Understanding the Proposed Rule

Technical Summit on EPA's Carbon Pollution Standards

Atlanta, Georgia

August 13, 2014

Bruce Biewald

Sarah Jackson

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

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

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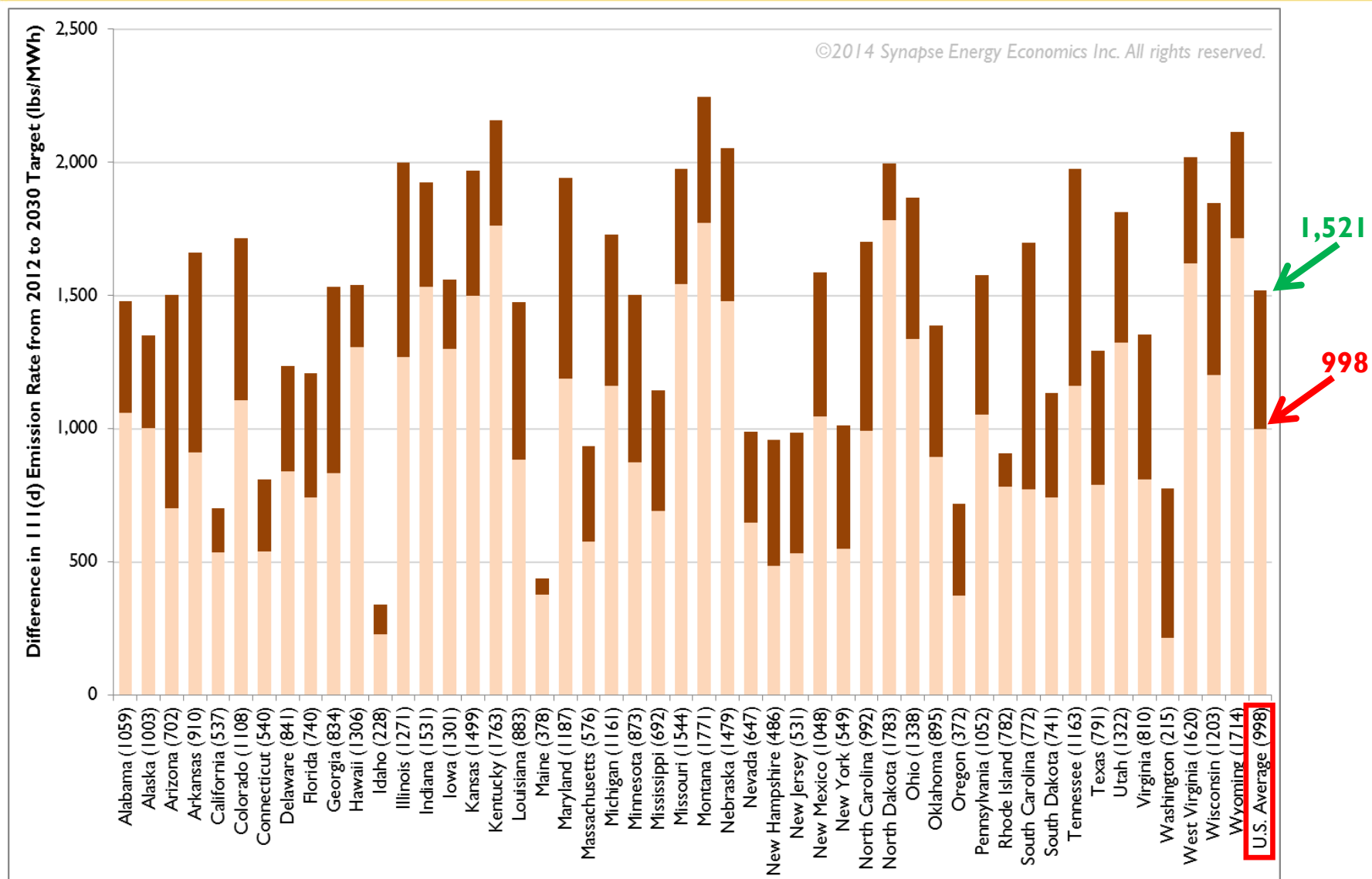
BB 3a-i: Credit for Existing "At-Risk" Nuclear (5.8% of 2012 nuclear fleet)

