AVERT and 111(d)

EPA Carbon Standards Technical Meeting for Midwest Advocates

24 July 2014

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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

- What is AVERT?
- How does AVERT work?
- How is AVERT currently being used?
- How could AVERT be used for 111(d)?

What is AVERT?

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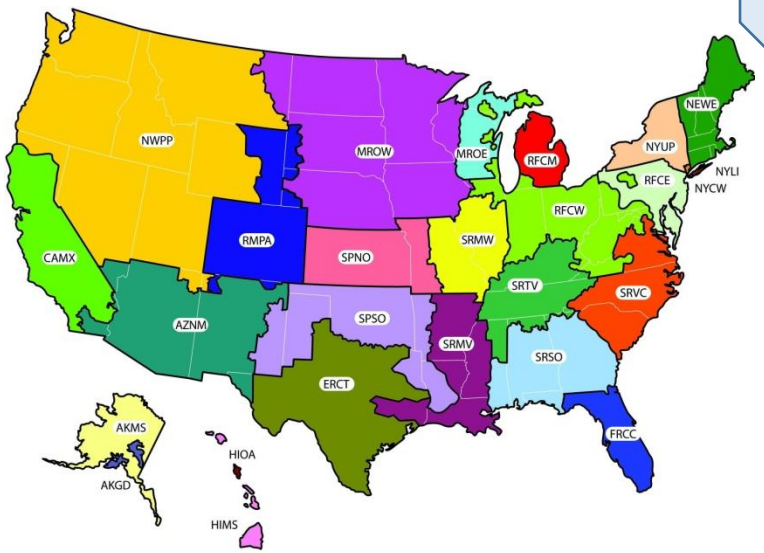
- AVERT – "Avoided Emissions and Generation Tool"
- AVERT began development in 2012 as EPA began to search for a tool that could provide users the capability to estimate the changes in generation and emissions at particular generating units due to new renewable energy (RE) and energy efficiency (EE) projects
- AVERT is now an EPA-approved tool used to translate the energy impacts of EE/RE policies and programs into emission reductions (NO_X, SO_2, CO_2)

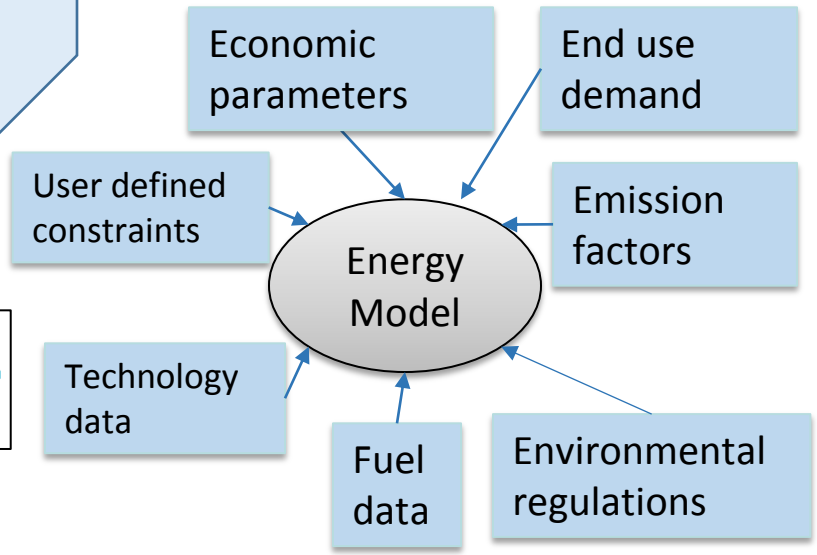
What is AVERT?

- AVERT aims to fill the gap between expensive and work-intensive tools (like dispatch models) and the use of generic state-by-state marginal emission rates

Basic Method	Intermediate Method	Sophisticated Method
eGRID region non-baseload emission rates	Historical hourly emission rates	Energy Modeling



AVERT
AVoided Emissions and geneRation Tool
www.epa.gov/avert



What is AVERT?

