

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



**Renewable Energy
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State and Local Analysis Team

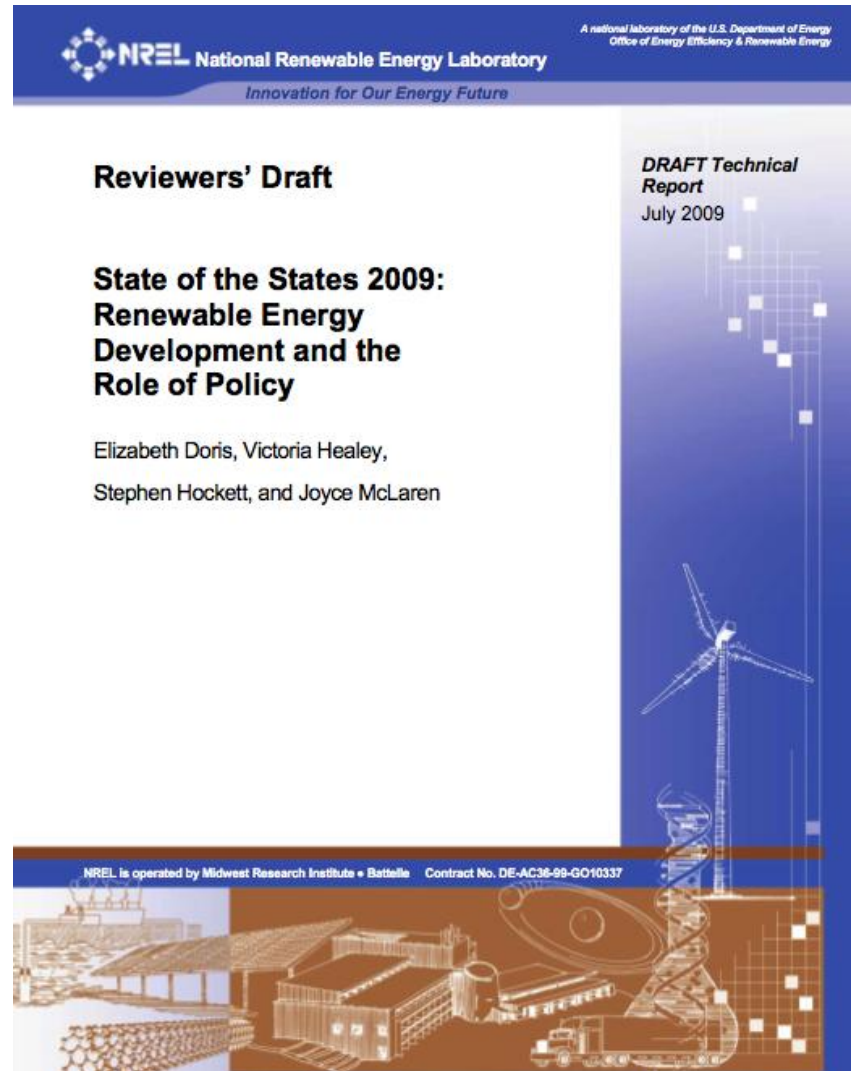


- Technical Assistance (Policy Analysis)
 - Direct requests
 - Projects to help States accomplish clean energy goals
- Multi-year analyses
 - Impact of policy on economic development, environment, etc. (State Clean Energy Policies Analysis)
 - Connecting policy with generation (State of the States)

State of the States 2009

Aim

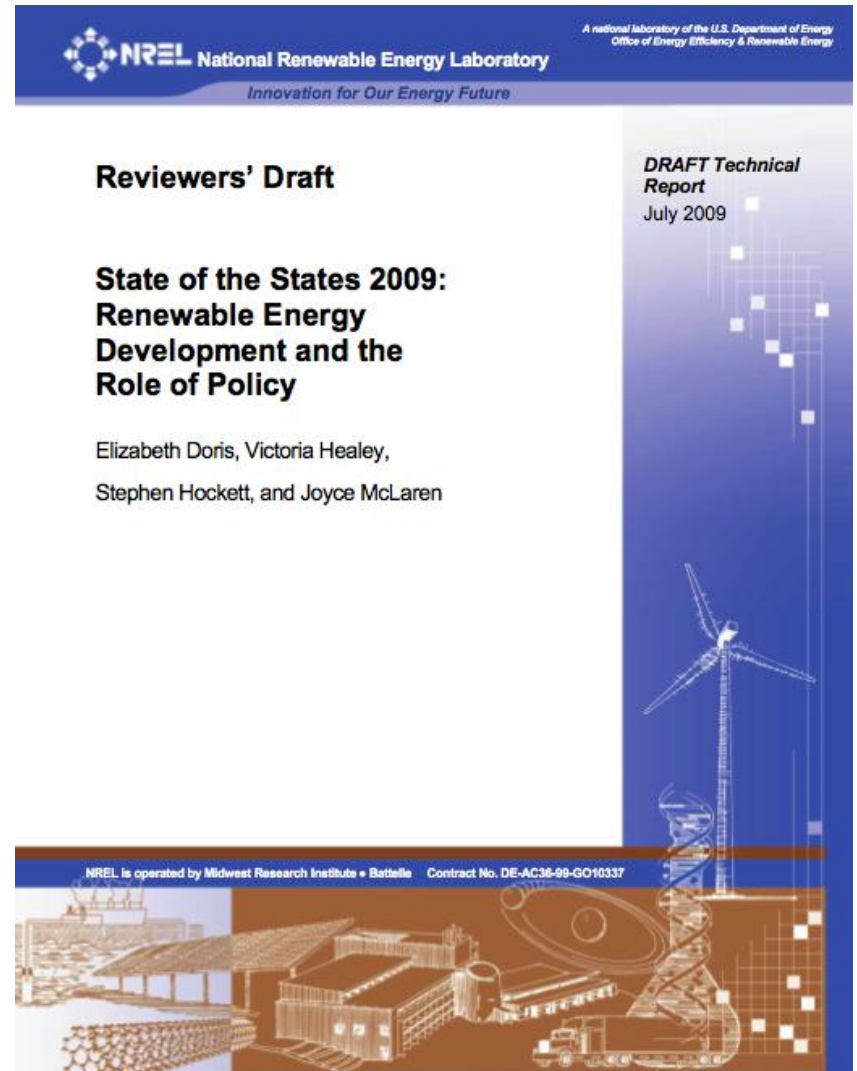
Supplement the existing *qualitative* policy analyses and individual case studies with *quantitative* policy analysis that explores the link between policy implementation and actual development.



