. TAP provides assistance with cross-cutting issues that are not addressed by individual EERE technology programs. www.eere.energy.gov/wip/tap.cfm
- The **Renewable Energy Data Book** includes information about renewable energy capacity, generation, investment, and other useful information. http://www1.eere.energy.gov/maps_data/pdfs/eere_databook_091208.pdf
- The **State Best Practices: Clean Energy Policy Analysis** project is evaluating the environmental, economic, and energy security impacts of a broad range of state policies to help policy-makers to select and design policies to best achieve state priorities. www.nrel.gov/applying_technologies/scepa.html
- The **State Renewable Energy Market Development** project facilitates discussions between the Clean Energy States Alliance and administrators of state renewable portfolio standards and with states that are considering establishing renewable standards. www.cleanenergystates.org/joinprojects.htm
- The **Clean Energy and Air Quality Integration** project helps states build on their experience by including clean energy projects that support their air quality programs. www.eere.energy.gov/wip/air_quality.cfm
- **Data, analysis, maps, and tools** are provided by the EERE Weatherization and Intergovernmental Program, which publishes an online list of energy models, databases, and documents that are ready for immediate use by state- and local-level energy analysts, officials, and decision-makers.
- The **EERE State Information Summaries** contain hundreds of Web pages with state-specific information such as an overview of energy consumption, listing of energy efficiency goals under the Energy Policy Act (EPAct) of 2005, a summary of the status of renewable energy and energy efficiency policies, and a list of political leaders and state agency administrators who shape energy policy for Oregon.

Resources: Building Technologies

- The **EERE Building Technologies Program** sets efficiency standards for equipment and appliances and works cooperatively with states and local jurisdictions to improve building energy codes. The program supports initiatives to improve the energy performance of schools, hospitals, homes, and commercial buildings, and it publishes an online publications database and software directory. www.eere.energy.gov/buildings
- **Energy efficiency design guidelines** provide builders with a series of best practices for building new homes that are durable, comfortable, and energy efficient in every climate found in North America. www.eere.energy.gov/buildings/building_america/
- DOE's **Builders Challenge** has posed a challenge to the homebuilding industry – to build 220,000 high performance homes by 2012. The initiative is called the Builders Challenge, and homes that qualify must meet a 70 or better on the EnergySmart Home Scale (E-Scale). The E-Scale is a scale that allows homebuyers to understand – at a glance – how the performance of a particular home compares to that of others. <http://www1.eere.energy.gov/buildings/challenge/index.html>
- The **Building Technologies Application Centers** provide technical, best practice, marketing, and other information to states to accelerate the widespread market adoption and implementation of advanced energy-efficient building technologies and practices.
- **Northwest Building Efficiency Center** <http://www.nwbuildings.org> and **Southern Energy Efficiency Center** <http://www.southernbuildings.org>

Resources: Electric Power

- The mission of the DOE **Office of Electricity Delivery and Energy Reliability** is to lead national efforts to modernize the electric grid, enhance security and reliability of the energy infrastructure, and facilitate recovery from disruptions to energy supply.
<http://www.oe.energy.gov/index.htm>
- The Office of Electricity Delivery and Energy Reliability (OE)'s mission with **State and Regional Policy Assistance** is to provide, on an as-requested basis, technical assistance and analysis to states and regions. This includes assistance with state electricity policies, market mechanisms, and programs that facilitate electricity delivery infrastructure investment needed to support competitive, reliable, environmentally sensitive, customer-friendly electric markets. http://www.oe.energy.gov/state_assist.htm
- The **Green Power Network** publishes tables and maps showing green power programs by state and publishes news about progress in the green power industry.
www.eere.energy.gov/greenpower/
- The **National Action Plan for Energy Efficiency** is a public-private initiative involving more than 120 organizations that are making an aggressive commitment to energy efficiency. EERE supports this effort by publishing guidelines that state and local governments, regulators, and utilities can use to plan their energy efficiency programs.
www.eere.energy.gov/effec/eere/napen.html
- The **utility technical assistance** project schedules seminars with utility regulators covering topics such as performance-based regulation, demand-side management, and green pricing through the Regulatory Assistance Project. www.raponline.org

