Clean Power Plan: Key Issues for Consumers

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Formula Refresher

Setting 111(d) Emission Rate Targets

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

Building Blocks: Challenges and Opportunities

EPA's Building Blocks for Target Setting

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)

Building Blocks Challenges and Opportunities

BB 1: Reduce Average Coal Emission Rate by 6%

- Each state differs; may not be possible or cost effective

BB 2: Redispatch to Natural Gas Generators

- Dependent on adequate supply of natural gas
- Multi-state compliance open additional dispatch opportunities and allow states to take advantage of NG price differentials
- FERC and wholesale market dispatch protocols may complicate re-dispatch decisions

BB 3a: At-Risk and Under-Construction Nuclear

- Not every state has "at risk" nuclear to leverage for this building block
- TN, SC, GA: if under-construction nuclear is not completed, compliance will be challenging

BB 3b: Credit for Renewable Generation

- Based on regional estimates; may over- or under-state technical & economic potential for individual states

BB 4: Credit for Energy Efficiency Improvements

- States with less EE experience may find targets harder to meet and sustain
- Other states may find targets can be exceeded at low cost, providing an opportunity

There May be Lower-Cost Ways to Comply

- EPA's Building Blocks are not mandatory, nor are they "least cost"
- States are not required to use any specific building block or apply building blocks to the extent EPA did in setting targets
- No effort has been made as yet to find least-cost options by state

Seeking out the best deal for consumers

Least-Cost Approach Requires Analysis

#1 Key issue for consumers:

Each state needs to do its own least-cost analysis to determine the least expensive way to achieve its target emission rate

- Use appropriate modeling tools that capture energy, capacity, T&D, ancillary services impacts
- Include state-specific assumption regarding costs, fuel-price projections, transmission constraints, and resource constraints
- Evaluate both rate impacts and bill impacts
- Conduct distributional analysis to evaluate equity impacts

Clean Power Plan Planning Tool (CP3T)

- Synapse developed an Excel-based spreadsheet tool for performing first-pass planning of statewide compliance with the Clean Power Plan
- Users can adjust:
  - unit retirements
  - fossil unit capacity factors
  - renewable energy and energy efficiency projections
  - 111(b) unit additions for each state
- Outputs for each scenario include:
  - generation
  - capacity
  - emissions
  - 111(d) emission rates
  - costs

Clean Power Plan Planning Tool (CP3T)

- The tool is available now on the Synapse website
- Synapse will host a webinar walkthrough of CP3T on November 21, 1:00-1:45 EST
- To access the tool and register for the free webinar, go to:

www.synapse-energy.com/cp3t

Thinking Outside the Blocks

#2 Key issue for consumers:

States may choose to employ measures other than those identified by EPA, as long as the 111(d) emissions rate goal is met

Options include:

1. Imports, REC trading
2. Retirement
3. Heat rate improvements at non-coal fossil plants
4. Carbon capture & storage
5. Fuel switching, co-firing
6. Integrated renewable technology
7. New natural gas capacity
8. Credits for new plant over-compliance
9. Transmission & distribution efficiency
10. Increased use of NGCTs
11. Innovative demand-side options
    - Storage
    - Distributed generation
    - Other forms of energy efficiency
    - Smart grid and demand response

Benefits of Multi-State Compliance

#3 Key issue for consumers:

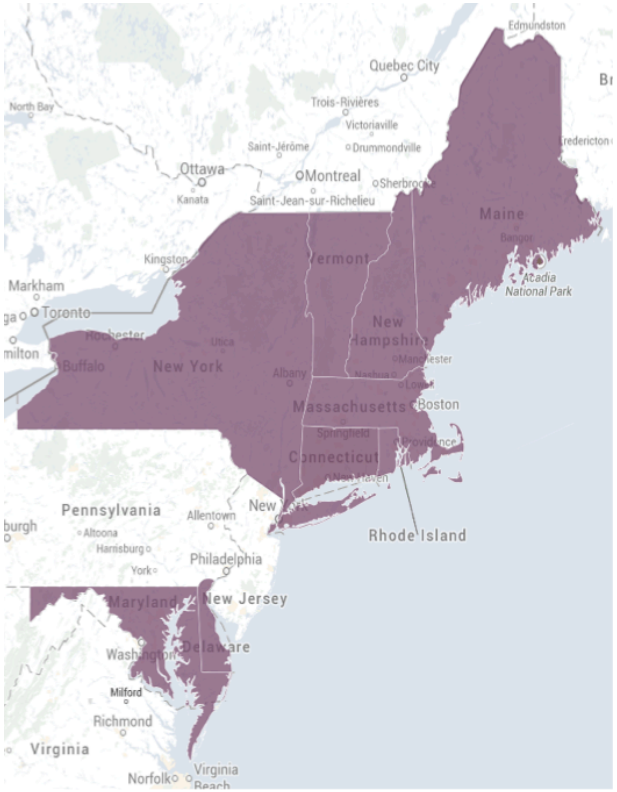
Multi-state compliance can help reduce costs

- Expands number of opportunities for emissions reductions
  - including expanded credit for energy efficiency for electricity importers
- Allows least-cost opportunities in the region to be exploited (similar to efficiencies of wholesale market regions)
- May reduce administrative costs

Multi-State Compliance and Tradable Instruments

- Multi-state compliance may entail a mass-based approach using tradable instruments, such as:
  - Allowances per ton CO_2
  - Allowances per ton above a certain threshold (e.g., 1,000 lbs/MWh)
  - Carbon reduction credits relative to a baseline (e.g., WRA proposal for West)
  - Renewable energy or energy efficiency certificates

Example: RGGI



Source: Carbon Offset Research & Education (CORE). "Regional Greenhouse Gas Initiative." Available at: http://www.co2offsetresearch.org/policy/RGGI.html

A Careful Approach to Tradable Instruments

#4 Key issue for consumers:

- Windfall profits for generators if CO_2 allowances are given away for free
  - Generators will raise their prices to reflect the cost of purchasing emissions permits, and pass these costs on to consumers
- Avoid windfall profits for generators:
  - Generators should purchase emissions permits through and auction or other mechanism
  - Revenues should be returned to ratepayers or invested in programs such as energy efficiency (which will mitigate electricity price increases)

Market Price Effects

- One critical area for analysis in electric-sector modeling for 111(d) compliance will be the effect of EPA's building blocks—and the Building Block 2 re-dispatch to NGCCs, in particular—on the wholesale market price of electricity.
- EPA expects that re-dispatch to NGCCs will be implemented via a price instrument (for example, a CO_2 allowance price).
- In our judgment, a price instrument is essential to this re-dispatch: electric markets follow economic dispatch based on price signals.

Market Price Effects

- Emission allowance price instruments can have either a strongly inflating effect or a neutral effect on the wholesale price of energy, depending on their design.
- The effect of an inflated wholesale market price would be windfall profits to existing low-emission resources, along with higher costs to consumers.
- This is an important area for additional research and modeling, along with careful policy design, for all states.

Questions & Answers

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About Synapse Energy Economics

- Synapse Energy Economics is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power sector for public interest and governmental clients.
- Staff of 30+ experts
- Located in Cambridge, Massachusetts