State of the States 2009

Contents

- Development Trends
- State Policies and Best Practices
- Quantitative Policy Evaluation
(Policy-Development Link)
- Contextual Factors



Part 1: Development Trends

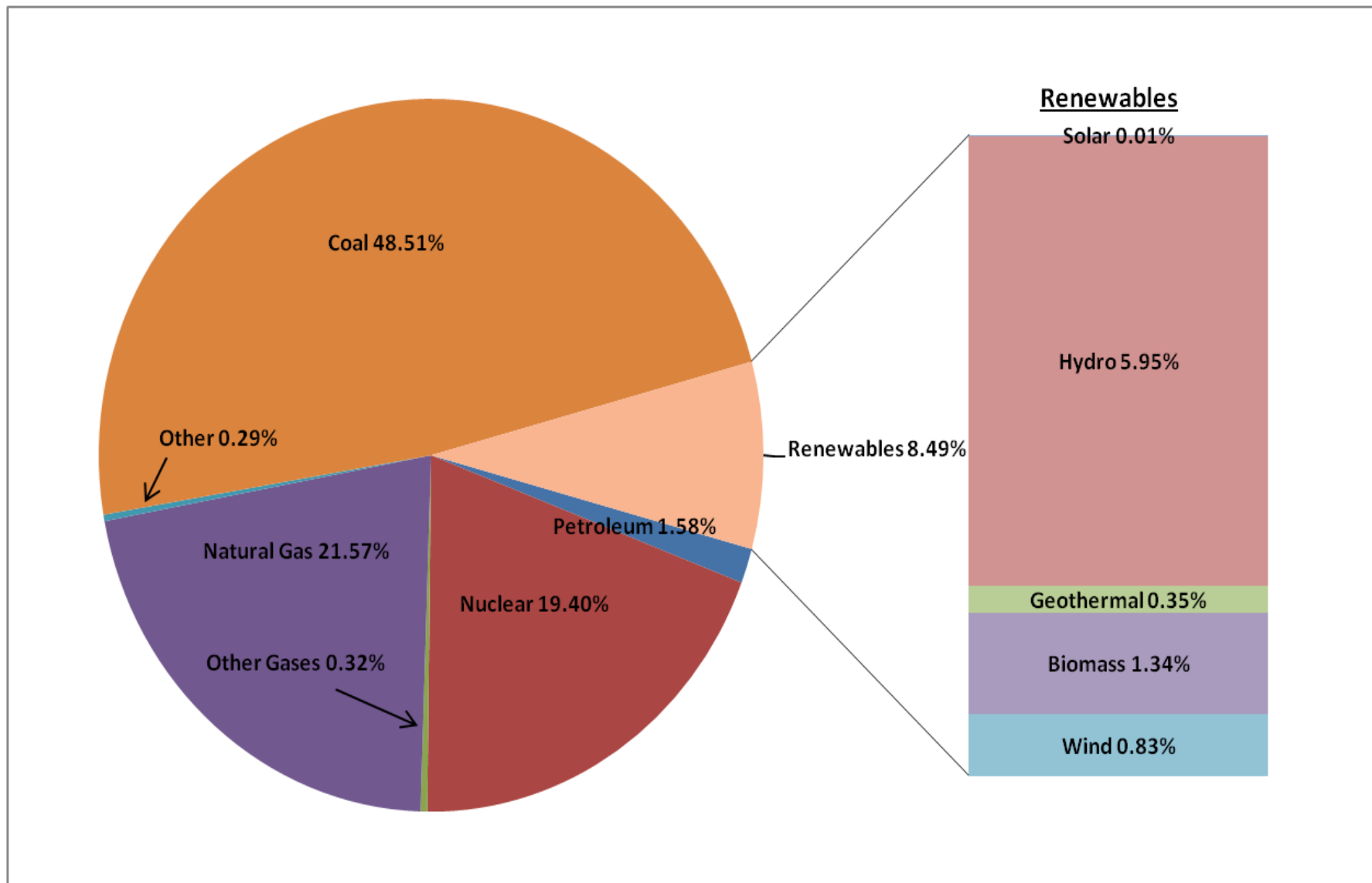
Metrics

How much
renewable energy
is being generated?

