NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Clean Energy Policies Analysis

The Role of Policy in Clean Energy Market Transformation

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TAP Webinar

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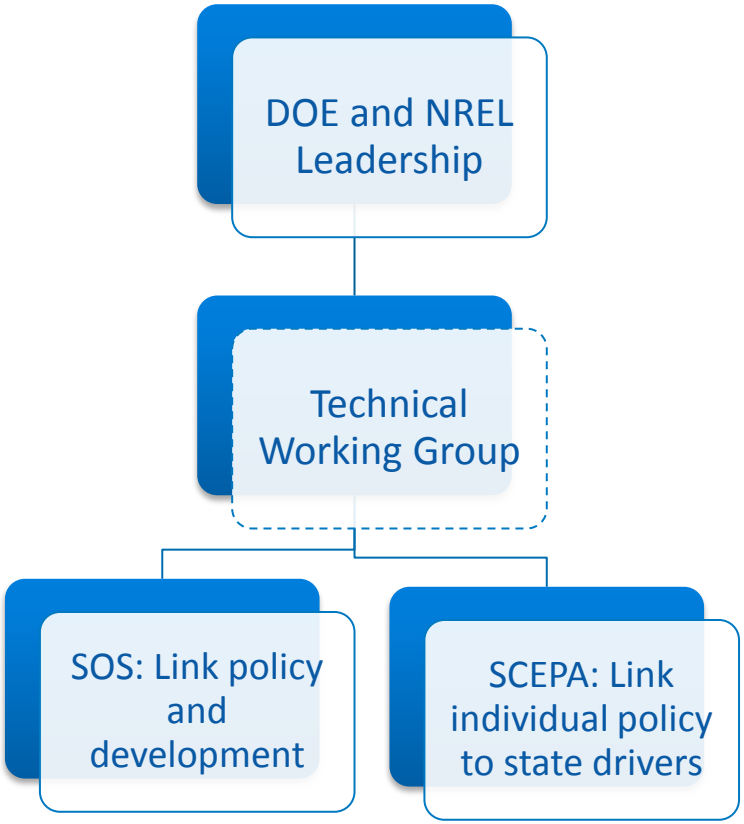
FY07-FY09 Structure and Outcomes

Goals:

1) Quantify the role of state policy in CE development

2) Connect CE policy to state goals



Reports:

