A recording of the following presentation, complete with audio, can be found here:

www.youtube.com/watch?v=OEvEbG6pIuM

111(d): Next Steps for States

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Elizabeth A. Stanton, PhD

Sarah Jackson

Bruce Biewald

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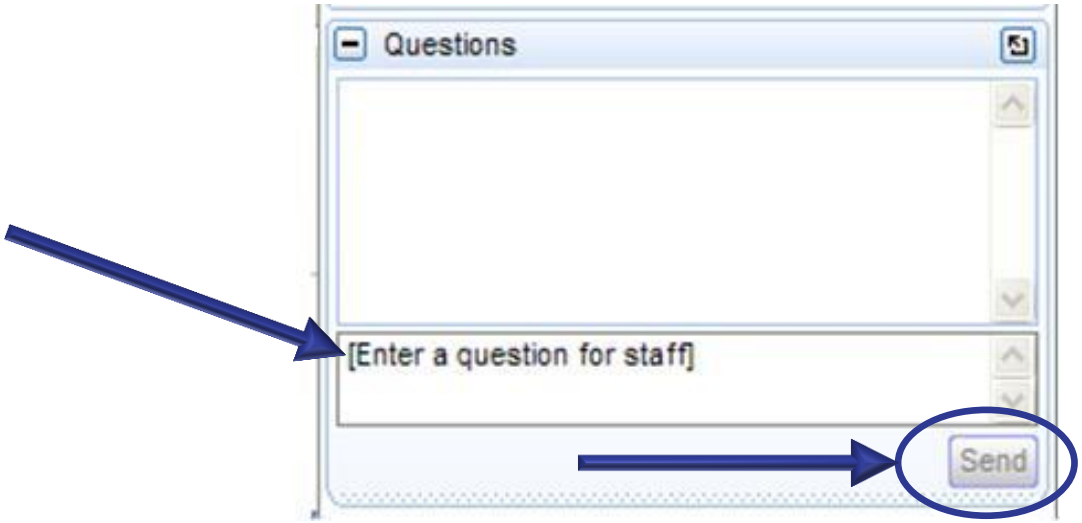
Webinar Logistics

- Presentation slides are available to download on Synapse's website at: http://www.synapse-energy.com/Downloads/SynapsePresentation.2014-07.0.111(d)-Next-Steps-Webinar.S0095.pdf
- Attendees will be in listen-only mode (muted) throughout today's webinar.
- During the webinar, you may submit a question by typing into the ***Enter a question for staff*** box and clicking the ***Send*** button. Staff will read and answer these questions as time allows.



Synapse Energy Economics

- Founded in 1996 by CEO Bruce Biewald
- Leader for public interest and government clients in providing rigorous analysis of the electric power sector
- Staff of 30 includes experts in energy and environmental economics and environmental compliance

Agenda

Today's Presentation:

- The Fundamentals: Components of 111(d) relevant to state action
- Drafting Comments: What feedback is EPA seeking?
- Compliance and Least-Cost Planning: Analysis tools for states

What We're Not Covering Today:

- Is 111(d) legal?
- Is 111(d) good or bad for my state?

Fundamentals

111(d) Timeline

1970	**Clean Air Act enacted** by President Nixon in the face of growing national concern over air pollution, which culminated in the 1970 Earth Day protests
1990	**Clean Air Act amendments** put in place by President Bush, Sr.
2007	**Massachusetts v. EPA ruling by U.S. Supreme Court** determines that greenhouse gases are air pollutants
Dec 2009	**EPA endangerment finding** declares that current and projected concentrations of six key GHGs—including CO_2—threaten the public health and welfare of current and future generations
Jan 2011	**EPA's first regulation of GHGs** requires air permitting only for high-emitting new or modified facilities that would otherwise have to go through air permitting for non-GHG pollutants
Apr 2012	**Proposed New Source Performance Standard (NSPS) for CO_2** under Section 111(b) of the Clean Air Act requires CO_2 performance standards for new fossil fuel-fired power plants
Jan 2014	**Initial 111(b) proposal withdrawn and new CO_2 NSPS for fossil fuel-fired power plants issued**
Jun 2014	**Proposed 111(d) rule issued for CO_2 from existing fossil fuel-fired power plants**

The 111(d) Emission Rate

- Measured in lbs of CO_2 per MWh
- The “currency” for both targets and compliance
- The same formula for initial year (2012), targets (2020-2030), and compliance measurement (2020-2030)
  - Initial 111(d) Emission Rate: for each state; based on 2012 historical data
  - Target 111(d) Emission Rates: for each state and each year 2020-2030; achievable emission reductions based on BSER
  - Compliance 111(d) Emission Rate Measurement: for each state and each year 2020-2030; emission and MWh measurements of actual performance in the previous year

The 111(d) Emission Rate

- Measured in lbs of CO_2 per MWh
- The "currency" for both targets and compliance
- The same formula for initial year (2012), targets (2020-2030), and compliance measurement (2020-2030)

111(d) Emission Rate =

$$\frac{\text{Fossil Fuel Emissions (lbs of } CO_2\text{)}}{\text{Fossil Fuel Generation (MWh)} + \text{Nuclear Generation (MWh)} + \text{Renewable Generation (MWh)} + \text{Energy Efficiency (MWh)}}$$

Fossil Fuel Emissions (lbs of CO_2)
Coal, natural gas CC and CT, oil, and IGCC, and useful thermal from co-generation from generators that existed in 2012 and use of NGCC's under construction in 2012 above a 55% CF

Fossil Fuel Generation (MWh)
Coal, natural gas CC and CT, oil, and IGCC, and useful thermal from co-generation from generators that existed in 2012 and use of NGCC's under construction in 2012 above a 55% CF

+

Nuclear Generation (MWh)
From 2020, 5.8% of use of 2012 existing nuclear; Use of under construction in 2012+ nuclear

Renewable Generation (MWh)
Excludes hydro existing in 2012

Energy Efficiency (MWh)
Cumulative from 2017 with sunsetting; In 2012, this value is 0 MWh

The 111(d) "Building Blocks"

BB 1: Reduce Average Coal Emission Rate by 6%

BB 2a: Redispatch to Existing NG (up to an average of 70%, coal and oil capacity permitting)