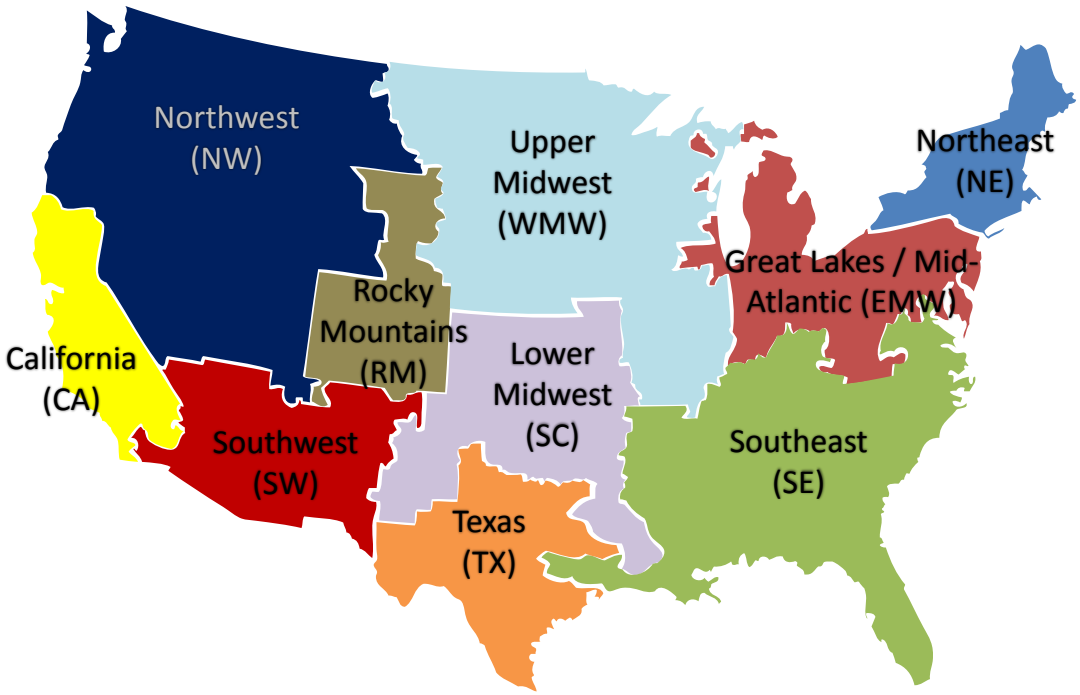
- AVERT was built to be:
  - user friendly
  - transparent
  - credible
- AVERT has been thoroughly reviewed, well-documented and tested. EPA has:
  - Conducted external and internal peer reviews
  - Benchmarked AVERT against industry-standard electric power sector model (PROSYM)
  - Worked with states to beta-tested tool for functionality, appropriate uses, and clarity of user manual

How does AVERT work?

AVERT has two main inputs

- User-input hourly MWh impacts of energy efficiency programs or wind and solar generation
- AVERT uses a data-driven analysis to distinguish *which* generators respond to marginal changes in load reduction
  - Rich dataset from EPA Clean Air Markets division (hourly, unit-by-unit generation & emissions)
  - Gathers statistics on unit operations under specific load conditions, and then replicate changes through a Monte Carlo analysis

