# 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:**

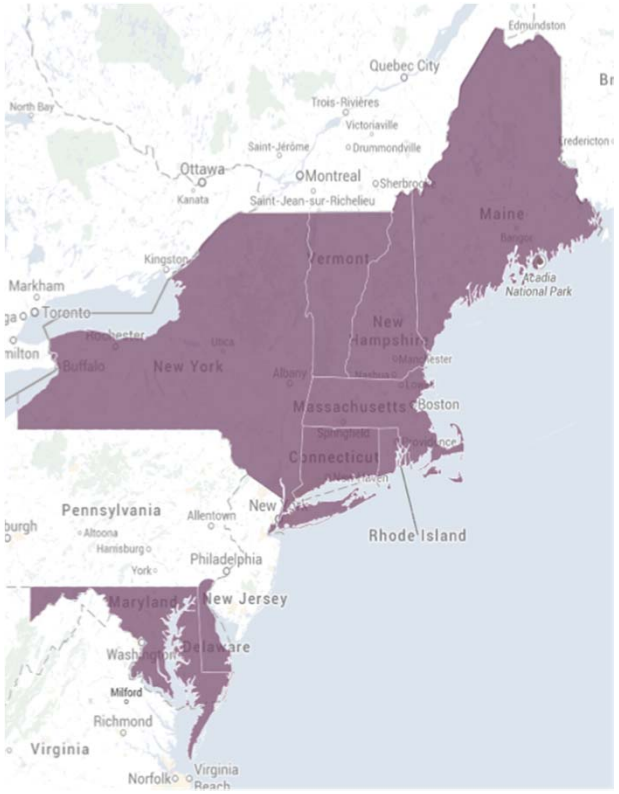
Multi-state compliance can help reduce costs

- 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

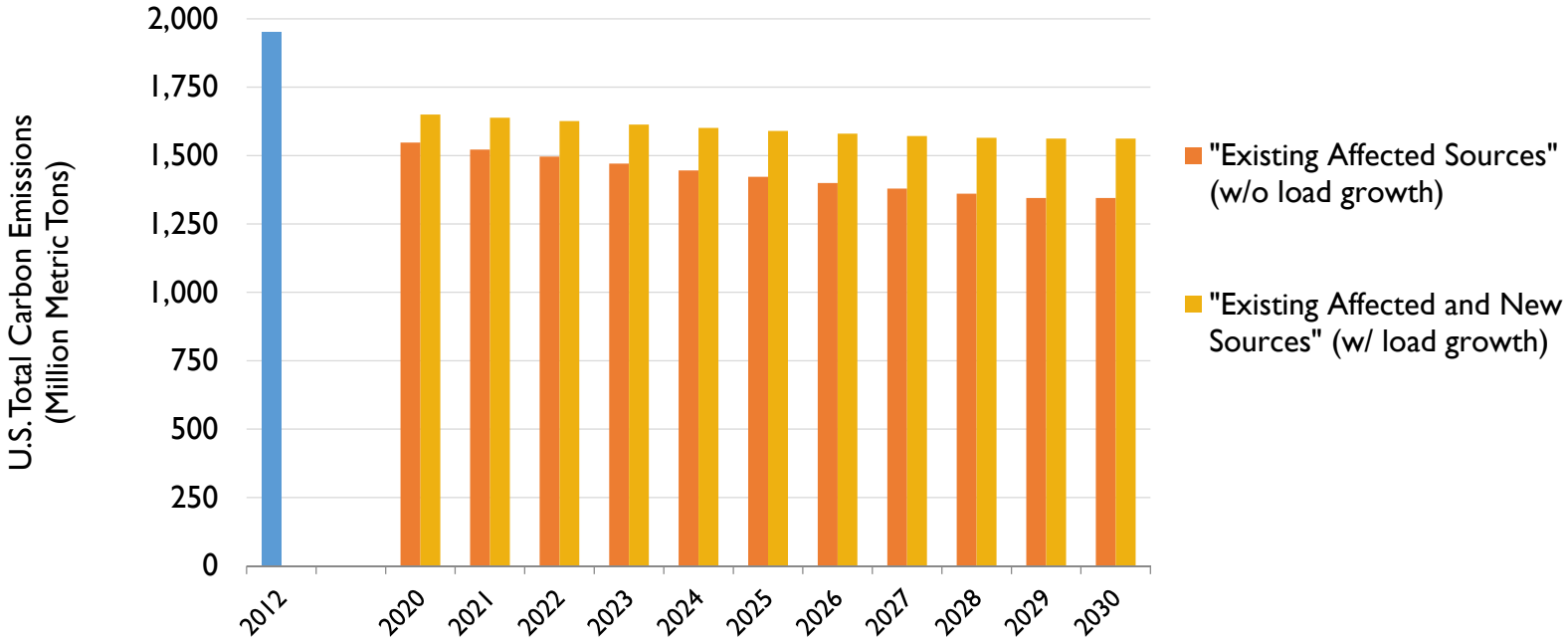
# Compliance Options

# 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 Coal 66 | 18,063 NGCC 21 | 0 O/G Steam 0 | 503 Other 1 | 0 Nuclear 5 | 0 Renewables 18 | 0 E.Efficiency 18 | = | 1,271 lbs/MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