BB 2b: Redispatch to Under-Construction NG (from 55% to 70%: only 15% difference counts)

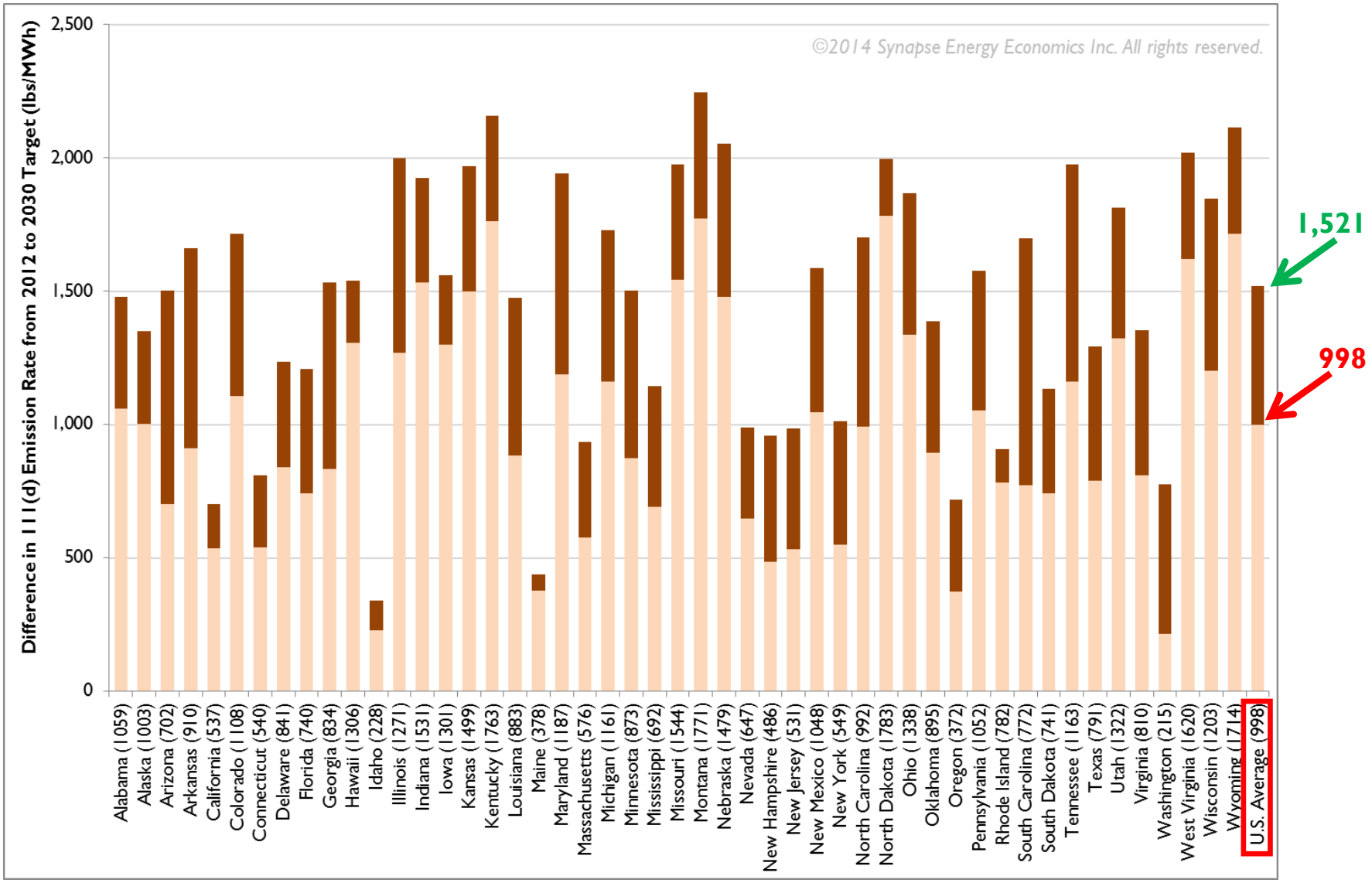
BB 3a-i: Credit for Existing "At-Risk" Nuclear (5.8% of 2012 nuclear fleet)