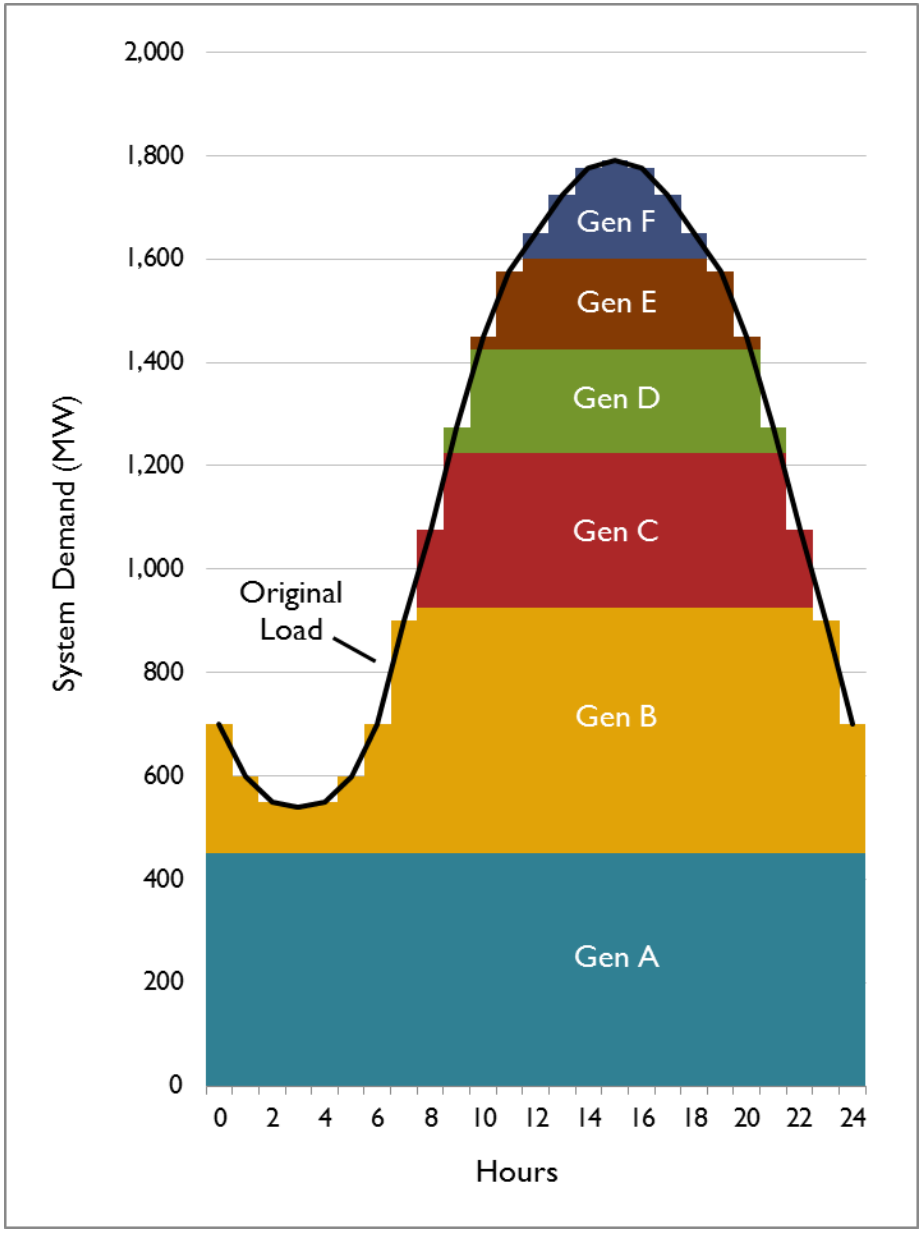
Map of AVERT Regions



Regions represent relatively autonomous electricity production zones, and are based on AEO electricity market module regions