- National data
- State by State data
- Individual technologies

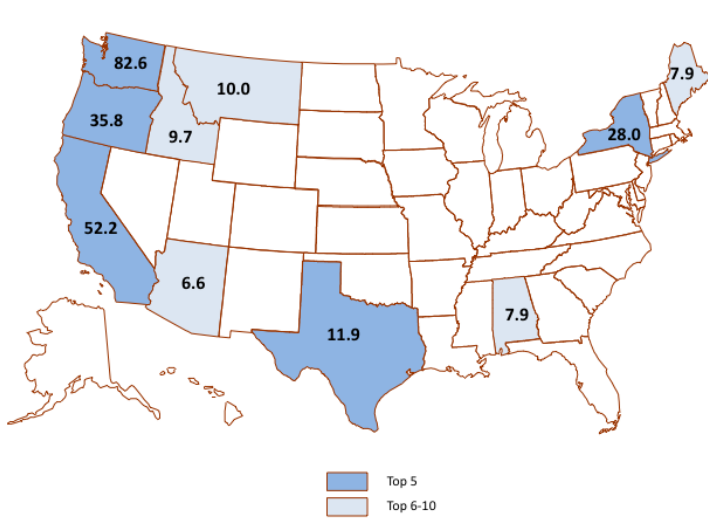
- Total capacity/generation
- Hydro vs. Non-hydro RE
- % of Total Generation
- Per Capita
- Per GSP
- % Change (most improved)

US Electricity Generation by Source (2007)



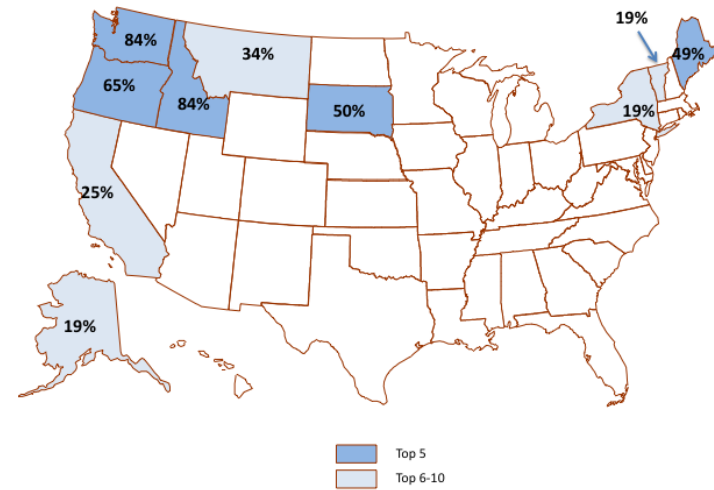
Total Renewable Energy Generation Leaders (2007)

Total Renewable Energy Generation (TWh)