BB 3a-ii: Credit for Nuclear Under Construction in 2012

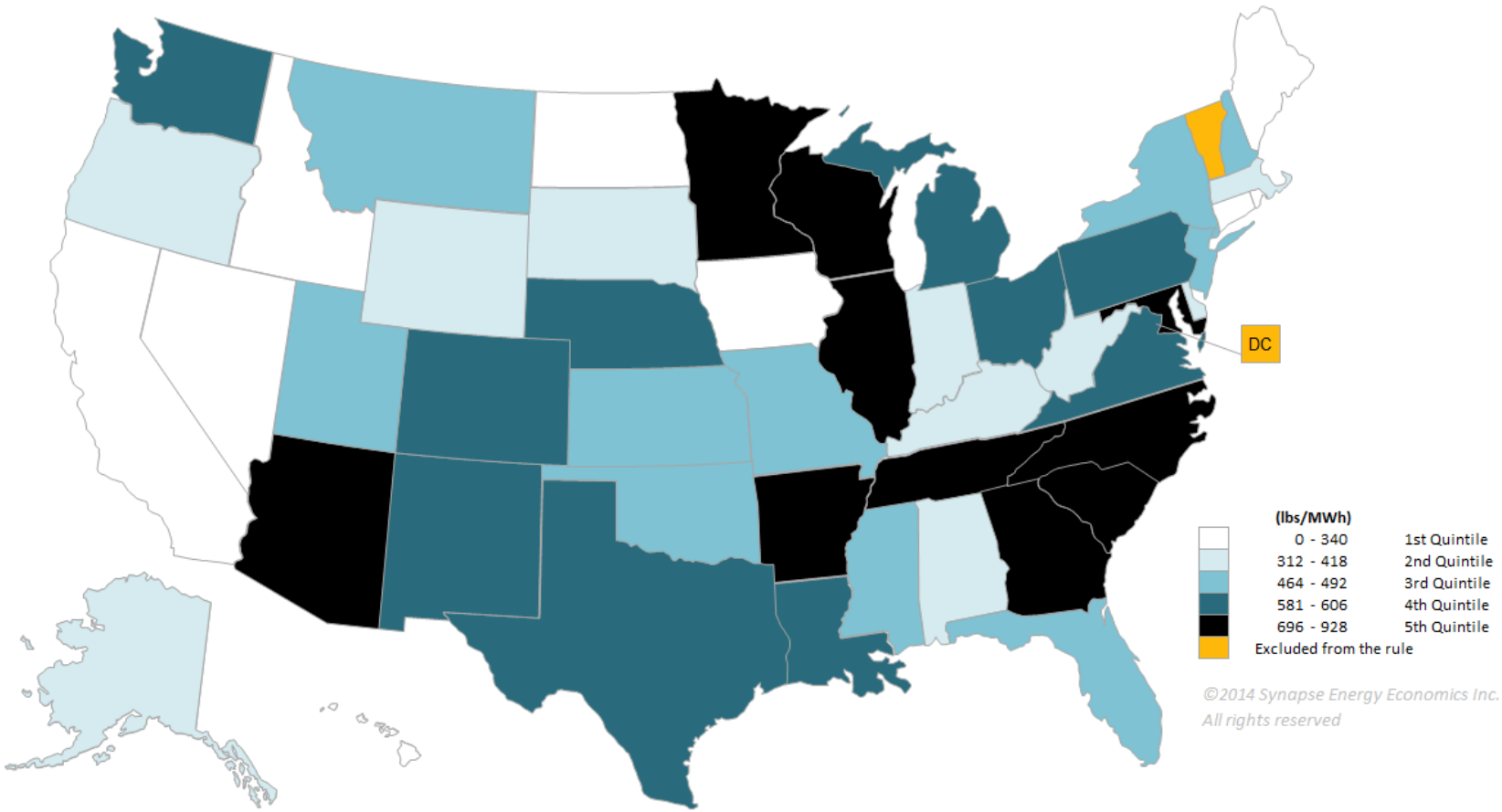
BB 3b: Credit for Renewable Generation (excludes existing hydro)

BB 4: Credit for Energy Efficiency Improvements (cumulative from 2017; in 2012, this value is 0 MWh)

U.S. Average Initial and Target
Initial 2012 and Target 2030 111(d) Emission Rates



Difference between Initial 2012 and Target 2030 111(d) Emission Rates (lbs/MWh)



EPA's Estimated Option 1 National 2030 Net Benefits in Billions of 2011$

	Benefits	less	Costs	equals	Net Benefits
Electric Sector [for both EE program participants and non-participants]	**$34** [total system benefits net of costs in IPM modeling]		**$21** [EE program administrator costs]		**$13**
Energy Efficiency Program Participants	not monetized		**$21**		**($21)**
Societal	**$10-$94** [climate] **$24-$66** [health]		**$0**		**$10-$94** [climate] *$1-$10 per capita* **$24-$66** [health] *$69-$189 per capita*
Total	**$68-$194**		**$42**		**$26-$152**

Energy Efficiency and 111(d) Impacts

Impacts on **Participants and Non-Participants**:

- Downward pressure on rates: wholesale market price suppression, avoided T&D, increased reliability, avoided risk
- Higher rates: due to utilities recovering fixed costs over lower sales

Impacts on **Participants**:

- Higher rates **but** lower bills because of reduced energy consumption, as well as reduced wholesale market costs
- May require expenditures from participant, but bill reduction greater