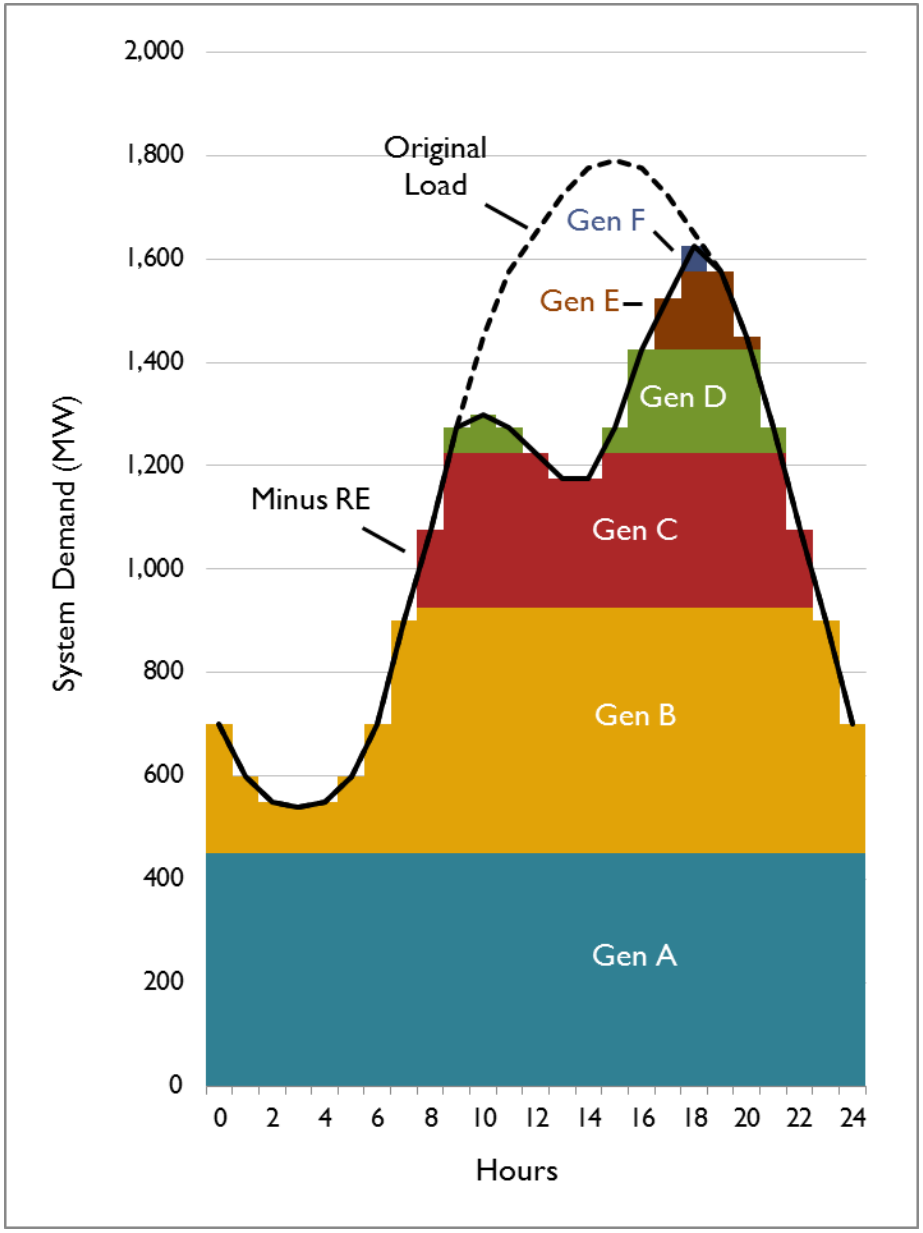
Regions include

- California
- Great Lakes/Mid-Atlantic
- Lower Midwest
- Northeast
- Northwest
- Rocky Mountains
- Southeast
- Southwest
- Texas
- Upper Midwest



Dispatch order – Example

- Daily system demand of ~1,800 MW
- Six units in hypothetical electric grid
- Some units (like "Gen A") run all the time as a baseload unit
- Other units (like "Gen F") are peaking units, and only run a few hours each day