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

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

# Nuclear

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

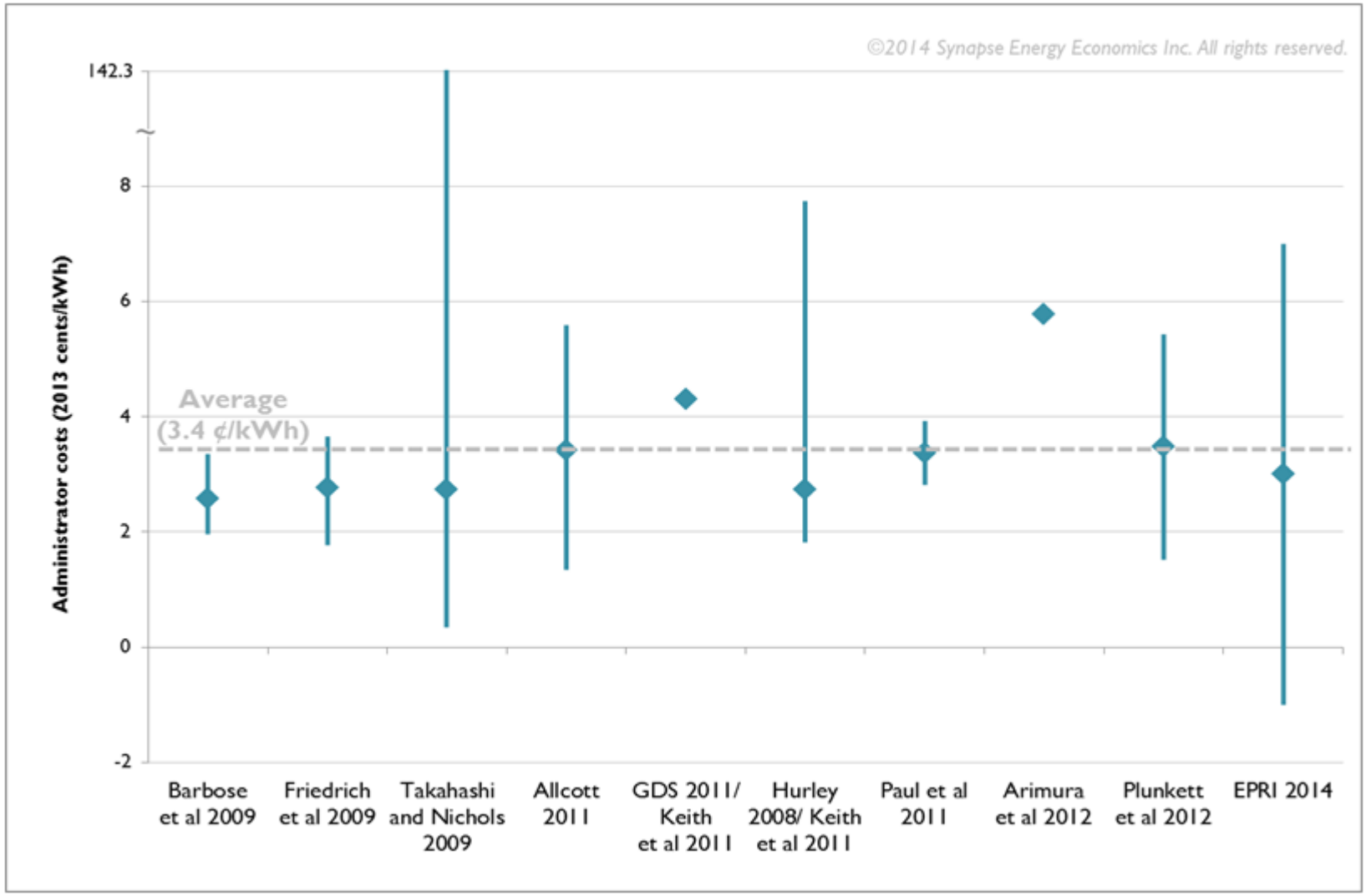
| 111(d) Emission Rate | = | million lbs / million MWh | = | 58,647 Coal: 27 | 43,213 NGCC: 51 | 0 O/G Steam: 0 | 68 Other: 0 | 0 Nuclear: 19 | 0 Renewables: 12 | 0 E.Efficiency: 12 | = | 834 lbs/MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

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

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

# 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 Coal | 26,387 NGCC | 396 O/G Steam | 2,791 Other | 0 Nuclear | 0 Renewables | 0 E.Efficiency | = | 1,338 lbs/MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 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 Coal | 26,387 NGCC | 396 O/G Steam | 2,791 Other | 0 Nuclear | 0 Renewables | 0 E.Efficiency | = | 1,165 lbs/MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 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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What if Ohio sells its excess renewables to Texas?

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