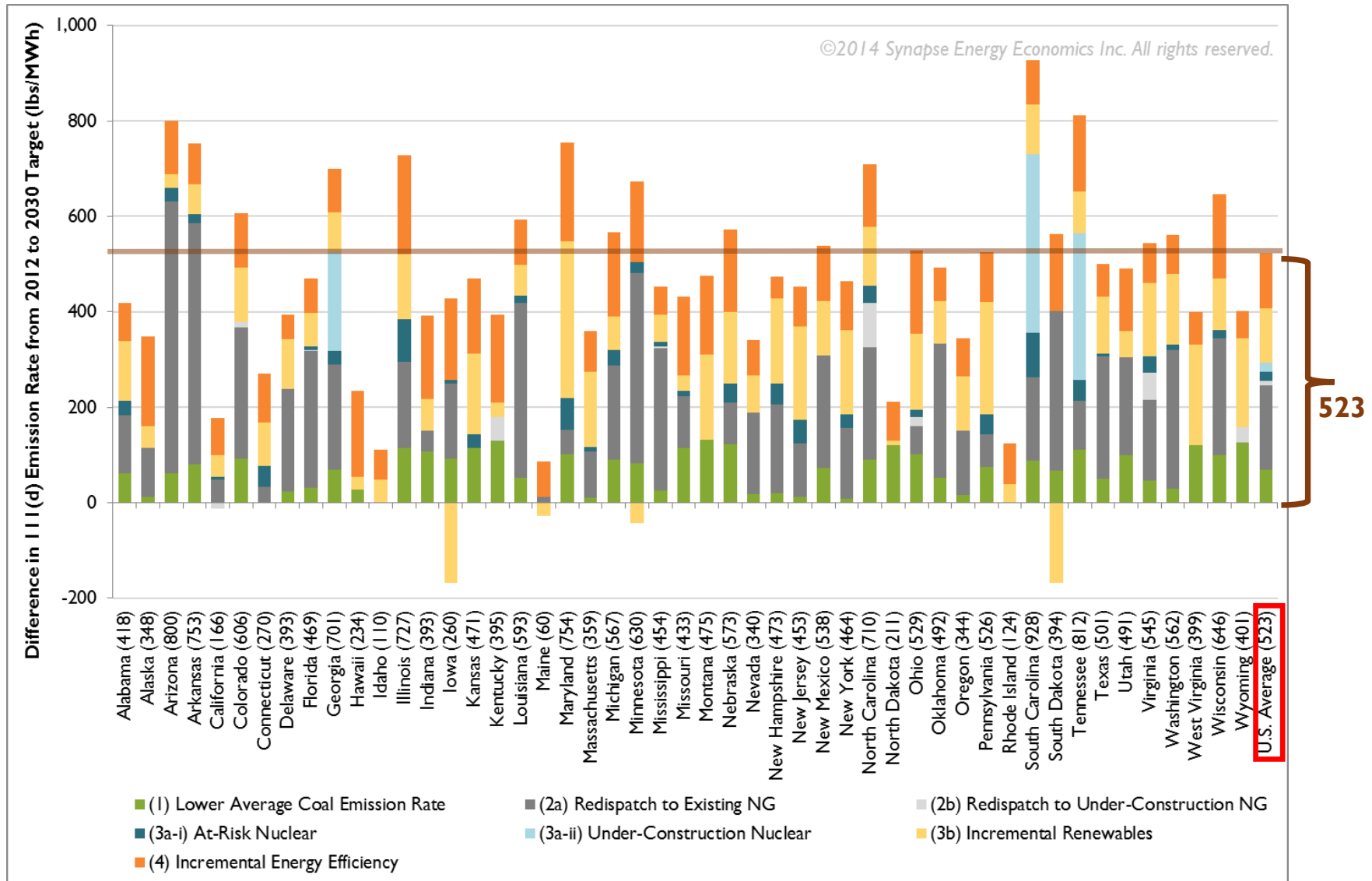**BB 3a-ii:** Credit for Nuclear Under Construction in 2012