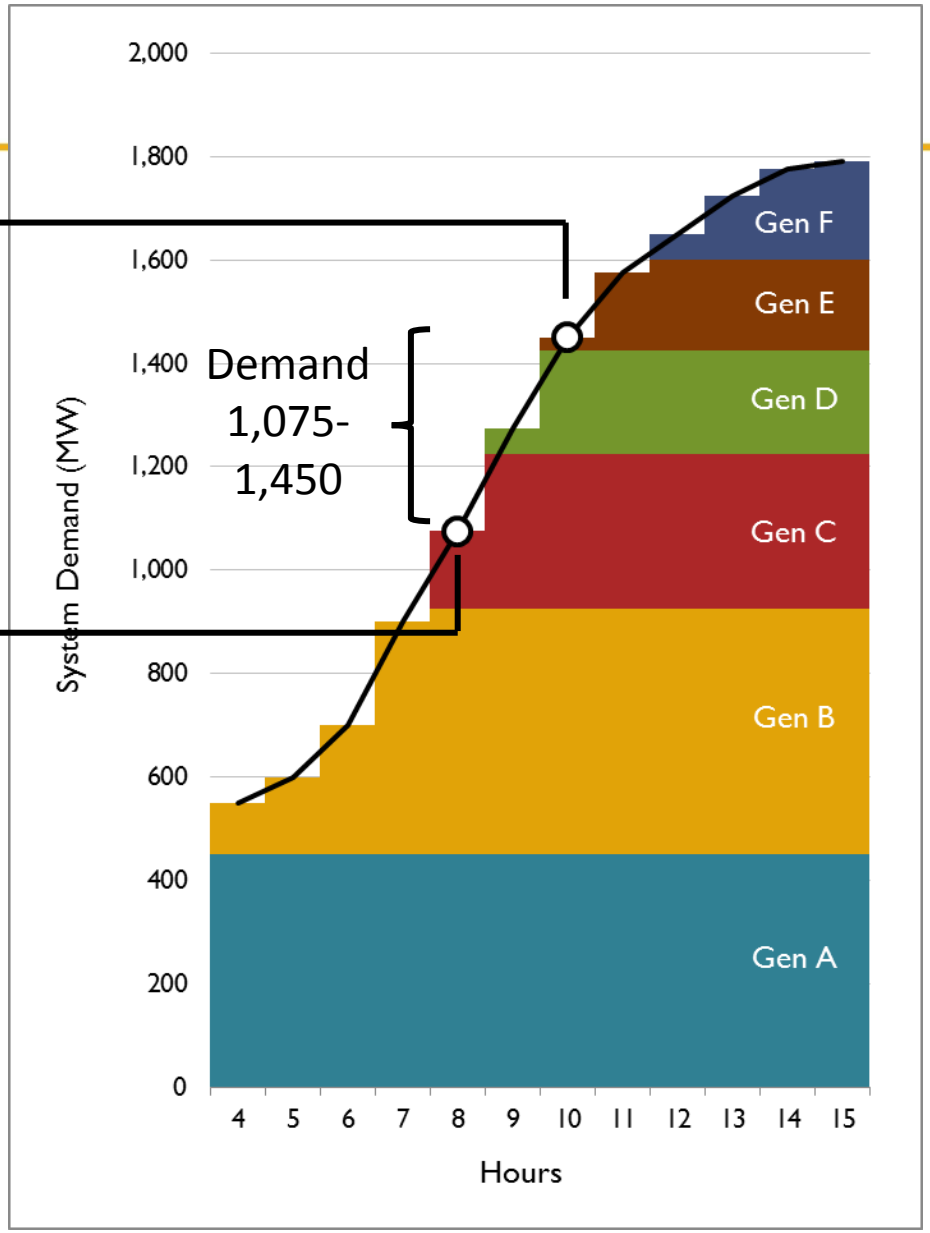
Dispatch order – Example

- When renewables or energy efficiency are added to the system, only some units are displaced
- Depending on the size and profile of the generation displacement, the units affected may be peakers, intermediate units, or baseload units
- Both generation and emissions are displaced as a result

Dispatch Order

Gen A @ 450 MW (100%)
Gen B @ 475 MW (100%)
Gen C @ 300 MW (100%)
Gen D @ 200 MW (100%)
Gen E @ 25 MW (15%)
Gen F @ 0 MW (0%)

Gen A @ 450 MW (100%)
Gen B @ 475 MW (100%)
Gen C @ 150 MW (50%)
Gen D @ 0 MW (0%)
Gen E @ 0 MW (0%)
Gen F @ 0 MW (0%)