2007: SCEPA: Summary of Working Group Input and Methodology Development

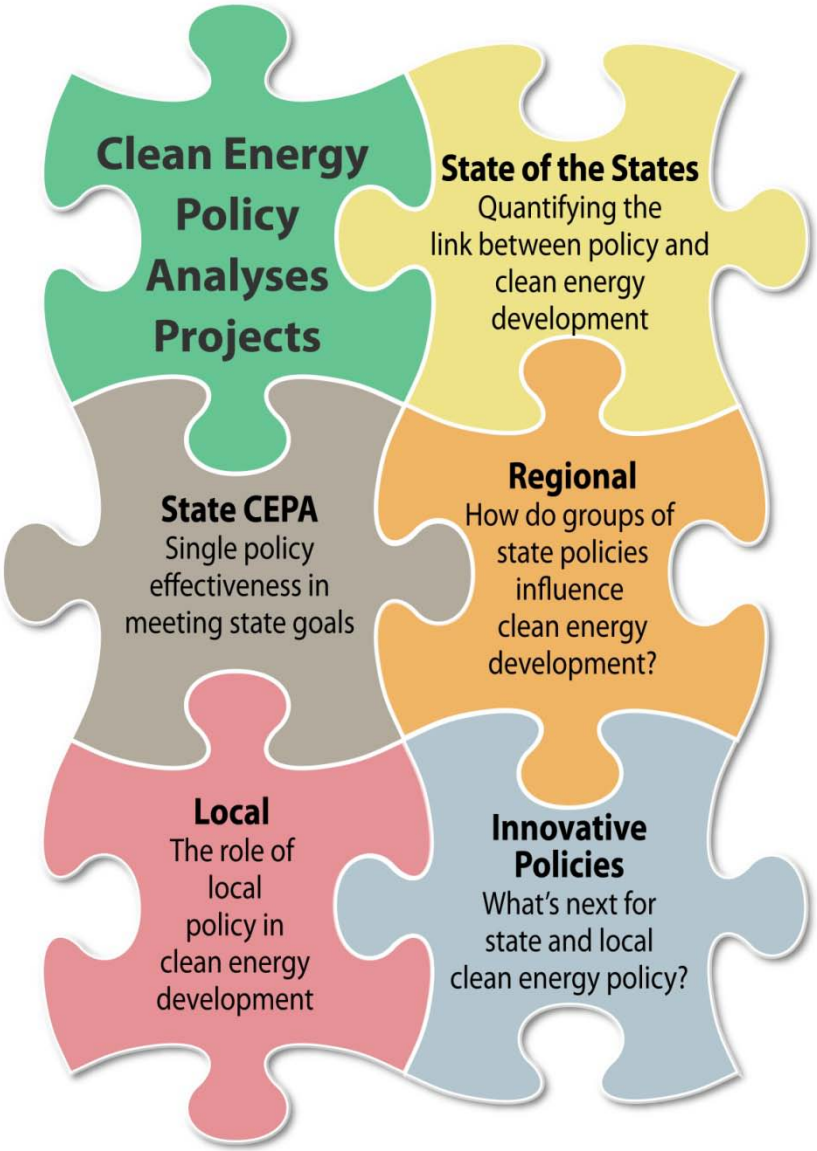
2008

- SCEPA: RPS, RFS, Tax Incentives
- SOS 2008 (2006 Data)

2009

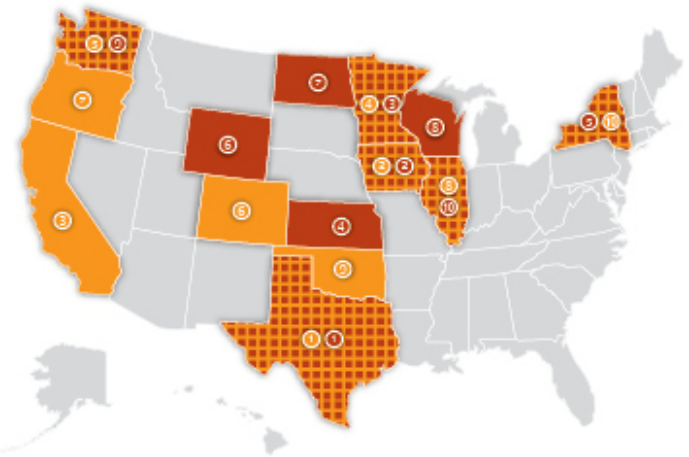
- SCEPA: FIT, Manufacturing Policies, Loan Programs
- SOS 2009 (2008 Data)

Outreach: Presentations, websites, TA


Clean Energy Policy Analyses Projects
State of the States
Quantifying the link between policy and clean energy development
State CEPA
Single policy effectiveness in meeting state goals
Regional
How do groups of state policies influence clean energy development?
Local
The role of local policy in clean energy development
Innovative Policies
What's next for state and local clean energy policy?