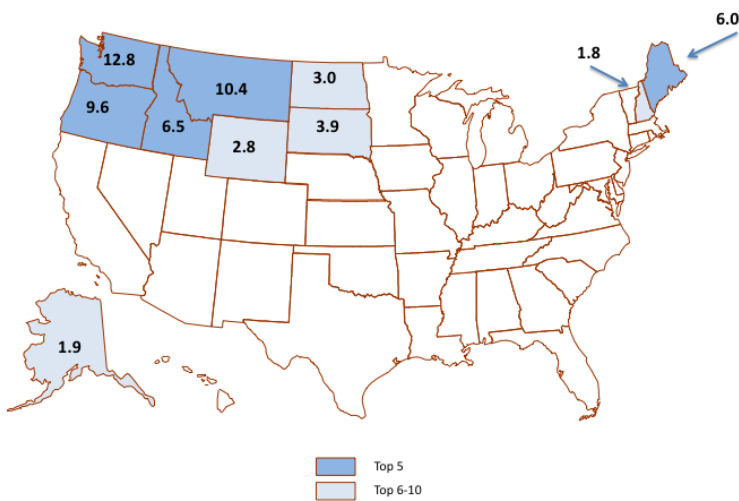
Source: State of the States 2009

Renewable Energy Generation as a % of Total State Electricity Generation



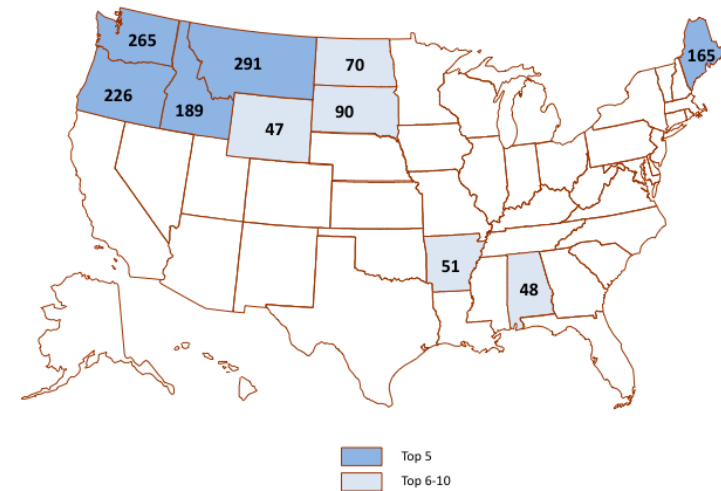
Source: State of the States 2009

Renewable Energy Generation per Capita (MWh/Capita)



Source: State of the States 2009

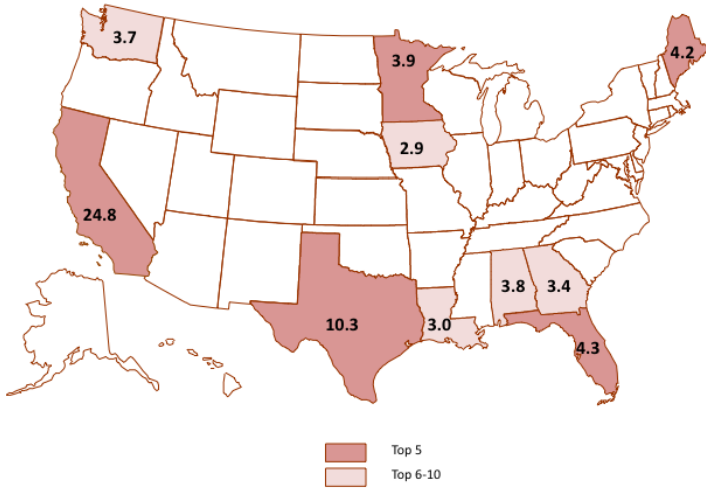
Renewable Energy Generation per Gross State Product (MWh/GSP2007)



Source: State of the States 2009

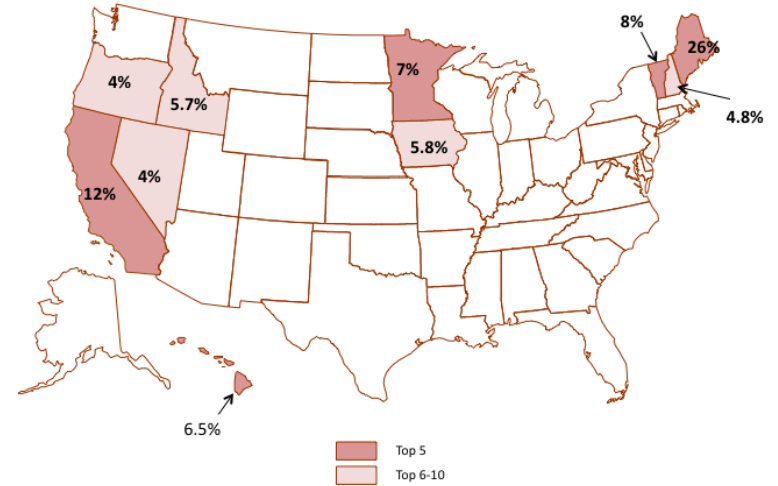
Non-hydro Renewable Generation Leaders (2007)

Non-Hydro Renewable Electricity Generation (TWh)