Appendix

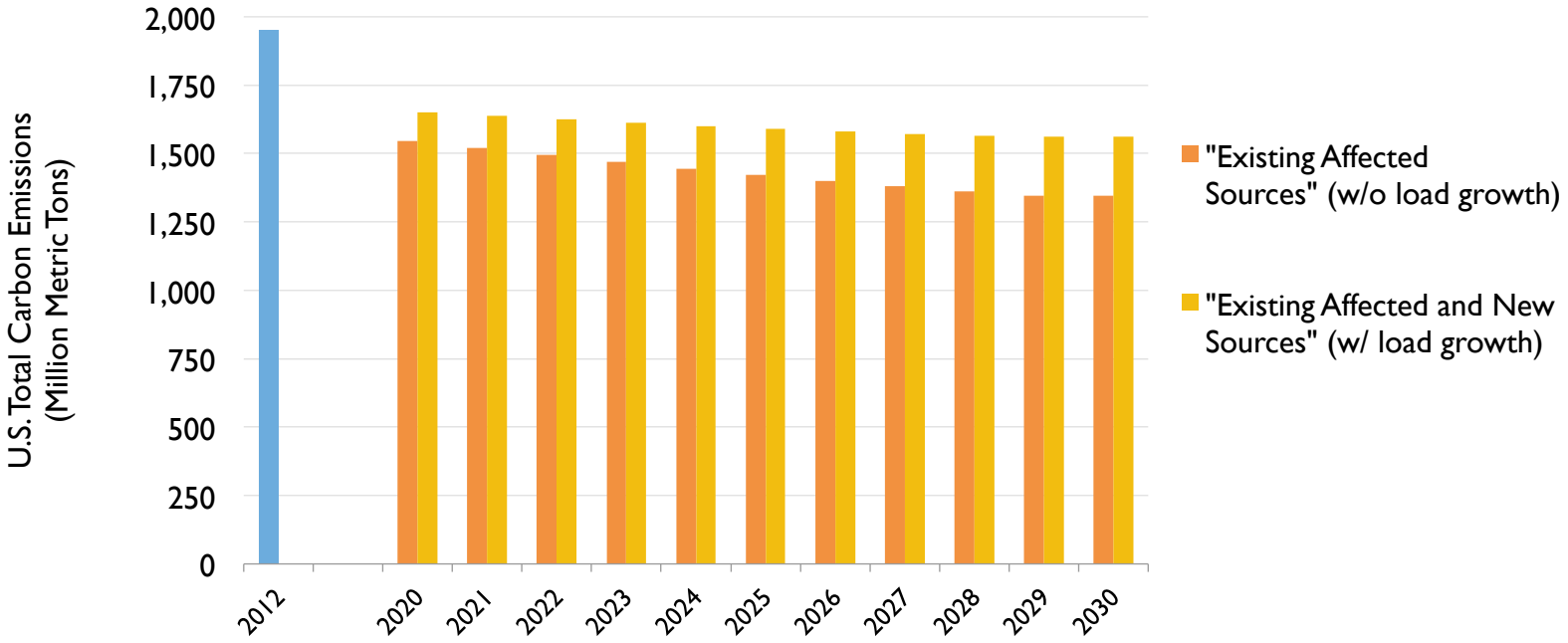
Compliance Options

Mass-Based Compliance

EPA has proposed two methods for "translating" state 111(d) emission rate-based targets (lbs CO_2 /MWh) into mass-based targets (tons of CO_2)

(1) "Existing Affected Sources"= 2012 generation level * rate-based target

(2) "Existing Affected and New Sources" = (load growth from AEO * transmission loss factor) + (2012 generation level * rate-based target)



State Plans and 111(d) Compliance

- EPA outlines several ways states could design compliance plans. Options include:
  - Hold affected sources (power plants) solely responsible for achieving the performance standard
  - "Portfolio" approach
  - A "state commitment" approach (not in EPA's proposal, but under consideration)
  - Individual state *or* multi-state plan
- All compliance plans must meet 4 general criteria and contain 12 specific components

Nuclear

Illinois' 2030 111(d) Emission Rate Target (including 91 million MWh of nuclear):

111(d) Emission Rate	=	million lbs / million MWh	=	145,156 / 66	18,063 / 21	0 / 0	503 / 1	0 / 5	0 / 18	0 / 18	= 1,271 lbs/MWh
				Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency	

Illinois' 2030 111(d) Emission Rate with all nuclear retired:

111(d) Emission Rate	=	million lbs / million MWh	=	145,156 / 66	18,063 / 21	0 / 0	503 / 1	0 / 0	0 / 18	0 / 18	= 1,325 lbs/MWh
				Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency	

Nuclear

Georgia's 2030 111(d) Emission Rate Target (including 31 million MWh of existing nuclear and 17 million MWh of new nuclear):