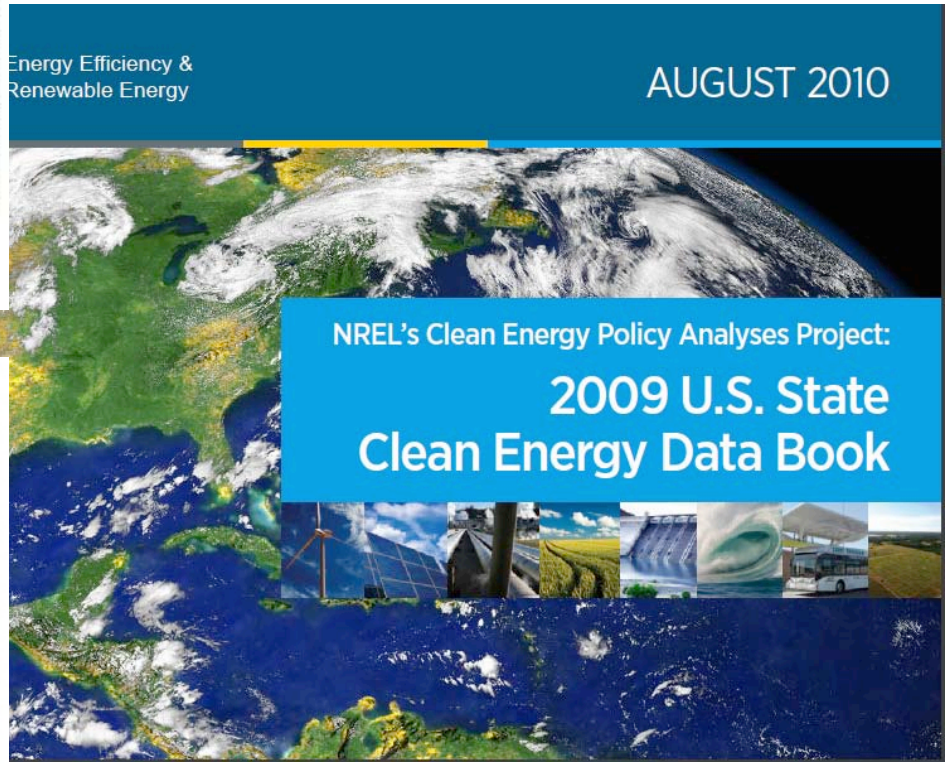
State Clean Energy Data Book

Total Installed Capacity (2009, MW)	
1 California	1,271
2 Louisiana	768
3 Vermont	759
4 Florida	711
5 Alabama	622
6 Oregon	564
7 New Mexico	449
8 Michigan	445
9 Massachusetts	430
10 Kentucky	426



Cumulative Capacity (2009, MW)	
1 Texas	9,410
2 Iowa	3,670
3 California	2,794
4 Washington	1,980
5 Minnesota	1,809
6 Oregon	1,758
7 Illinois	1,547
8 New York	1,274
9 Colorado	1,246
10 North Dakota	1,203

Annual Capacity (2009, MW)	
1 Texas	2,292
2 Indiana	905
3 Iowa	879
4 Oregon	691
5 Illinois	632
6 New York	568
7 Washington	542
8 North Dakota	488
9 Wyoming	425
10 Pennsylvania	388