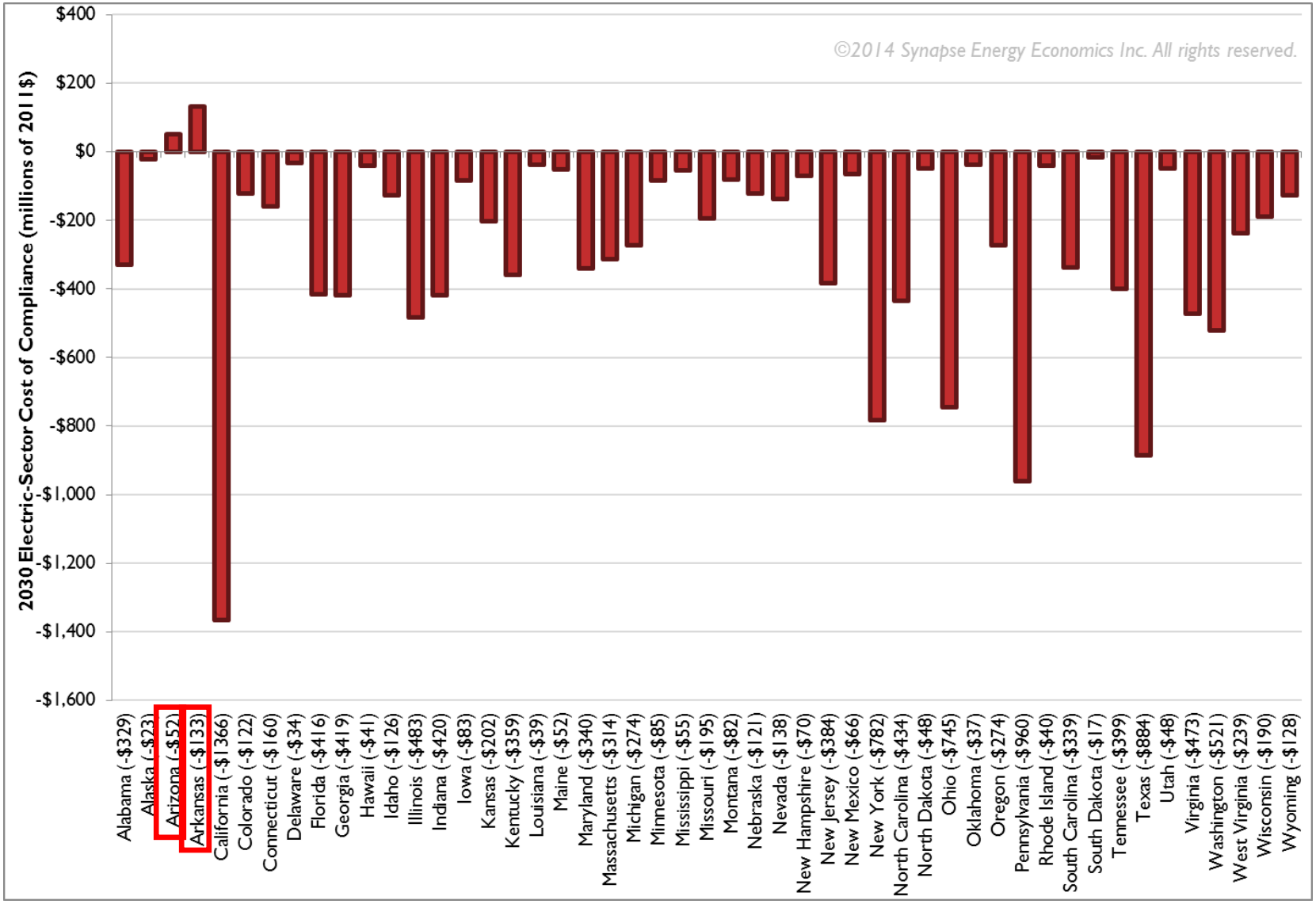
Impacts on **Non-Participants:**

- Higher rates, no change in usage; thus higher bills

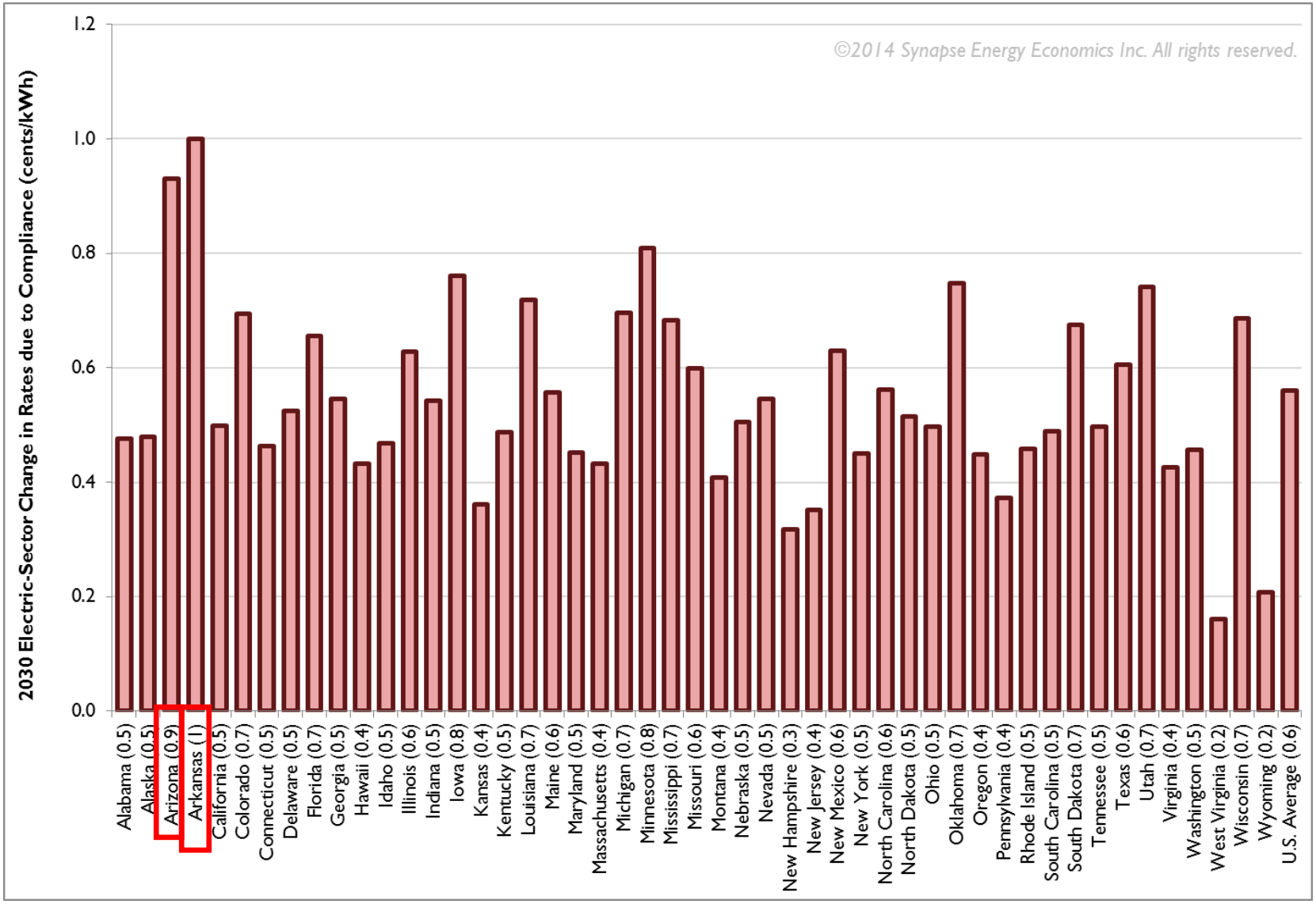
Caveats
Estimated 2030 State Electric Sector Net Benefits in Billions of 2011$

- EPA presents Building Blocks by state to assess how much can be done and assign targets
- EPA costs are not “least cost”: neither best nor worst case
- EPA considers the cost of the target case to be “reasonable”: not so onerous as to present a threat to the electric industry
- No effort has as yet been expended to find least-cost options by state
- Each state needs to do its own least-cost analysis to determine the least expensive way to achieve its target emission rate
- Regional compliance expected to cost less than individual state compliance
- State estimates presented here (1) assume EPA’s average national costs by building block, (2) do not follow IPM modeling methods, and (3) are gauged to match EPA’s national costs by adjusting the avoided cost of energy