Resources: Industrial Technologies

- The **Industrial Technologies Program State Activities Web site** provides users with a summary of all ITP-related activities by state. In addition, this Web site provides a summary of the industrial profile and energy use trends within each state. Moreover, the site has a listing of key state contacts that can provide assistance to industrial manufacturers to help improve their energy efficiency. http://www1.eere.energy.gov/industry/about/state_activities/main_map.asp
- The EERE **Industrial Technologies Program** provides the *States Incentives and Resources Database*. This database is a repository of energy incentives, tools, and resources for commercial and industrial managers. Incentives and resources are available at the national, state, county, and local levels. Utilities, private companies, and nonprofits also offer incentives for energy efficiency measures including rebates, waived fees, tax credits, and loans. Resources include analysis tools, education, training programs, and energy audits. This database is designed to help those seeking to make energy efficiency upgrades to their facilities.
http://www1.eere.energy.gov/industry/about/state_activities/incentive_search.asp
- **Save Energy Now** provides U.S. industrial companies with energy assessments free of charge. Save Energy Now is a national initiative to reduce the energy intensity of American industry by 25% in 10 years. Through Save Energy Now, DOE energy experts identify opportunities for savings in energy-intensive processes such as manufacturing.
- The **Industrial Assessment Centers (IACs)**, sponsored by EERE's Industrial Technologies Program, provide eligible small- and medium-sized manufacturers with no-cost energy assessments.

Resources: CHP

- **Intermountain CHP Center** – for the states of Arizona, Colorado, New Mexico, Utah, and Wyoming. www.intermountainchp.org/
- **Mid-Atlantic CHP Application Center** – for the District of Columbia and the states of Delaware, Maryland, New Jersey, Pennsylvania, Virginia, and West Virginia. www.chpcentermw.org/home.html
- **Gulf Coast CHP Application Center** – for the states of Texas, Louisiana, and Oklahoma. www.gulfcoastchp.org
- **Northeast CHP Application Center** – for the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. www.northeastchp.org/nac/index.htm
- **Northwest CHP Application Center** – for the states of Alaska, Oregon, Washington, Idaho, and Montana. www.chpcenternw.org/
- **Pacific Region CHP Application Center** – for the states of California, Hawaii, and Nevada. www.chpcenterpt.org/
- **Southeast CHP Application Center** – for the states of Kentucky, Arkansas, Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Georgia. www.chpcenterse.org/home.html

Resources: Vehicle Technologies

- The **EERE Vehicle Technologies Program** helps states meet alternative fuels requirements under the Energy Policy Act of 1992 and provides a comprehensive clearinghouse of data, publications, tools, and information related to advanced transportation technologies through the Alternative Fuels and Advanced Vehicles Data Center. www.eere.energy.gov/afdc
- **Clean Cities Tiger Teams** provide local solutions to reducing petroleum consumption in the transportation sector. Clean Cities is a nationwide network of more than 85 coalitions that are partly supported by DOE. Sometimes coalitions encounter problems that slow progress in their regions, or vehicle fleet owners who want to implement alternative fuels projects experience technical problems. When solutions cannot be found locally, experts from Clean Cities Tiger Teams can help. Their assistance can be used to evaluate the feasibility of complex projects, fueling station design and fire safety, and operation and maintenance of alternative fuel vehicles. www.eere.energy.gov/cleancities/technical_assistance.html

Resources: Solar, Wind, Hydrogen

- The **Solar America Showcases** project provides hands-on technical assistance to enable states and local agencies to implement their large, high-impact solar installations: www.eere.energy.gov/solar/solar_america/solar_america_showcases.html
- **Wind Powering America** coordinates with wind energy stakeholders in key states to overcome market barriers to wind developments. Wind Powering America also publishes online wind data and lists activities by state. www.eere.energy.gov/windandhydro/windpoweringamerica/
- The **Hydrogen and Fuel Cells Program** provides regular educational programs about hydrogen that involve stakeholders in the states. www.eere.energy.gov/windandhydro/hydrogenandfuelcells/education/