http://www.nrel.gov/cepa

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Purpose

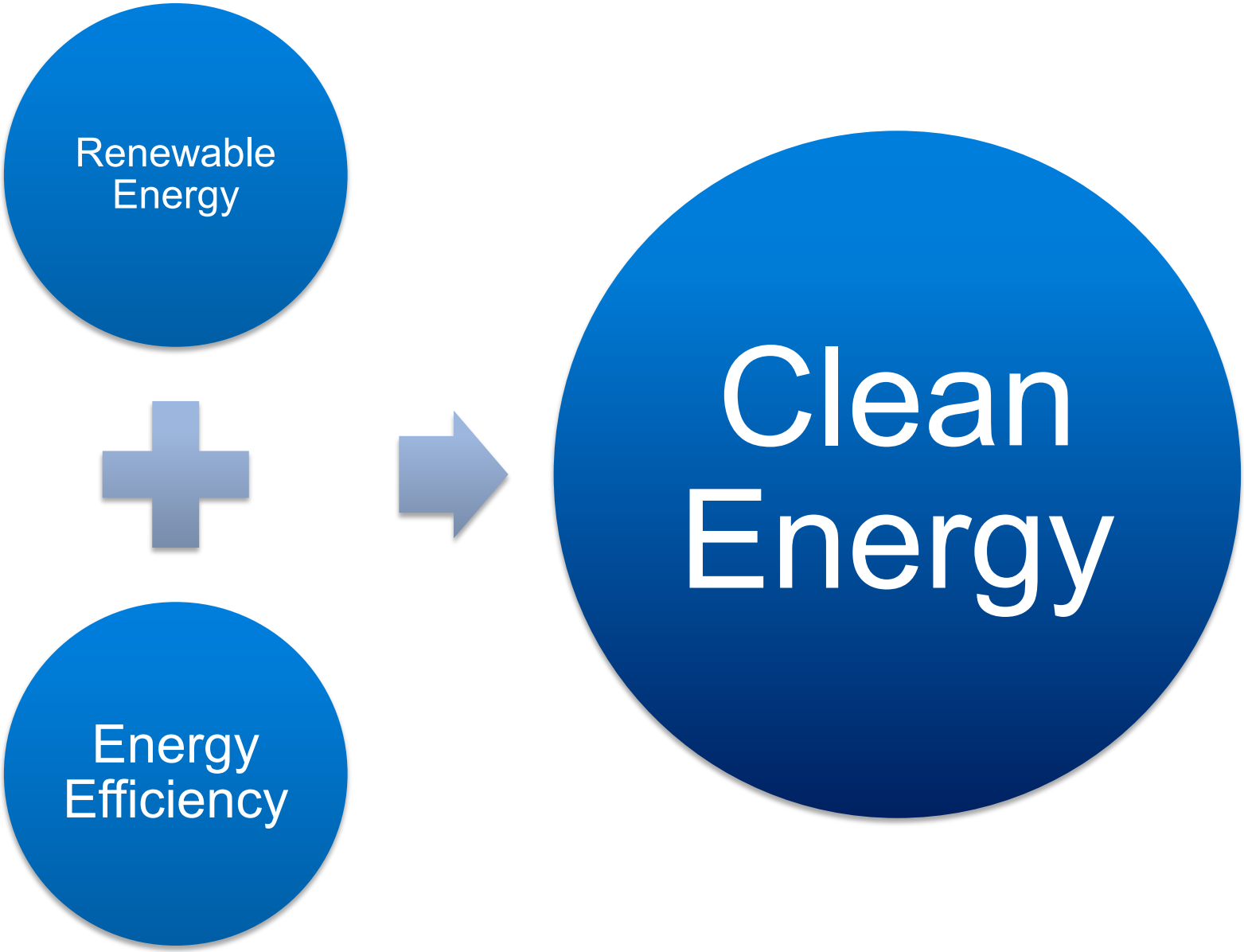
Background

Methods

Results

Conclusions

Definition: Clean Energy



Purpose

To augment and build on traditional case study and narrower quantitative analyses to develop a **quantitative understanding of policy impacts** using statistical and empirical methods