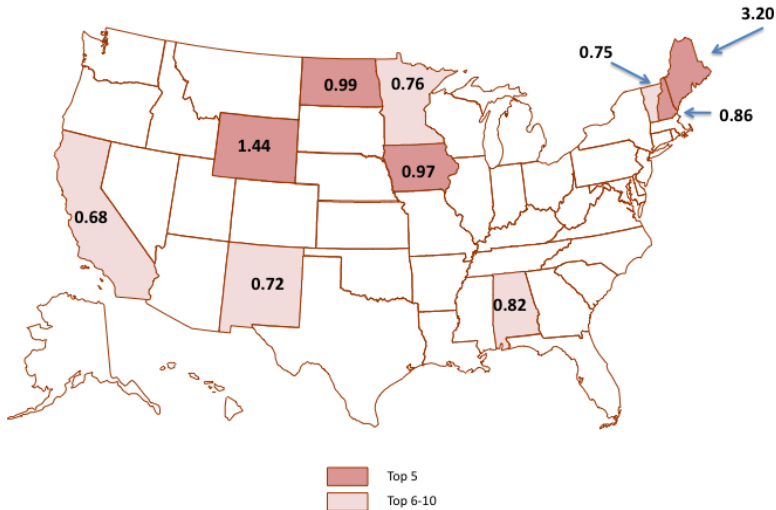
Source: State of the States 2009

Non-Hydroelectric Renewable Energy as a % of Total State Generation



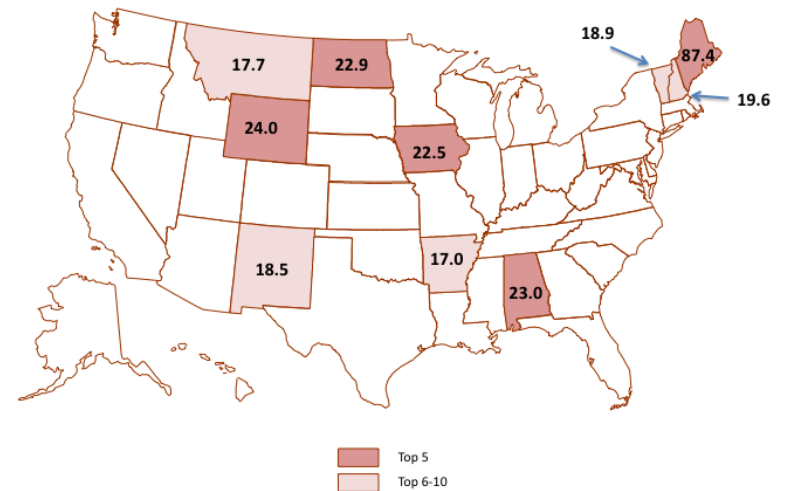
Source: State of the States 2009

Non-Hydroelectric Renewable Energy Generation per Capita (MWh/Capita)



Source: State of the States 2009

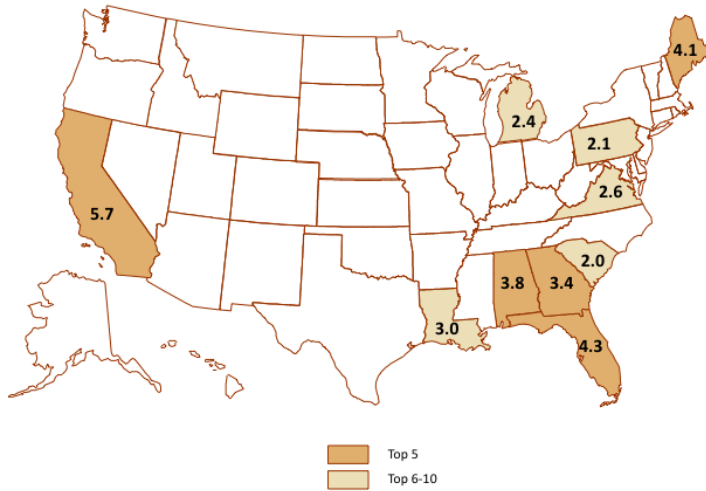
Non-Hydroelectric Renewable Energy Generation per GSP (MWh/M\$ 2007GSP)



Source: State of the States 2009

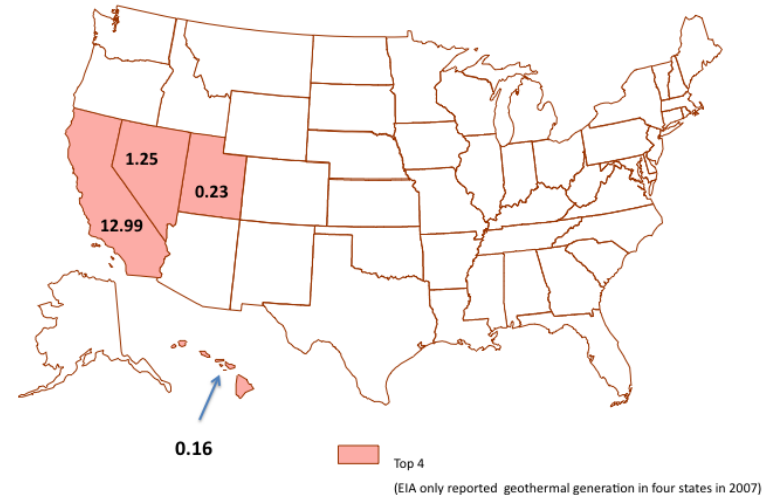
Renewable Energy Leaders by Resource (2007)

Biomass Generation – TWh (2007)



Source: State of the States 2009

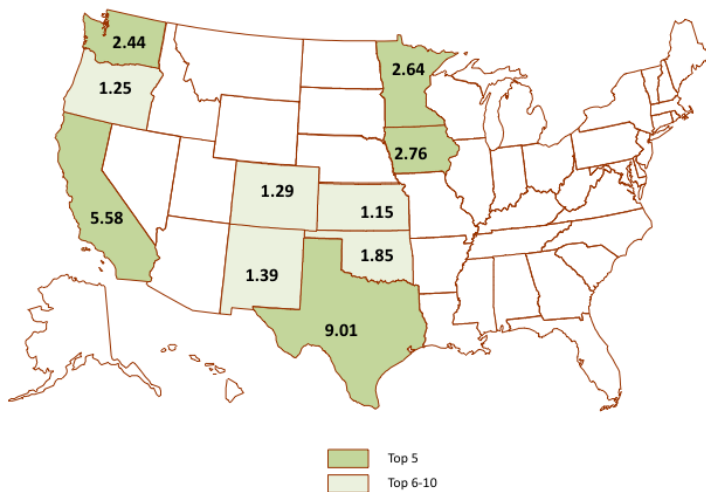
Geothermal Generation – TWh (2007)