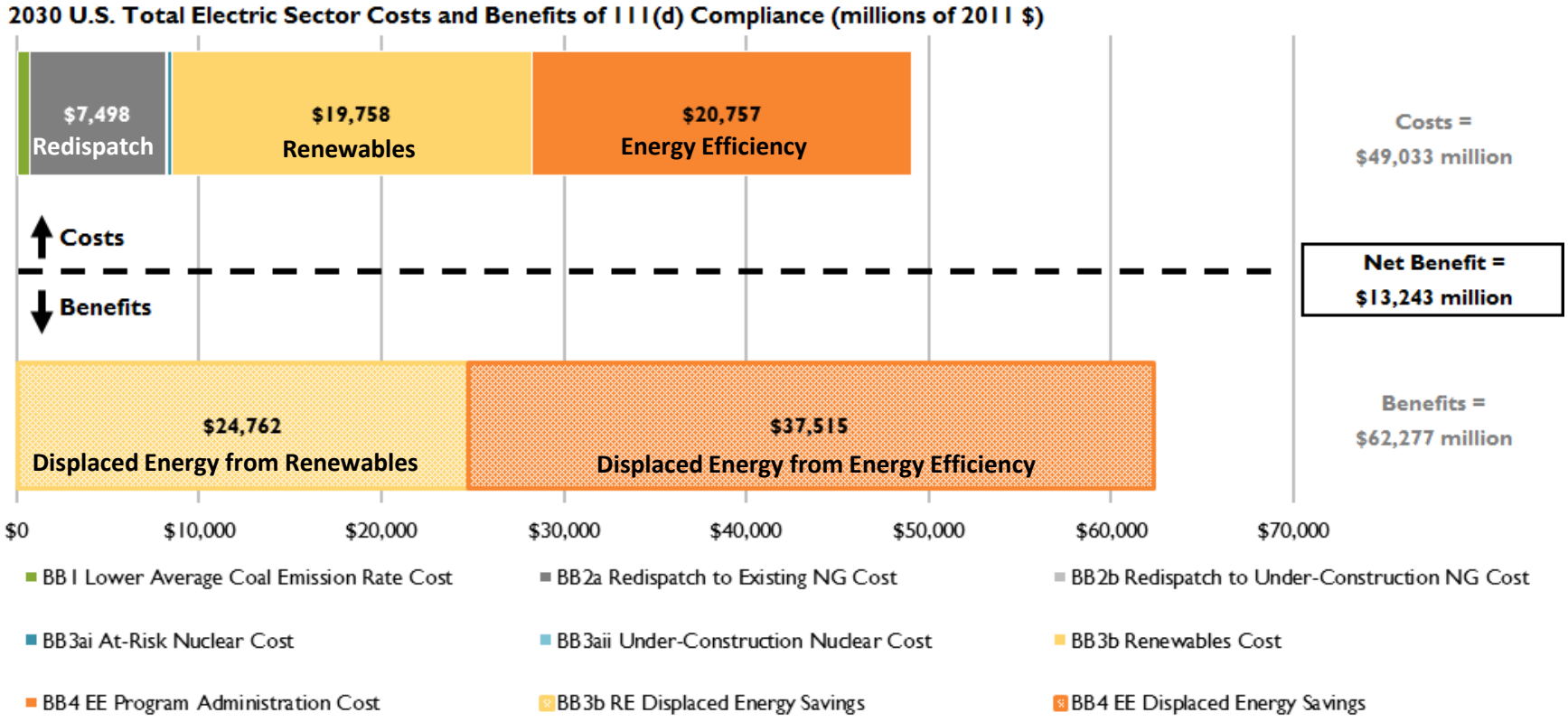
2030 Estimated Electric-Sector Cost of Compliance (millions of 2011$)



2030 Estimated Electric-Sector Change in Rates due to Compliance (cents/kWh)



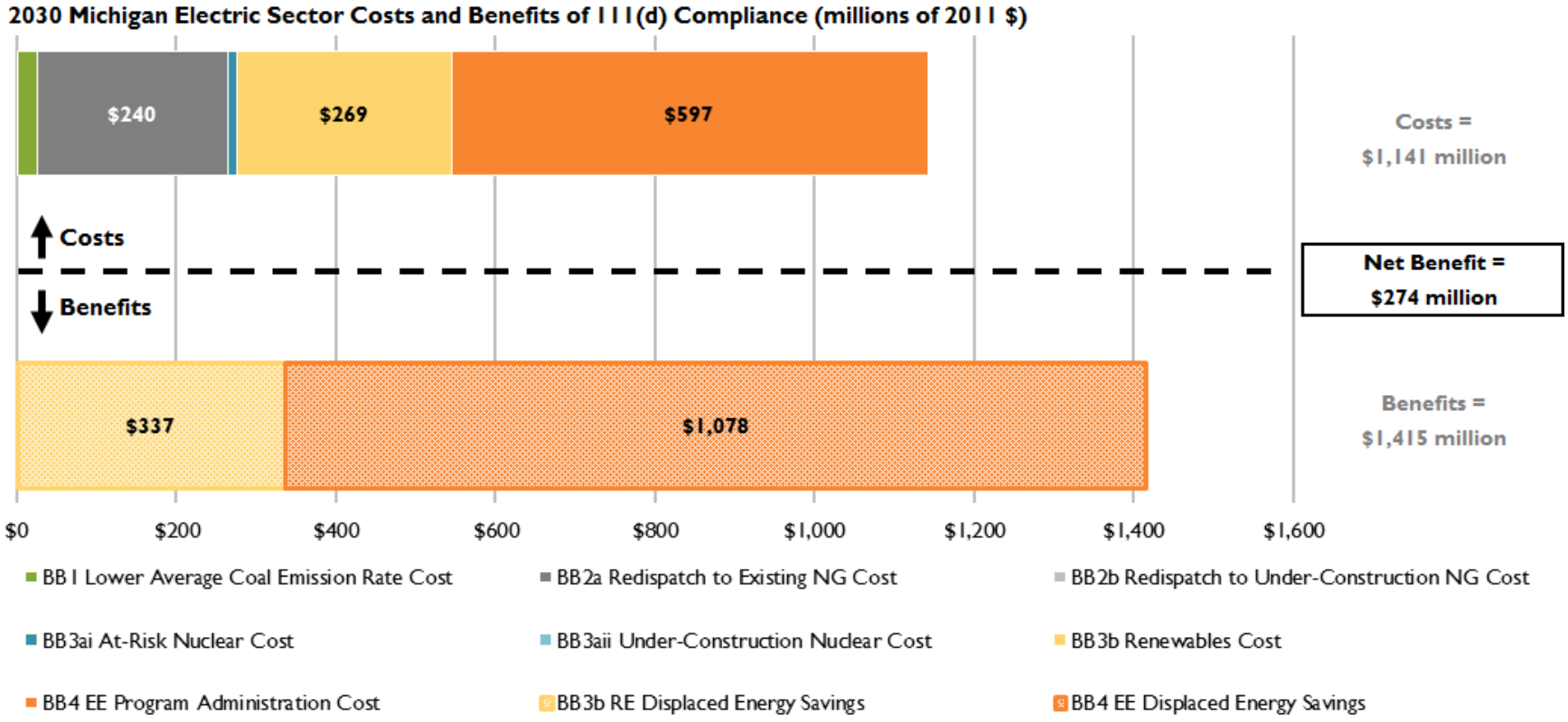
EPA's Estimated 2030 Electric-Sector Costs and Benefits