To open the door for more thorough analyses of policy options

To inform future policy development

To ultimately optimize the market share of clean energy

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Background

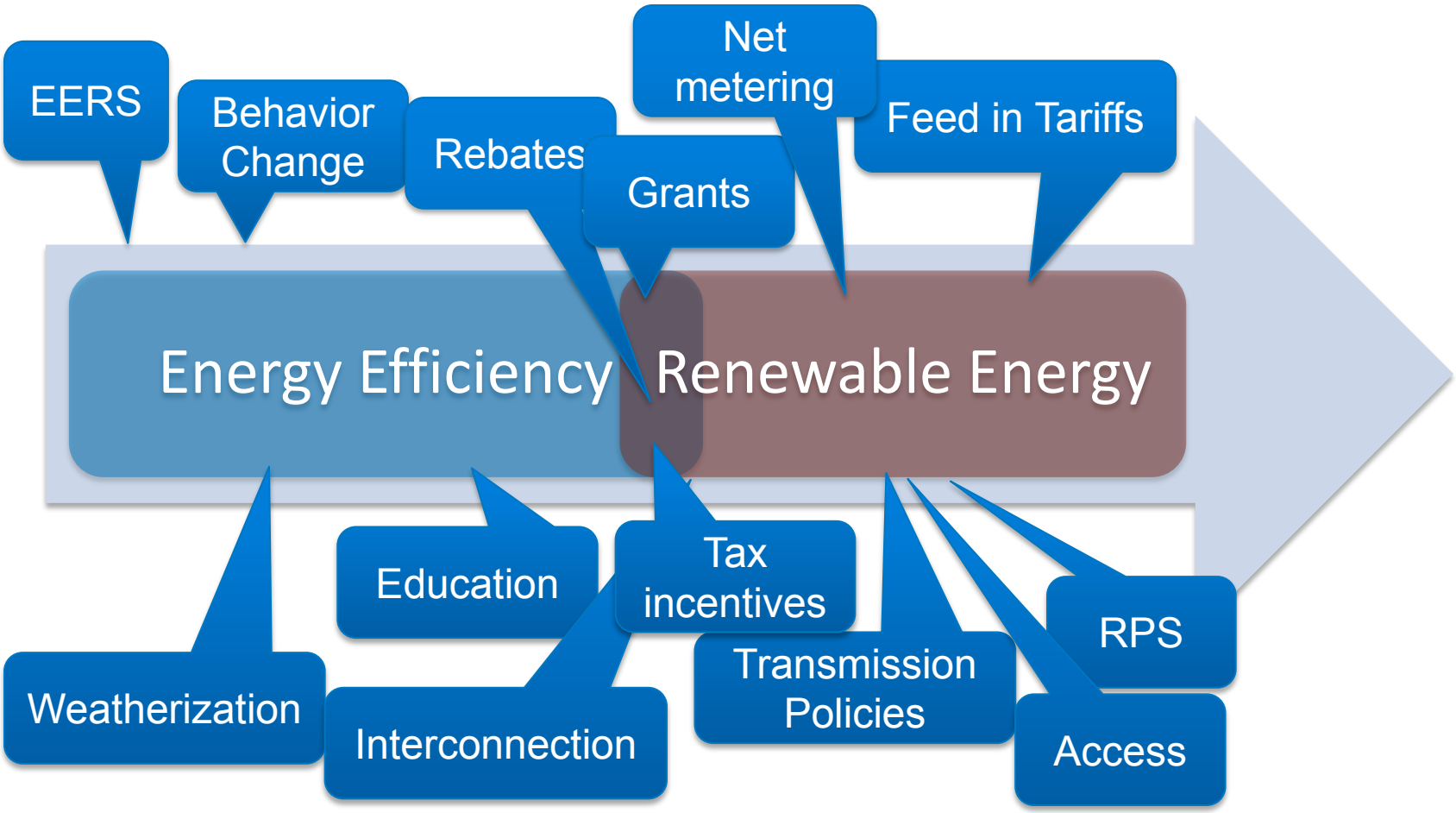
Increasing use of state policy to drive clean energy market transformation is leading to extensive research working to determine the best policies

Result: numerous best practice guidebooks have emerged to assist the development of effective policy

EPA	BERKELEY LAB LAWRENCE BERKELEY NATIONAL LABORATORY	U.S. DEPARTMENT OF ENERGY	SOLAR AMERICA CITIES
Clean Energy: Environment Guide to Action	Case studies on projects and policy implementation	Case studies and examples of RE and EE projects	Design best practices and a local policymaker's guidebook

Background

State policymakers have many policy options aiming at the development of clean energy resources, including various rules, regulations, and incentives