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

Legend:
- (1) Lower Average Coal Emission Rate
- (2a) Redispatch to Existing NG
- (2b) Redispatch to Under-Construction NG
- (3a-i) At-Risk Nuclear
- (3a-ii) Under-Construction Nuclear
- (3b) Incremental Renewables
- (4) Incremental Energy Efficiency

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

2030 Estimated Electric-Sector Cost of Compliance (millions of 2011$)
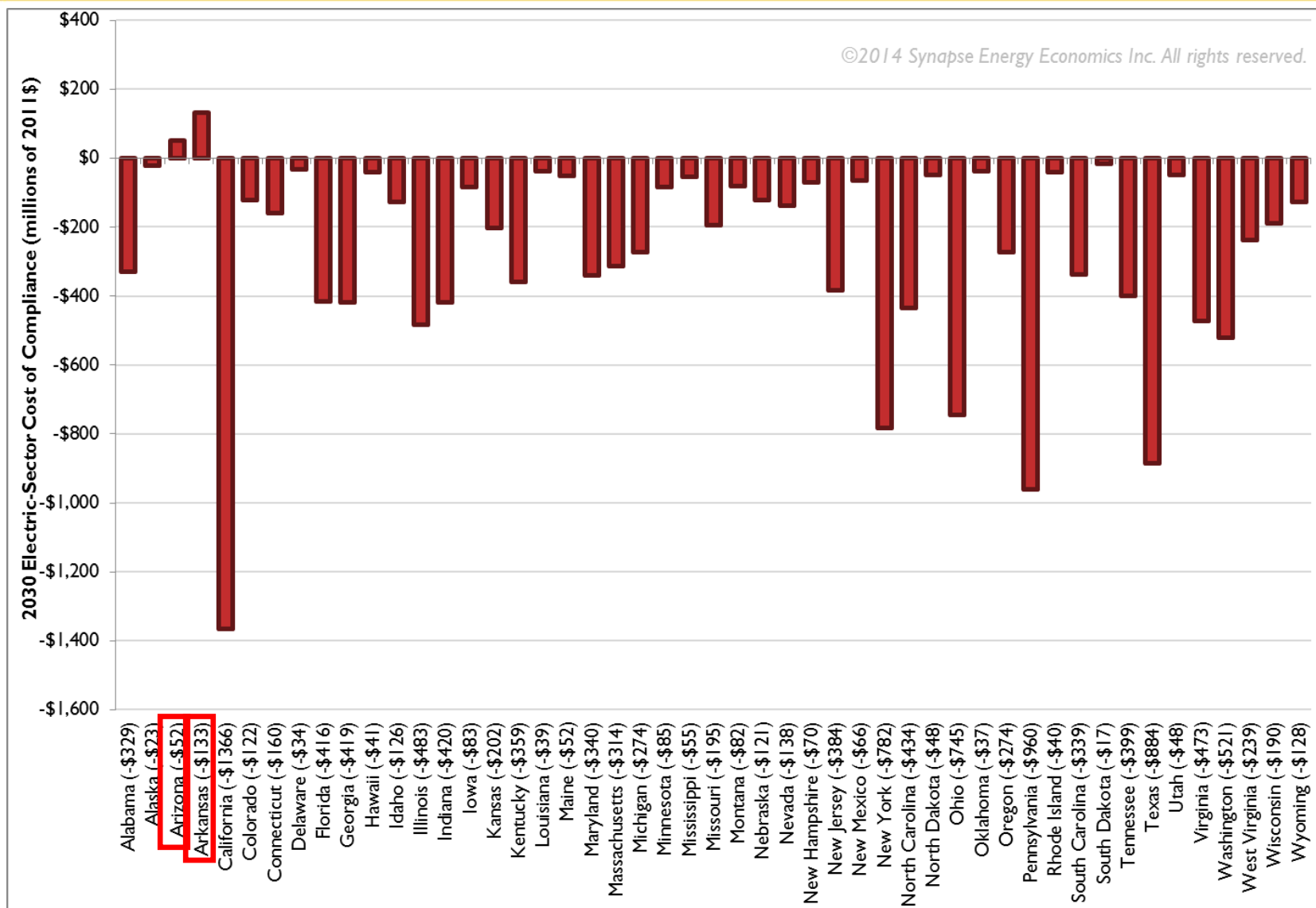
EPA's Estimated 2030 Electric-Sector Costs and Benefits