Note: Values estimated by Synapse. Does not include energy efficiency participant costs or climate and health benefits.

	BB1	BB2a	BB2b	BB3ai	BB3aii	BB3b	BB4	BB3b	BB4	Net
(Costs) and Savings	($684)	($7,498)	($69)	($267)	$0	($19,758)	($20,757)	$24,762	$37,515	$13,243
Percent of Net Savings	1%	15%	0%	1%	0%	40%	42%	-51%	-77%	

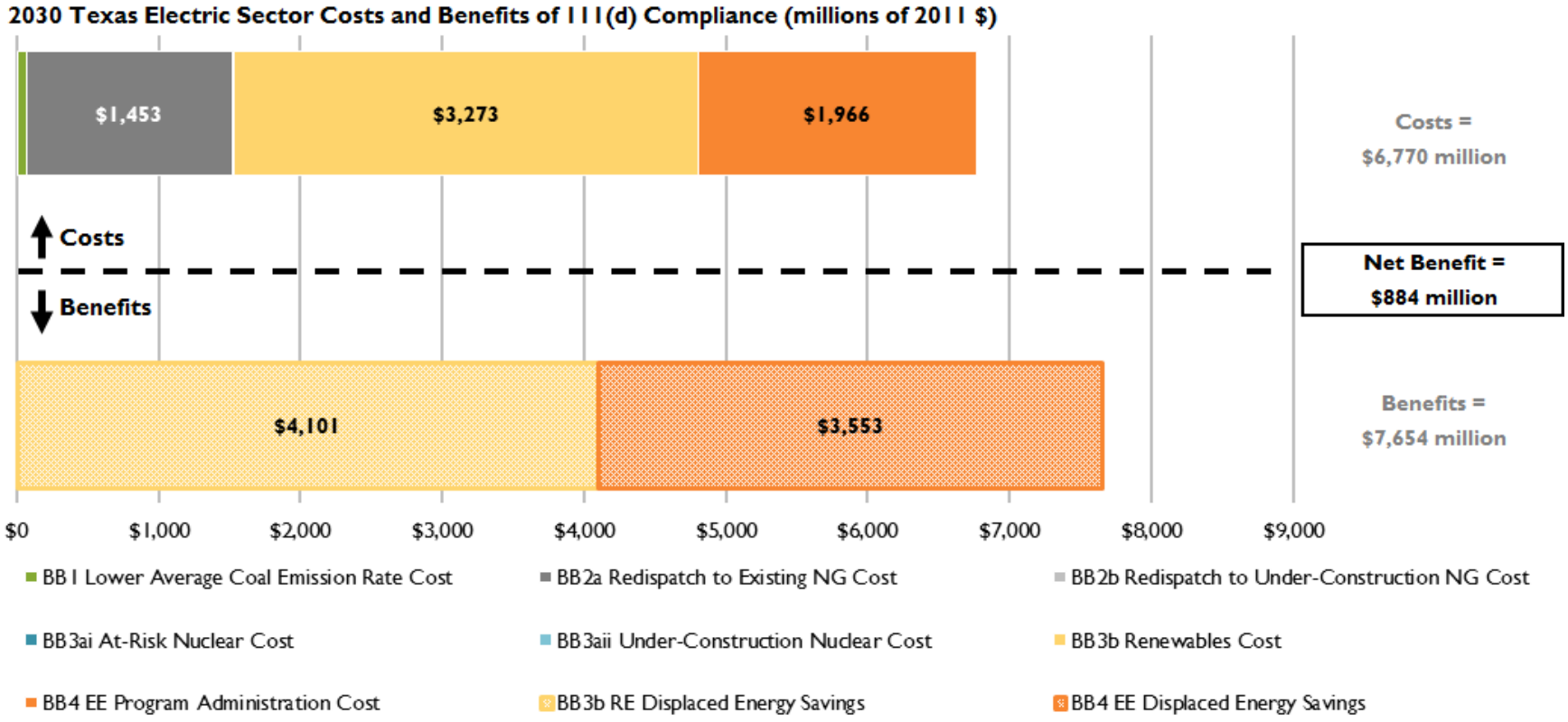
EPA's Estimated 2030 Costs and Benefits



Note: Values estimated by Synapse. Does not include energy efficiency participant costs or climate and health benefits.

	BB1	BB2a	BB2b	BB3ai	BB3aii	BB3b	BB4	BB3b	BB4	Net
(Costs) and Savings	($25)	($240)	$0	($11)	$0	($269)	($597)	$337	$1,078	$274
Percent of Net Savings	2%	21%	0%	1%	0%	24%	52%	-30%	-94%	

EPA's Estimated 2030 Costs and Benefits



Note: Values estimated by Synapse. Does not include energy efficiency participant costs or climate and health benefits.

	BB1	BB2a	BB2b	BB3ai	BB3aii	BB3b	BB4	BB3b	BB4	Net
(Costs) and Savings	($65)	($1,453)	$0	($14)	$0	($3,273)	($1,966)	$4,101	$3,553	$884
Percent of Net Savings	1%	21%	0%	0%	0%	48%	29%	-61%	-52%	

111(d) Can Benefit Customers

- Even using EPA's high expected cost of energy efficiency and no exploration of least-cost implementation options, 111(d) benefits customers in 47 states
- Under these assumptions:
  - 111(d) costs customers $52 million in Arizona
  - 111(d) costs customers $133 million in Arkansas
  - 111(d) benefits customers in all other states
- On average in the United States:
  - Electric sector benefits are 25 percent higher than costs
  - Costs are:
    - 42 percent energy efficiency program administration
    - 40 percent renewables
    - 15 percent redispatch of natural gas CCs
  - 111(d) benefits customers $13 billion in the United States

Drafting comments

On What Topics is EPA Seeking Comments?