Source: State of the States 2009

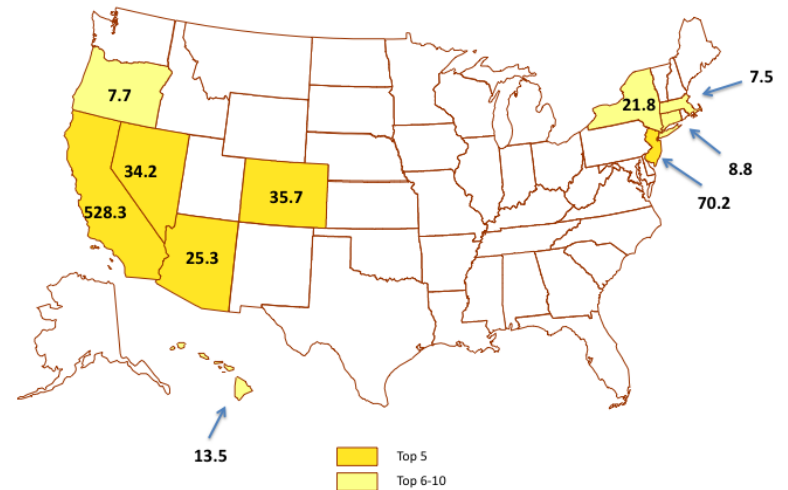
(EIA only reported geothermal generation in four states in 2007)

Wind Generation – TWh (2007)



Source: State of the States 2009

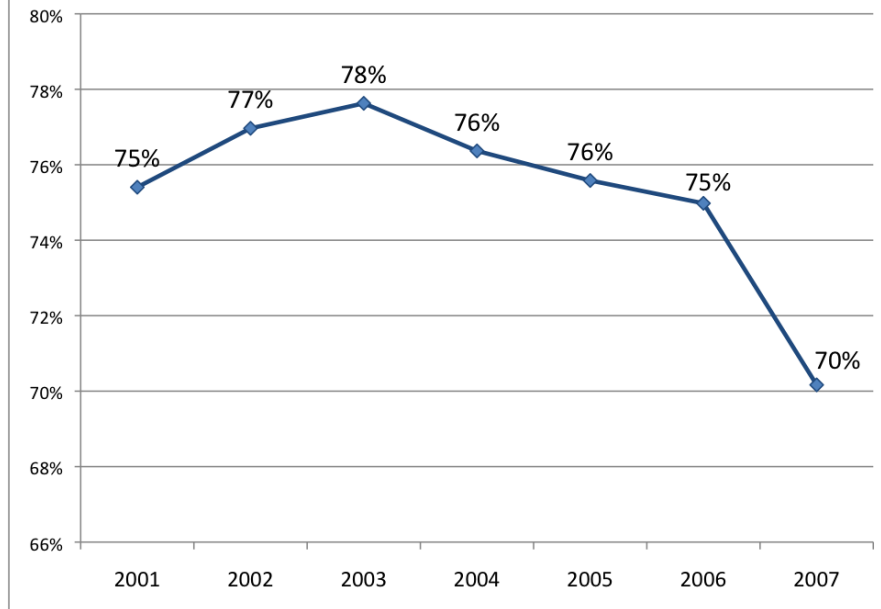
Grid-Connected Solar Capacity – MWdc (2008)



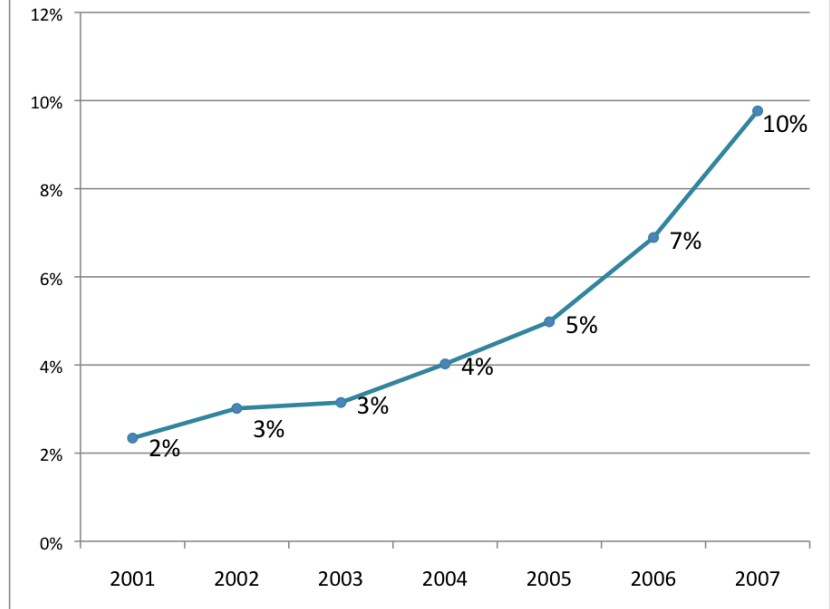
Source: State of the States 2009

Hydro and Wind Generation as a % of Total Renewable Energy

U.S. Hydroelectric Generation as a Percent of Total Renewable Generation (2001-2007)



U.S. Wind Generation as a Percent of Total Renewable Generation (2001-2007)



Part 2: State Policies

Policy Definitions

What policies are being used?