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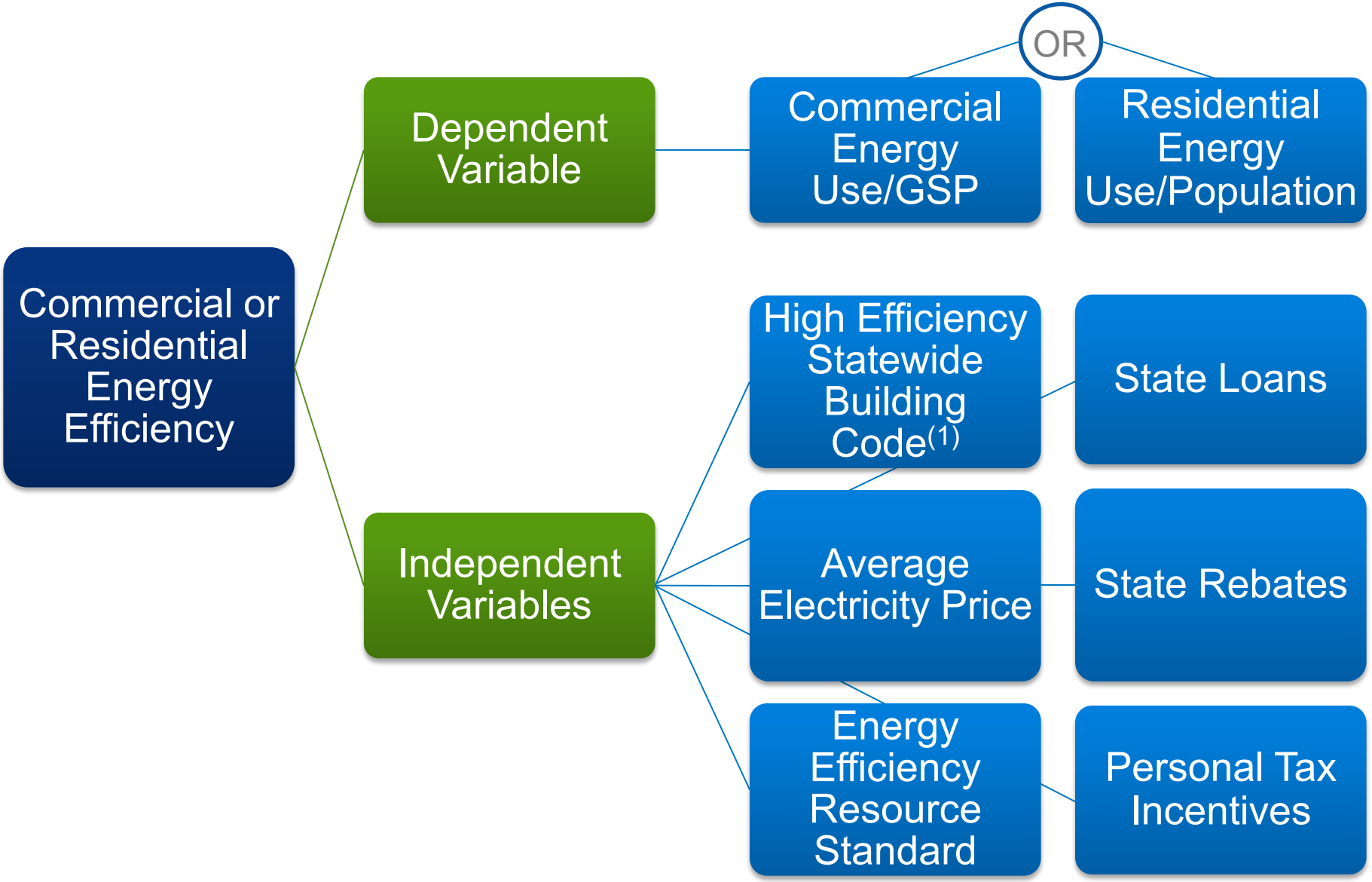
Methods – Renewable Energy