- BSER
- Each building block
- State goals
- State plans and compliance
- A wide variety of other topics

For a list of EPA's requests for comment see:

http://www.synapse-energy.com/Downloads/SynapsePaper.2014-06.0.111d-Issues-for-Comment.A0041.pdf

Least-cost compliance

Choices for States

- Multi-state compliance
- Mass-based compliance
- Short- and long-term options
- SIPs considerations
- **Least-cost compliance**

Take Advantage of the Rule's Flexibility

- EPA's Building Blocks are not mandatory, nor are they "least cost"
- No effort has been made as yet to find least-cost options by state
- Each state needs to do its own least-cost analysis to determine the least expensive way to achieve its target emission rate
- States are not required to use any specific building block or apply building blocks to the extent EPA did in setting targets
- States may choose to employ measures other than those identified by EPA, as long as the 111(d) emissions rate goal is met

Choose the Most Cost-Effective Compliance Options

Each state is unique:

- Costs will vary widely from state-to-state depending on existing infrastructure, renewable resource potential, and whether the state is part of a multi-state plan

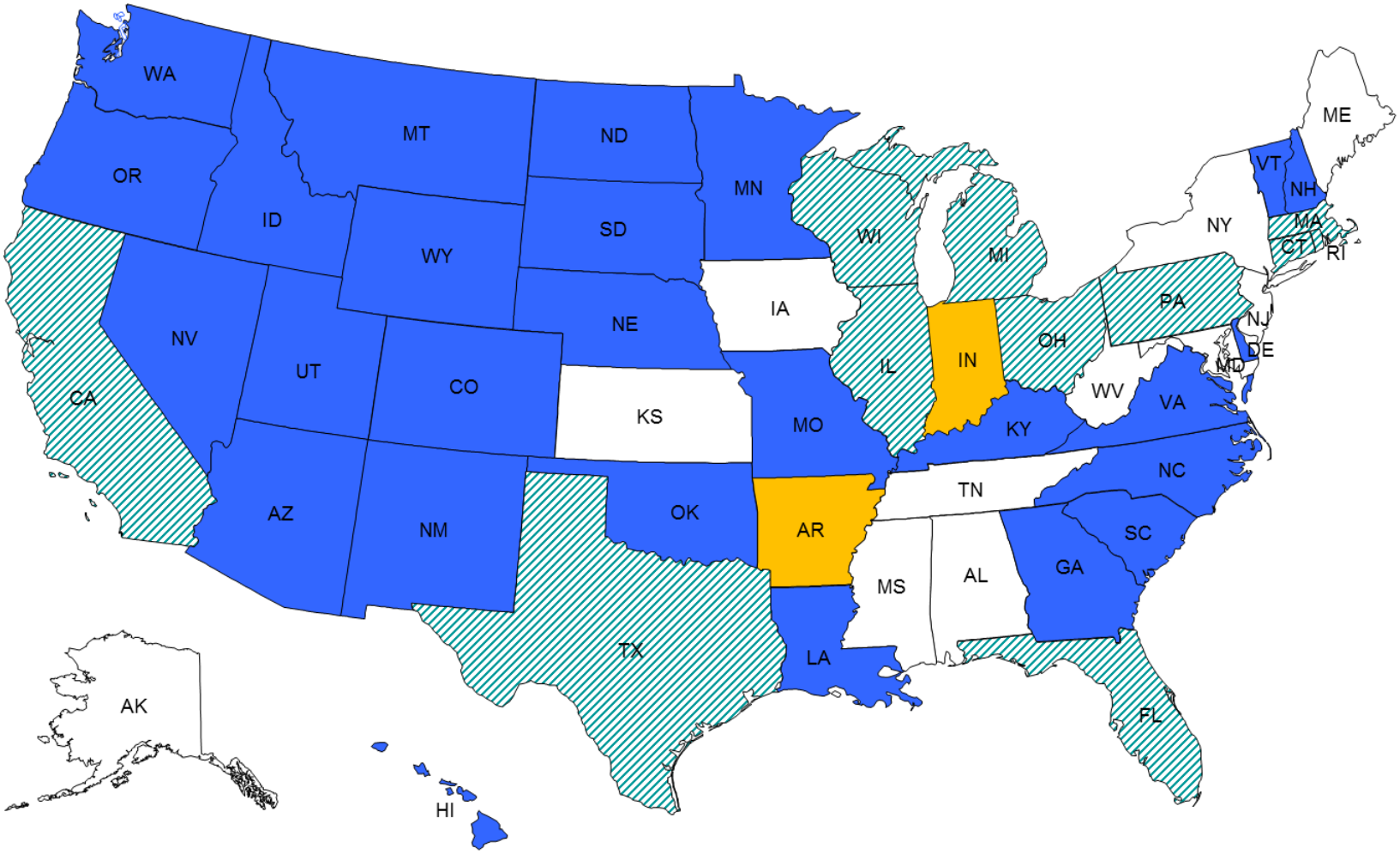
Incorporation into IRP process:

- States that use an Integrated Resource Planning (IRP) process should incorporate the EPA targets as a constraint in the IRP modeling so that the compliance options achieve the IRP criteria

Incorporation into EE Screening:

- States that employ energy efficiency screening processes should ensure that 111(d) compliance is included in avoided costs

State IRP Requirements



Choose the Most Cost-Effective Compliance Options

	Resource Options
Consider full range of resources	• Supply-side and demand-side • Innovative options (storage, demand response, etc.) • Imports, REC trading • Modifications to existing resources (e.g., fuel switching, retirement)

	Determine appropriate assumptions, risks, and constraints of each resource option
Cost estimates	Appropriate capital cost estimates, fuel prices (reasonable, recent, and consistent fuel price projections)
Constraints	Transmission upgrades required, resource availability constraints, etc.
Risk	Thorough risk analysis