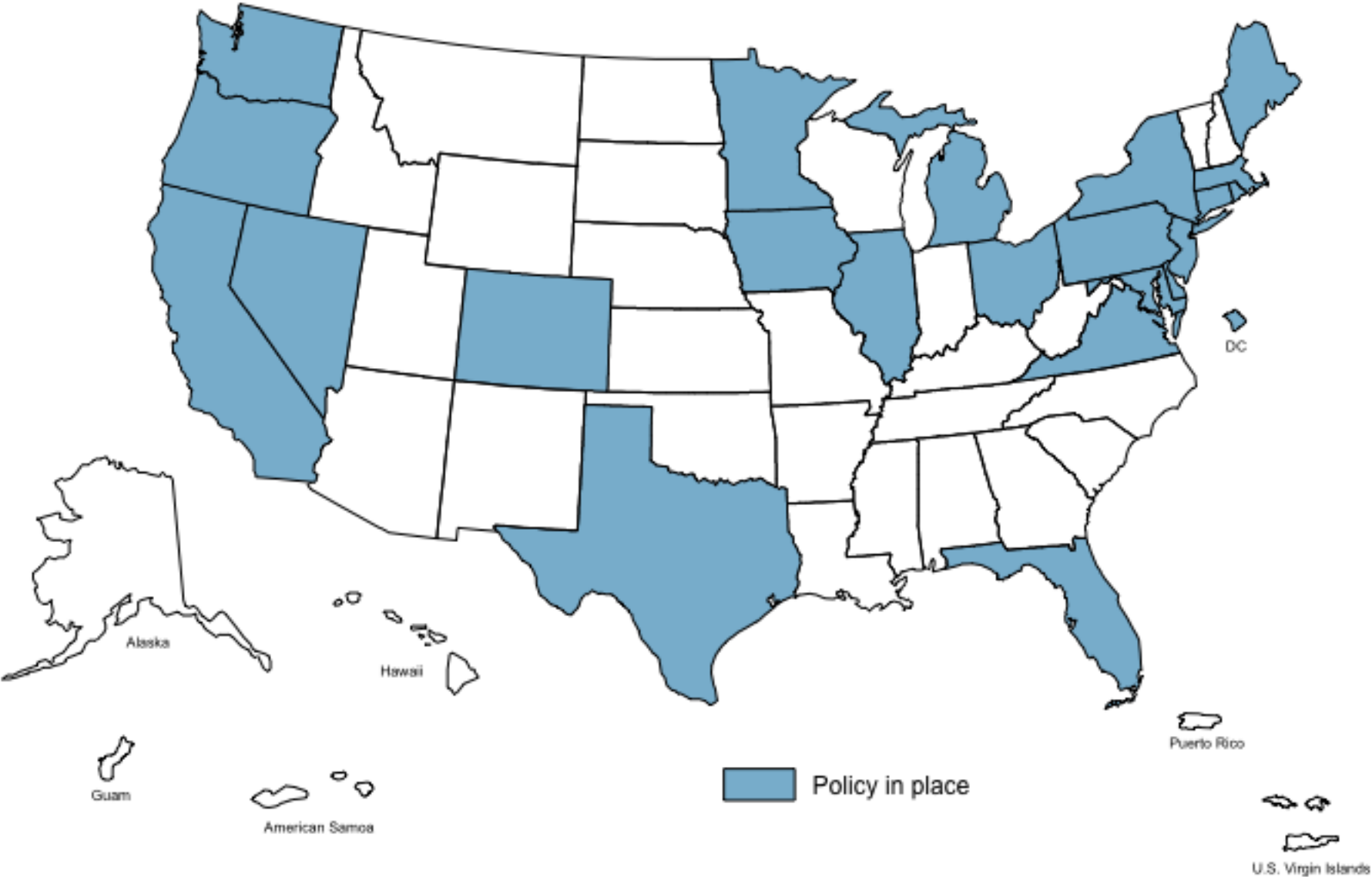
Best Practices

What are the most effective features of the policies?

Implementation

Which states have implemented the various policies?