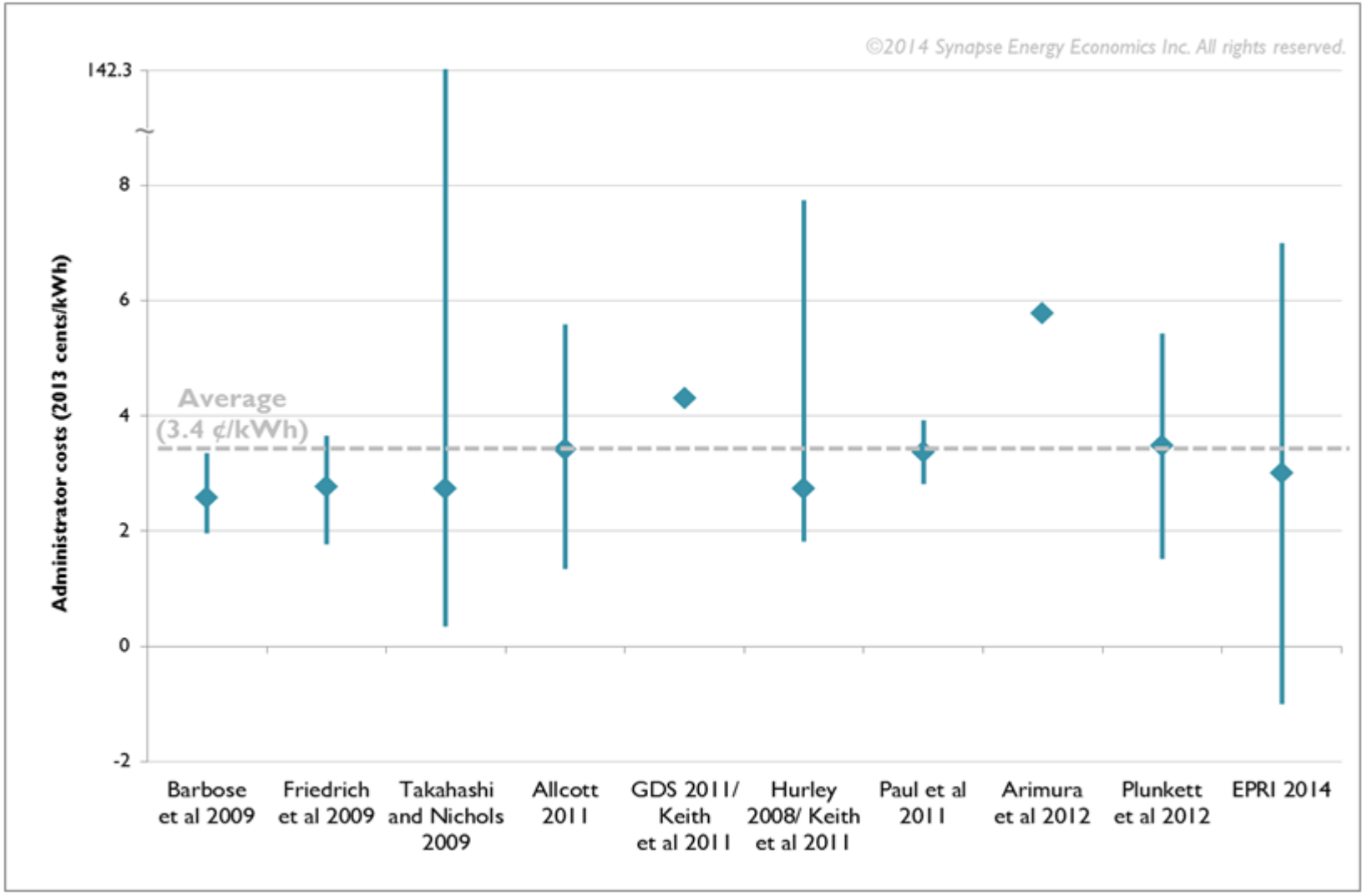
111(d) Emission Rate	=	million lbs / million MWh	=	58,647 / 27	43,213 / 51	0 / 0	68 / 0	0 / 19	0 / 12	0 / 12	=	834 lbs/MWh
				Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency		