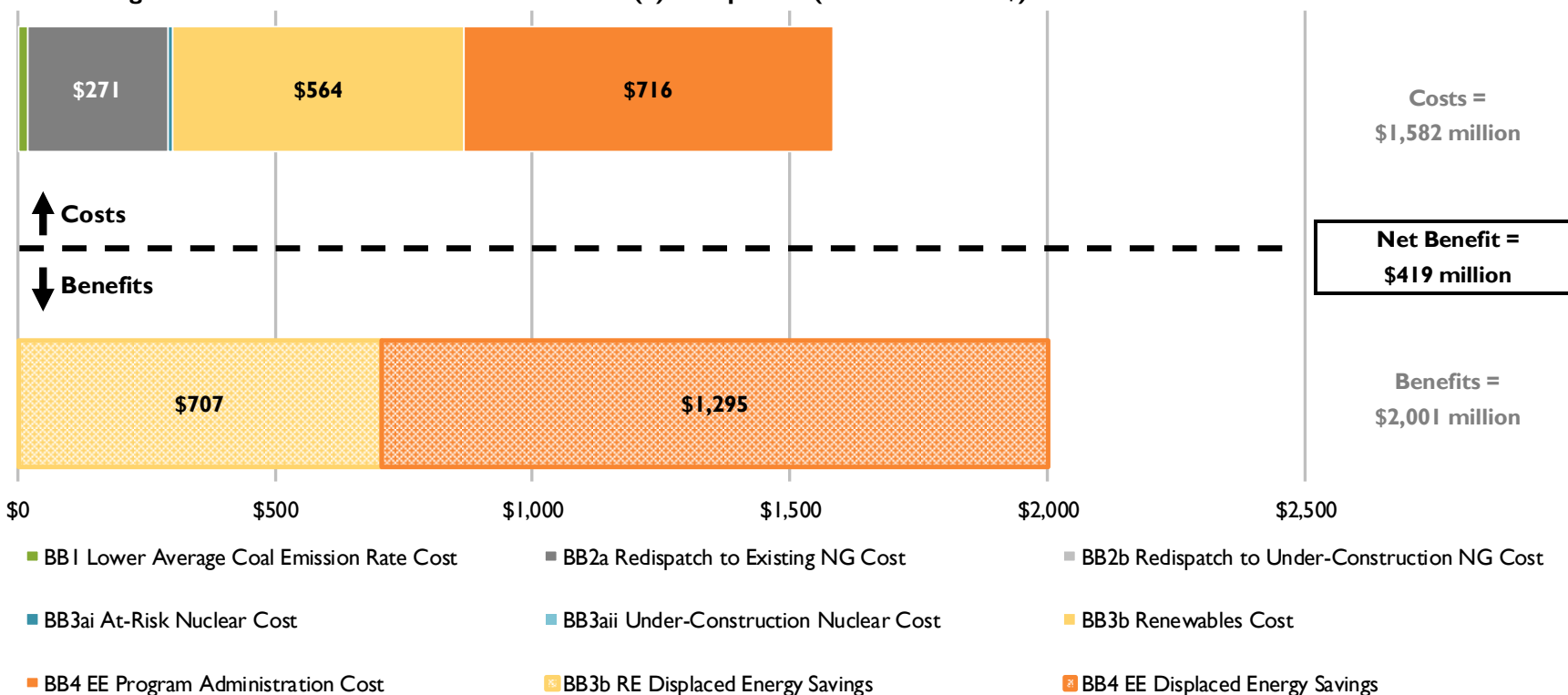**2030 U.S. Total Electric Sector Costs and Benefits of 111(d) Compliance (millions of 2011 $)**