Policies Serving as Independent Variables

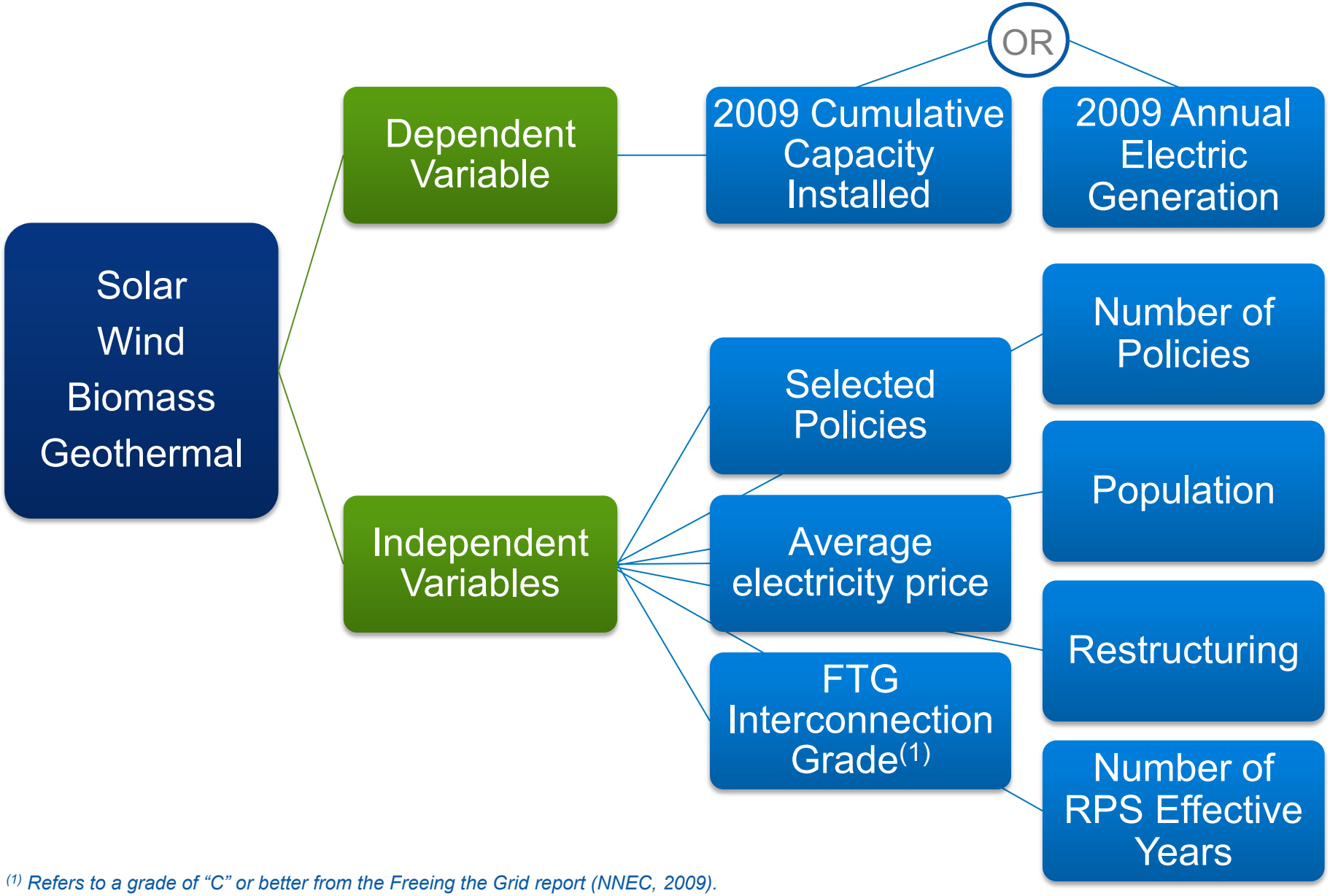
	PV	Wind	Geothermal	Biomass
Access Laws	x			
Bonds				
Construction and Design				
Contractor Licensing	x	x	x	x
Corporate Tax Incentives	x	x		x
Equipment Certification	x			
Generation Disclosure				
Grants	x			
Industry Support		x	x	x
Interconnection	x	x		
Line Extension Analysis	x		x	
Loans			x	x
Net Metering	x	x		
Personal Tax Incentives	x		x	
Production Incentives	x	x	x	x
Property Tax Incentives	x			x
Rebates	x			
RPS	x	x		
RPS with Solar Set Aside	x			
Sales Tax Incentives	x	x		
Voluntary & Mandatory Green Power	x	x		