Choose the Most Cost-Effective Compliance Options

Analysis Tools

Model Choice

- Use appropriate modeling tools that capture energy, capacity, T&D, ancillary services impacts

Cost Analysis

Consistent

- Analysis of resource options should be done on a consistent and comparable basis
- Benefits and costs should be accurately estimated

Consumer Impacts

Rate and Bill Impacts

- Impacts on both rates and bills should be considered
- Some compliance options may raise rates
- Evaluate distributional impacts

Electric-Sector Modeling Systems

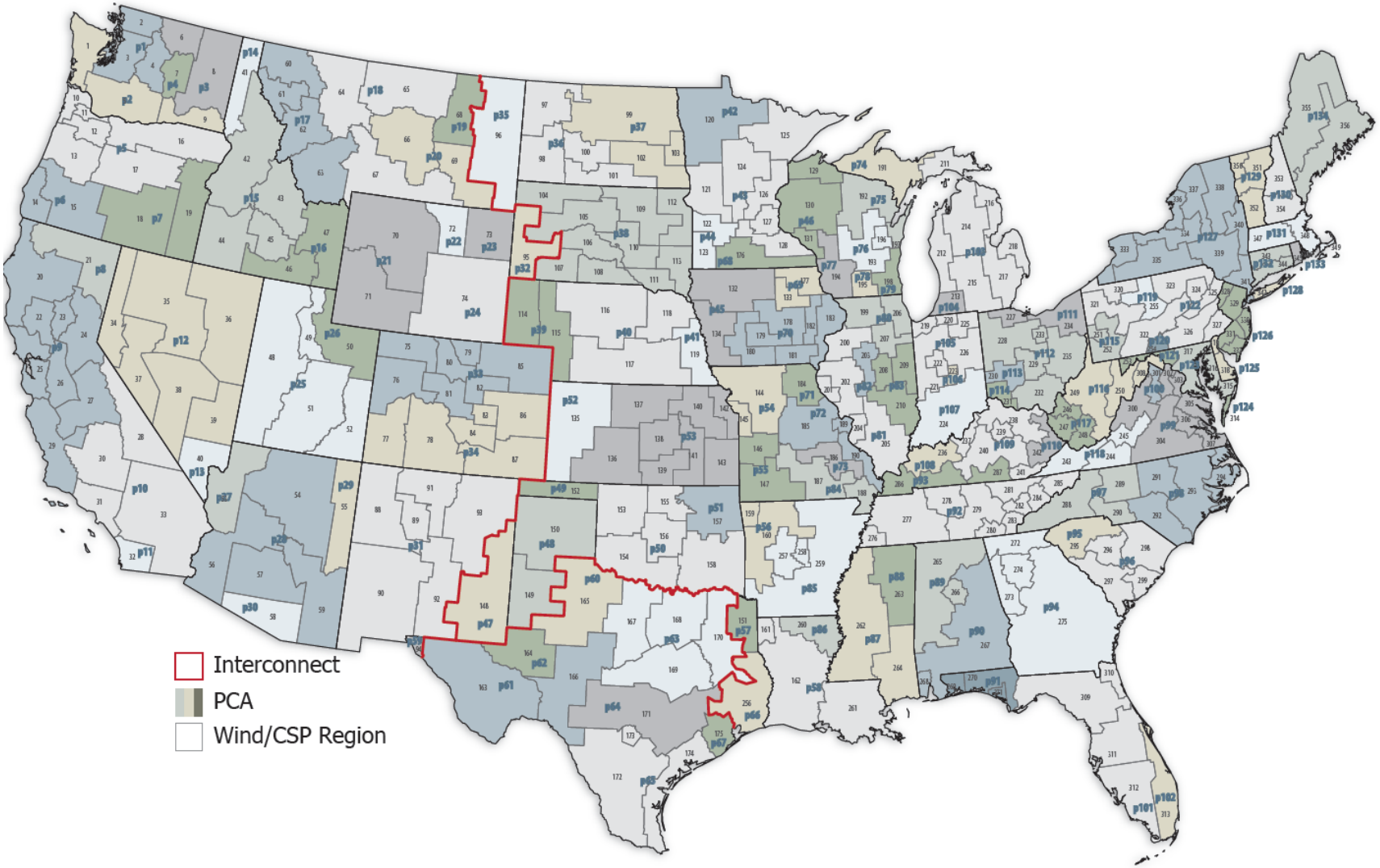
- PROSYM (Ventyx)
- PROMOD (Ventyx)
- Strategist (Ventyx)
- MIDAS (Ventyx)
- EGEAS (EPRI)
- System Optimizer (Ventyx)
- GE MAPS (General Electric)
- PLEXOS (Energy Exemplar)
- ReEDS (NREL)
- IPM (ICF)
- NEMS (EIA)

ReEDS – Model Description

- **R**egional **E**nergy **D**eployment **S**ystem, developed by NREL
- Long-term capacity expansion model of the U.S. electricity sector
- Optimizes capacity, generation, and transmission for lowest cost in 134 balancing areas, corresponding to state lines
- Calibrated to existing capacity with Ventyx data
- Includes existing state RPS policies

- **At Synapse**, we have used ReEDS to model long-term clean energy scenarios, with high spatial resolution inputs and outputs
- Open code base allows us to add features or modify existing capabilities

ReEDS Regions



Using ReEDS to understand 111(d) compliance

- ReEDS has been used to evaluate many proposed federal climate policies, including cap and trade and clean energy standards
- The model has the resolution to (a) evaluate state-level policies and (b) understand regional and national implication of state actions
  - Sub-state level coal capacity binning allows for heat rate improvements and re-dispatch
  - Substantial renewable resource detail accounts for local resource availability and transmission constraints
  - Energy efficiency exogenously input (though we are planning to add optimization of EE)
- EPA 111(d) targets are not an optimal path to compliance – ReEDS can help find the lowest cost mix of building blocks

Questions & Answers

Panelists	
Dr. Elizabeth A. Stanton, senior economist	eastanton@synapse-energy.com
Sarah Jackson, associate	sjackson@synapse-energy.com
Bruce Biewald, founder and CEO	bbiewald@synapse-energy.com

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