$7,498 Redispatch	$19,758 Renewables	$20,757 Energy Efficiency

Costs = $49,033 million

↑ Costs

- -

↓ Benefits

Net Benefit = $13,243 million

$24,762 Displaced Energy from Renewables	$37,515 Displaced Energy from Energy Efficiency

Benefits = $62,277 million

$0 $10,000 $20,000 $30,000 $40,000 $50,000 $60,000 $70,000

- BB1 Lower Average Coal Emission Rate Cost
- BB2a Redispatch to Existing NG Cost
- BB2b Redispatch to Under-Construction NG Cost
- BB3ai At-Risk Nuclear Cost
- BB3aii Under-Construction Nuclear Cost
- BB3b Renewables Cost
- BB4 EE Program Administration Cost
- BB3b RE Displaced Energy Savings
- BB4 EE Displaced Energy Savings

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

2030 Georgia Electric Sector Costs and Benefits of 111(d) Compliance (millions of 2011 $)

Costs = $1,582 million

Net Benefit = $419 million

Benefits = $2,001 million

- ■ BB1 Lower Average Coal Emission Rate Cost
- ■ BB2a Redispatch to Existing NG Cost
- ■ BB2b Redispatch to Under-Construction NG Cost
- ■ BB3ai At-Risk Nuclear Cost
- ■ BB3aii Under-Construction Nuclear Cost
- ■ BB3b Renewables Cost
- ■ BB4 EE Program Administration Cost
- ▨ BB3b RE Displaced Energy Savings
- ▨ BB4 EE Displaced Energy Savings

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	($20)	($271)	$0	($11)	$0	($564)	($716)	$707	$1,295	$419
Percent of Costs	1%	17%	0%	1%	0%	36%	45%	-45%	-82%	

Coal Efficiency: Challenges and Opportunities

- Some parties are concerned that 6% efficiency improvements are not available for their plants

- Redispatch of coal and oil to NGCCs reduces significance (or in some cases obviates) Building Block #1

Redispatch to NGCCs: Challenges and Opportunities

- Will gas supply be sufficient to redispatch targets? What costs will be associated with changes in gas distribution?

- For multi-state groups redispatch can have a much larger potential

- For rate-based compliance there could be distortions related to cross-state redispatch or coal retirement

- For some coal plants, retirement may be the least-cost way to redispatch

- Redispatch protocals have to comply with FERC and ISO market rules

Nuclear: Challenges and Opportunities

- In states with existing nuclear there may be concerns regarding the older units

- The three states with under-construction nuclear in 2012 may face difficulties with complying with 111(d) if the construction is not completed

- Nuclear can be very expensive and the expected costs may increase during the construction period

REC Treatment for Renewables Can Benefit Customers

- In its proposed rule EPA requests comments on whether eligibility for renewables should be determined by geographic location or by Renewable Energy Credit (REC) purchase.

- REC treatment allows for eligibility of both in-state and out-of-state renewable generation

