State of the States 2009: Renewable Energy Development and the Role of Policy

Technical Assistance Program (TAP) Webinar

Joyce McLaren

November 18, 2009
State and Local Analysis Team

- Technical Assistance (Policy Analysis)
  - Direct requests
  - Projects to help states accomplish clean energy goals

- Multi-year analyses
  - Impact of policy on economic development, environment, etc. (State Clean Energy Policies Analysis)
  - Connecting policy with generation (State of the States)
Supplement the existing qualitative policy analyses and individual case studies with quantitative policy analysis that explores the link between policy implementation and actual development.
State of the States 2009

Contents

1. Development Trends

2. State Policies and Best Practices

3. Quantitative Policy Evaluation (Policy-Development Link)

4. Contextual Factors
Part 1: Development Trends

How much renewable energy is being generated?

Metrics

• National data
• State by State data
• Individual technologies
• Total capacity/generation
• Hydro vs. Non-hydro RE
• % of Total Generation
• Per Capita
• Per GSP
• % Change (most improved)
US Electricity Generation by Source (2007)

- **Coal**: 48.51%
- **Natural Gas**: 21.57%
- **Nuclear**: 19.40%
- **Petroleum**: 1.58%
- **Other Gases**: 0.32%
- **Other**: 0.29%
- **Renewables**: 8.49%
  - **Hydro**: 5.95%
  - **Wind**: 0.83%
  - **Biomass**: 1.34%
  - **Geothermal**: 0.35%
  - **Solar**: 0.01%
Hydro and Wind Generation as a % of Total Renewable Energy


- 2001: 75%
- 2002: 77%
- 2003: 78%
- 2004: 76%
- 2005: 76%
- 2006: 75%
- 2007: 70%


- 2001: 2%
- 2002: 3%
- 2003: 3%
- 2004: 4%
- 2005: 5%
- 2006: 7%
- 2007: 10%

Total Renewable Energy Generation (TWh)

Renewable Energy Generation as a % of Total State Electricity Generation

Renewable Energy Generation per Capita (MWh/Capita)

Renewable Energy Generation per Gross State Product (MWh/GSP2007)

Source: State of the States 2009

National Renewable Energy Laboratory
Innovation for Our Energy Future

**Biomass Generation – TWh (2007)**

- Top 5: 5.7, 3.8, 3.0, 2.6, 2.4
- Top 6-10: 2.1, 2.0, 1.4, 1.3, 1.0

**Geothermal Generation – TWh (2007)**

- Top 4: 1.25, 0.23, 12.99, 0.16

**Wind Generation – TWh (2007)**

- Top 5: 2.44, 1.25, 1.29, 1.15, 1.08
- Top 6-10: 1.85, 1.15, 0.91, 1.08, 0.89

**Grid-Connected Solar Capacity - MWdc (2008)**

- Top 5: 7.7, 34.2, 35.7, 28.3, 25.3
- Top 6-10: 13.5

Source: State of the States 2009

[Renewable Energy Leaders by Resource (2007)](#)
Questions?
Part 2: Renewable Energy Policies

Policy Definitions
What policies are being used to support renewables?

Policy Implementation
Which states have implemented the policies?

Policy Design Best Practices
How can I design an effective policy?
What policies are being used to support renewables?

- Renewable Portfolio Standards
- Tax Incentives
- Public Benefit Funds
- Required Generation Disclosure
- Required Green Power Programs
- Contractor Licensing
- Equipment certification
- Interconnection standards
- Line extension analysis
- Rebates
Which states have implemented the policies?

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States with Required Generation Disclosure
Questions?
Part 3: Quantitative Policy Evaluation

Is there a quantifiable relationship between policy implementation and renewable energy development?

Explores the effects of:

- Individual policies
- Policy portfolios
- Policy age
- Policy best practice design features
- Contextual factors

...on renewables development.
Quantitative Policy Evaluation: Methodology

Two-tailed t-tests or Correlation analyses

Independent variables: State policies (2005)
» RPS
» Tax Incentives
» Net metering
» Generation Disclosure
» Interconnection Standards
» Etc.

Dependent variables: Generation metrics (2007)
» Total RE generation
» RE as % of total generation
» RE as % of GSP
» RE per capita
» Individual technologies
» Etc.
Quantitative Policy Evaluation: Methodology

Step 1:
Identify significant relationships through t-tests/correlations.

Step 2:
For each significant relationship the data is visualized.
States with Net Metering Policy in 2005 had significantly more renewable energy generation in 2007 than those without the policy.
States with Net Metering Policy in 2005 had significantly more renewable energy generation in 2007 than those without the policy.