Georgia's 2030 111(d) Emission Rate with new nuclear not completed:

111(d) Emission Rate	=	million lbs / million MWh	=	58,647 / 27	43,213 / 51	0 / 0	68 / 0	0 / 2	0 / 12	0 / 12	=	972 lbs/MWh
				Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency		

Energy Efficiency

Review of recent estimates of the cost of saved energy (excluding participant costs)



On What Issues is the EPA Requesting Comments?

List of Specific Issues

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

Short- Versus Long-Term Compliance

EPA 111(d) proposed and alternative rule comparison

	Proposed Rule (Option 1)	Alternative Rule (Option 2)
End of rule roll-out	2030	2025
(BB1) Lower Average Coal Emission Rate	6% reduction by 2020; steady to 2030	4% reduction by 2020; steady to 2025
(BB2a) Redispatch to Existing NG; (BB2b) Redispatch to Under-Construction NG	redispatch from coal and steam to 70% NGCC capacity factors by 2020; steady to 2030	redispatch from coal and steam to 65% NGCC capacity factors by 2020; steady to 2025
(BB3a-i) At-Risk Nuclear	credit for 5.8% of nuclear in use in 2020; steady % to 2030	credit for 5.8% of nuclear in use in 2020; steady % to 2025
(BB3a-ii) Under-Construction Nuclear	credit for all post-2012 nuclear in 2020; steady to 2030	credit for all post-2012 nuclear in 2020; steady to 2025
(BB3b) Incremental Renewables	annual state targets starting in 2020; growing each year through 2030	same annual state targets starting in 2020; growing each year through 2025
(BB4) Incremental Energy Efficiency	annual state targets starting in 2020; growing each year through 2030	lower annual state targets starting in 2020; growing each year through 2025
Annual electric-sector net costs (billions of 2011$):		
in 2020	$2.3	$1.4
in 2025	($9.0)	($4.8)
in 2030	($12.6)	N/A

REC Purchases Versus In-State Renewable Generation

Ohio's 2013 111(d) Emission Rate Target (includes 15% annual growth in RE):

111(d) Emission Rate	=	million lbs / million MWh	=	159,898	26,387	396	2,791	0	0	0	= 1,338 lbs/MWh
				Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency	
				80	27	0	3	1	14	16	

Ohio's 2013 111(d) Emission Rate with 30% annual growth in RE:

111(d) Emission Rate	=	million lbs / million MWh	=	159,898	26,387	396	2,791	0	0	0	= 1,165 lbs/MWh
				Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency	
				80	27	0	3	1	35	16	

What if Ohio sells its excess renewables to Texas?

Exchange Rates

- Under the proposed 111(d) Clean Power Plan, states can comment on whether compliance should be attained through only in-state actions, or whether trading mechanisms can be set up so actions pursued in other states can be used to meet another state's compliance target
- If trading is allowed, then states will be able to meet their compliance target emission rates by conducting trades of emission certificates
- Unlike trades for RPS compliance, the commodity being traded is tons, not MWh
- How do you compare the emission impacts of 100 MWh of energy efficiency in one state versus 100 MWh of energy efficiency in another?

Exchange Rates – Example

AVERT calculates that one MWh of renewable energy yields:

1,541 lbs of CO_2 reductions in Ohio

1,288 lbs of CO_2 reductions in Texas

So, one MWh of renewable energy in Ohio is 1.2 times (1,541 / 1,288) as valuable to someone in Texas than one MWh of renewable energy in Texas

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		million MWh		Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency	
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		million MWh		Coal	NGCC	O/G Steam	Other	Nuclear	Renewables	E.Efficiency	
				80	27	0	3	1	35	16	

What if Ohio sells its excess renewables to Texas?

21 million MWh of RE in Ohio is worth 25 million MWh in Texas