Methods – Energy Efficiency



(1) *Equal to or better than ASHRAE 90.1 2004.*

Methods – Renewable Energy



(1) *Refers to a grade of "C" or better from the Freeing the Grid report (NNEC, 2009).*

Methods – Challenges

Small Sample Size	• Constrains the number of variables that may be tested in the regression • Policies are binary
Time Series Data	• Data for policies beyond 2007 would allow for the construction of a more robust model
Policy Terms	• Vary from state to state
Dependent Variable	• RE capacity or generation installed, not the percent of generation that is RE, which is typically targeted by RPS

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Results

The regression models produced were able to explain between 44% and 63% of the variation between states in capacity and generation (depending on technology), and between 46% and 68% of energy use

Percent of Variation Between States Explained by Models (Adjusted R^2)

	2009 Capacity/Generation vs 2008 Policies (One Year Lag)		2009 Capacity/Generation vs 2007 Policies (Two Year Lag)	
Technology	**Capacity (MW)**	**Generation (MWh)**	**Capacity (MW)**	**Generation (MWh)**
Biomass	43.7%	46.7%	49.8%	52.6%
Geothermal	47.2%	47.4%	49.8%	50.5%
PV	58.2%		63.3%	
Wind	47.5%	45.7%	45.5%	43.6%

	Impact of Policy on Efficiency
Commercial	67.5%
Residential	46.1%

Results – Commercial Energy Use

- **Expected**: a negative relationship between efficiency building codes, energy efficiency resource standards (EERS), commercial electricity price, and commercial energy consumption

- **Unexpected**: the existence of personal tax incentives is associated with increased commercial energy use

Impact of Policy on Commercial Efficiency: Commercial Consumption/GSP (2008 Incentives)

Variable	Beta	P-Value
Constant	2,029.5	0.000
High Efficiency Commerical Building Code	-104.7	0.042
2008 Personal Tax Incentives	154.4	0.010
Average Commercial Electricity Price (2009)	-48.8	0.000
Energy Efficiency Resource Standard (EERS)	-193.8	0.000
Adjusted R^2	0.675	
Number of Observations	51	

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Policy Alone

- Does not explain variability in state clean energy growth
- Results are better when other variables (population, electricity price, number of years a policy is in place) are incorporated into the models

Conclusions

Targeting

- Current set of policies is more targeted at influencing wind and solar development than development of biomass and geothermal
- State policies, while broadly applicable across renewable energy resources, may not be usable by developers of those resources because the policies do not meet the resource's needs

Conclusions

Time

- Policies are more connected with clean energy development the longer they are in place
- Policy longevity is an important aspect of effectiveness

Conclusions

Policy Mixes

- Where significant relationships were found, mixes of policies explain growth best
- Creating an environment for investment in clean energy by implementing a suite of policies may be more effective than choosing a single or small number of mechanisms

Conclusions and Next Steps

- This research provides another piece in the understanding of how **policy interacts with market development of clean energy**
- **More experience** with policies and **further research** are necessary to better understand these relationships
- As policies are in place for longer periods of time, their **impacts on clean energy development will become clearer**, as it takes time to develop clean energy projects once the environment is established for their development

Conclusions

Thank you for your time!

For more information: http://www.nrel.gov/cepa

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