<table>
<thead>
<tr>
<th>2007 Generation Metric</th>
<th>States without Net metering Policy in 2005 (Mean Value)</th>
<th>States with Net metering Policy in 2005 (Mean Value)</th>
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<tbody>
<tr>
<td>Non-hydro renewable generation as a % of total state generation**</td>
<td>1.80%</td>
<td>4.10%</td>
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<td>Non-hydro renewable generation per capita**</td>
<td>0.26 MWh/person</td>
<td>0.59 MWh/person</td>
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<td>Non-hydro renewable generation per GSP**</td>
<td>6.7 MWh/M$GSP</td>
<td>13.6 MWh/M$GSP</td>
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**t-test significant to the 0.05 level
Policy Evaluation: Results

States that have implemented both Generation Disclosure and Required Green Power Program policies have significantly more renewable energy generation.
There is a correlation between the age of an RPS policy and increased wind capacity.
Some RPS best practice features are related to increased generation.

(However no successful model for combining features was identified.)
Caveat:

We can not assume causality!

We can say:

It is unlikely that these relationships are due to chance.
Removing the highest and lowest performing states reduces the number of relationships seen.

Thus, contextual factors other than policy may be stronger indicators of development.
What other factors affect development?
Take Home Message 1

Consider Policy Portfolios

Which policies will support each other to create a whole that is greater than the sum of the parts?

Example:
Required Generation Disclosure + Green Power Programs
= Renewable Energy
Consider contextual factors when choosing policy

One size does not fit all.

What are the specific characteristics of your region?
How can you use them to your benefit?
What special challenges do you face?
Which policies address those characteristics best?
Questions?
Next Steps

• Look for multi-year results
• Investigate effects of different time-lags
• Include contextual factors into analyses
• Strengthen statistical methods
• Conduct in-depth investigation of individual results
• Correlate results with qualitative analyses
For More Information

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State of the States 2009: Renewable Energy Development and the Role of Policy

The State of the States project is a series of annual policy analyses that summarizes renewable energy generation and policy implementation at the U.S. state and territory level. This analysis investigates the role of policy in renewable energy development and also considers other contextual factors.

This Web site provides a summary of the results of the second version of the report. You can learn more about the efforts that your state is taking to develop renewable energy technologies through the links below, or by accessing the full report "State of the States 2009: Renewable Energy Development and the Role of Policy." (PDF 4.2 MB) Download Adobe Reader.

In this section of the site, you will find project information, results, and current activity summaries, including:

- Purpose and Background
- Summary of Trends
- State Policy Implementation
- State Policy Impact on Renewable Energy Development
- Other Factors Affecting Renewable Energy Development
- Conclusions

The State of the States project was developed by the U.S. Department of Energy, The National Renewable Energy Laboratory (NREL), and the American Council for an Energy-Efficient Economy (ACEEE). It is funded by the Department of Energy (DOE) Weatherization and Intergovernmental Program (WIP) in the office of Energy Efficiency and Renewable Energy (EERE).

The project is part of the DOE-funded State Clean Energy Policies Analysis (SCEPA) project. More information can be found on the SCEPA Web site. The project teams appreciate input and participation by stakeholders.
Acknowledgements

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NREL’s State of the States ‘09 Team:

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Questions?

http://eere.energy.gov/states

State of the States 2009: Renewable Energy Development and the Role of Policy
The State of the States 2009 analysis project summarizes clean energy use and examines the role of policy in clean energy development in the U.S. states and territories. For more information on the project, overall results, and current activity summaries, visit the State of the States.

State of the States 2009: Renewable Energy Development and the Role of Policy
The State of the States project is a series of annual policy analyses that summarizes renewable energy generation and policy implementation at the U.S. state and territory level. This analysis investigates the role of policy in renewable energy development and also considers other contextual factors.

This Web site provides a summary of the results of the second version of the report. You can learn more about the efforts that your state is taking to develop renewable energy technologies through the links below, or by accessing the full report "State of the States 2009: Renewable Energy Development and the Role of Policy." (PDF 4.2 MB) Download Adobe Reader.

In this section of the site, you will find project information, results, and current activity summaries, including:

- Purpose and Background
- Summary of Trends
- State Policy Implementation
- State Policy Impact on Renewable Energy Development
- Other Factors Affecting Renewable Energy Development
- Conclusions

The State of the States project was developed by the U.S. Department of Energy, the National Renewable Energy Laboratory (NREL), and the American Council for an Energy-Efficient Economy (ACEEE). It is funded by the Department of Energy (DOE) Weatherization and Intergovernmental Program (WIP) in the office of Energy Efficiency and Renewable Energy (EERE).

The project is part of the DOE-funded State Clean Energy Policies Analysis (SCEPA) project. More information can be found on the SCEPA Web site. The project team appreciates input and participation by stakeholders.