- This flexibility would lower costs for states

Synapse Research on the Cost of Saved Energy
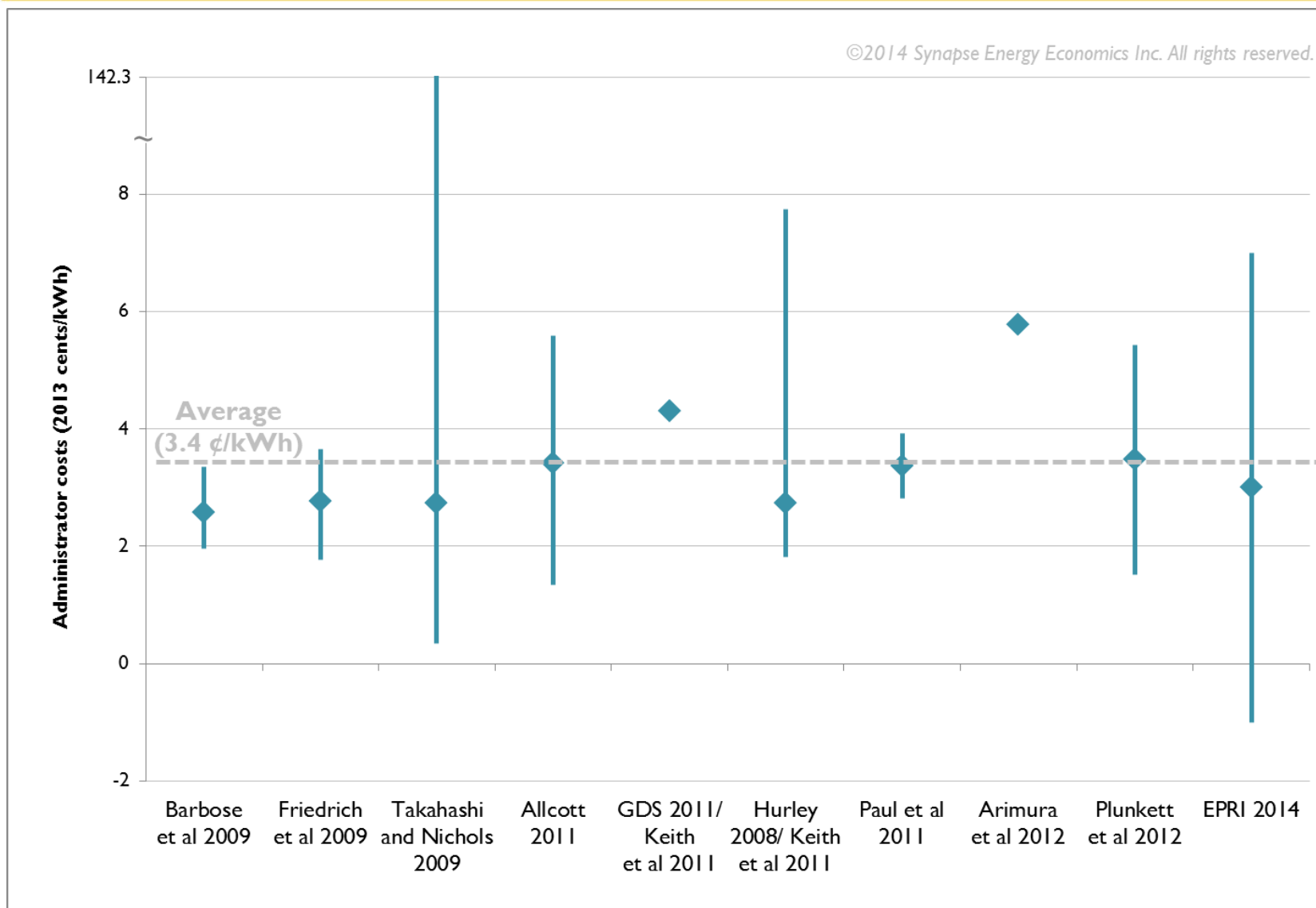
Tools for 111(d) Compliance Planning

1. Spreadsheet Tools
   a. Coal Asset Valuation Tool or CAVT (Synapse)
   b. 111(d) Cost Estimate Tool (Synapse)
   c. Excel based tools (various)

2. AVERT (EPA)

3. Utility System Models
   a. Strategist (Ventyx)
   b. EGEAS (EPRI)

4. Regional Electric System Models
   a. PROMOD (Ventyx)
   b. PROSYM (Ventyx)
   c. GEMAPS (General Electric)
   d. PLEXOS (Energy Exemplar)

5. National Electric System Models
   a. NEMS (EIA)
   b. IPM (ICF)
   c. REEDS (NREL)