States with Required Generation Disclosure



Part 3: Quantitative Policy Evaluation

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

Explore the effects of:

- Individual policies
- Policy interactions (portfolios)
- Policy Age (RPS)
- Best practice design features
- Contextual factors

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

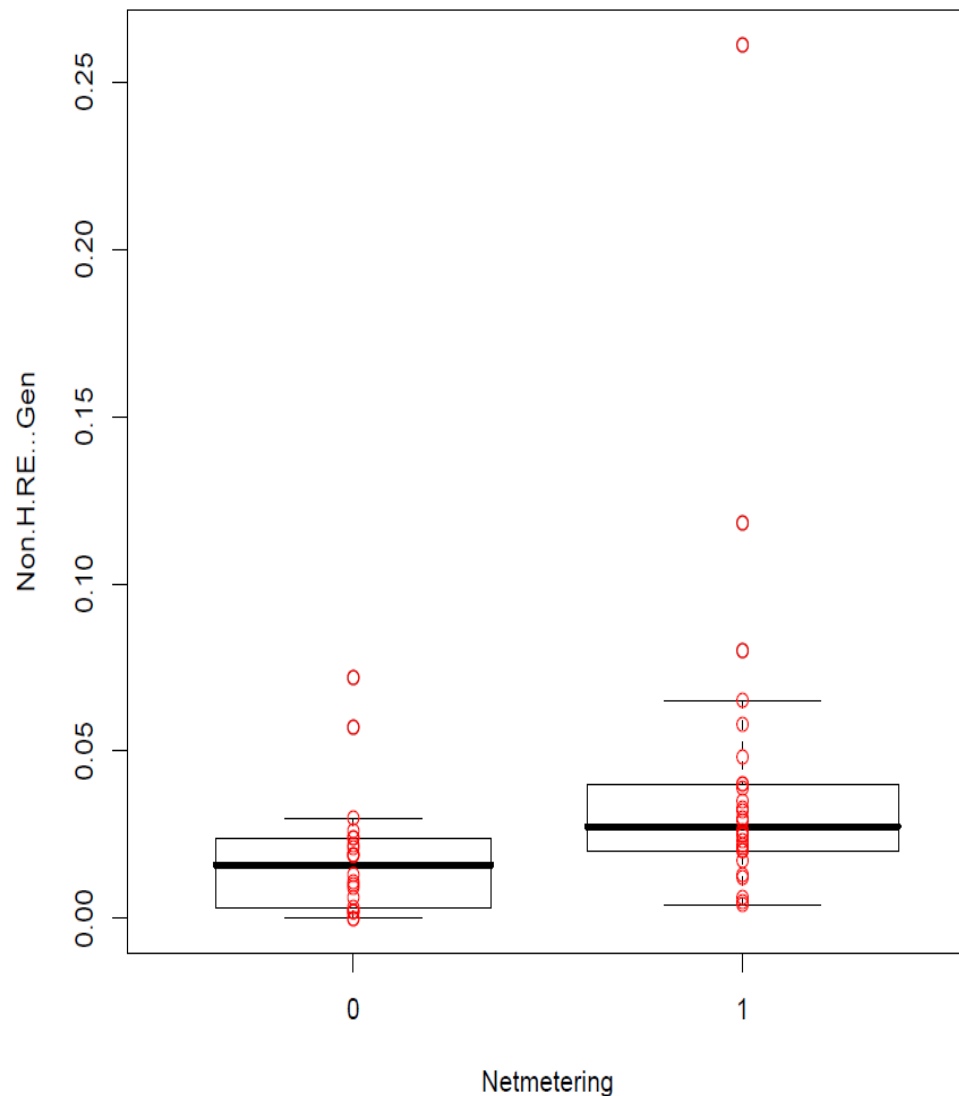
Step 1:

Identify significant relationships.

Step 2:

Visualize the data for each significant relationship.

t-test: p-value = 0.0276147084711383



Quantitative Policy Evaluation: Results

Individual Policies

States with Net Metering Policy in 2005 had significantly more renewable energy generation in 2007 than those without the policy.

2007 Generation Metric	States without Net metering Policy in 2005 (Mean Value)	States with Net metering Policy in 2005 (Mean Value)
Non-hydro renewable generation as a % of total state generation**	1.80%	4.10%
Non-hydro renewable generation per capita**	0.26 MWh/person	0.59 MWh/person
Non-hydro renewable generation per GSP**	6.7 MWh/M\$GSP	13.6 MWh/M\$GSP

**t-test significant to the 0.05 level

Quantitative Policy Evaluation: Results

Policy Portfolios

The total number of policies implemented is related to higher levels of generation, particularly for individual technologies.

States that have implemented both Generation Disclosure and Required Green Power policies also have significantly more renewable energy generation.

Quantitative Policy Evaluation: Results

Policy Age (RPS)

There is a correlation between the age of an RPS policy and increased state wind capacity.

Best Practice Design Features

Some RPS best practice features are related to increased generation, however no successful model for combining features was identified.

Quantitative Policy Evaluation: Results

Contextual Factors

Removing the highest and lowest performing states reduces the number of relationships seen. Contextual factors other than policy may be stronger indicators of development

Caveat for all results:

We can not assume causality!

- There is a relationship between policy and increased renewable energy development.
- This relationship is unlikely to be due to chance.

Part 4: Contextual Factors

What other factors affect development?

Factors Affecting Renewable Energy Markets



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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Data Sources

DSIRE

(policies & incentives)

EIA

(generation)

AWEA

(small wind data)

IREC/Sherwood

(solar PV)

Census Bureau

(population)

Bureau of Economic Analysis

(GSP)