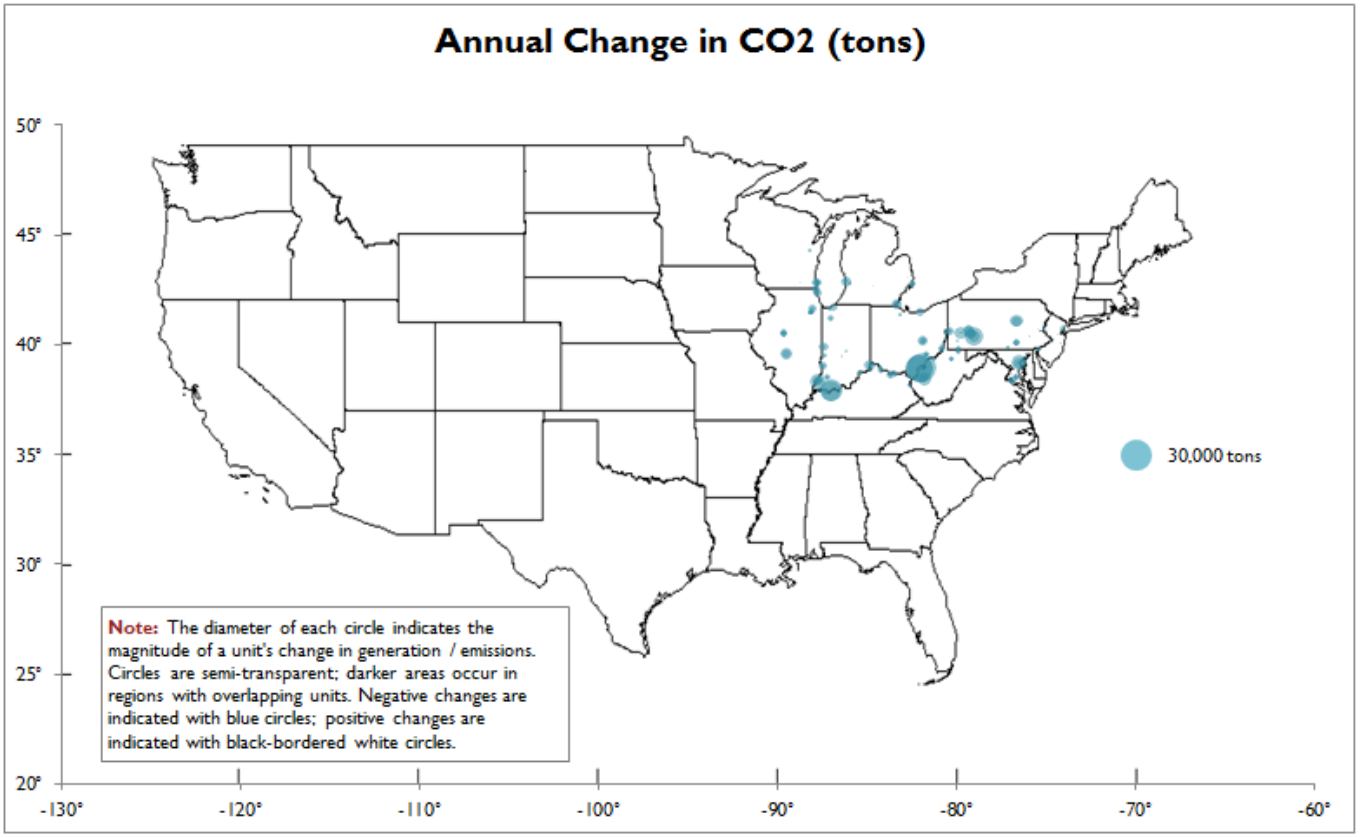
Impact of 200 MW baseload EE program

Great Lakes / Mid-Atlantic, 2013 AVERT

Output: Displaced Generation and Emissions Map

Click here to return to Step 4: Display Outputs

Select variable to display: Annual Change in CO2 (tons) Refresh map



Impact of 200 MW baseload EE program in OH

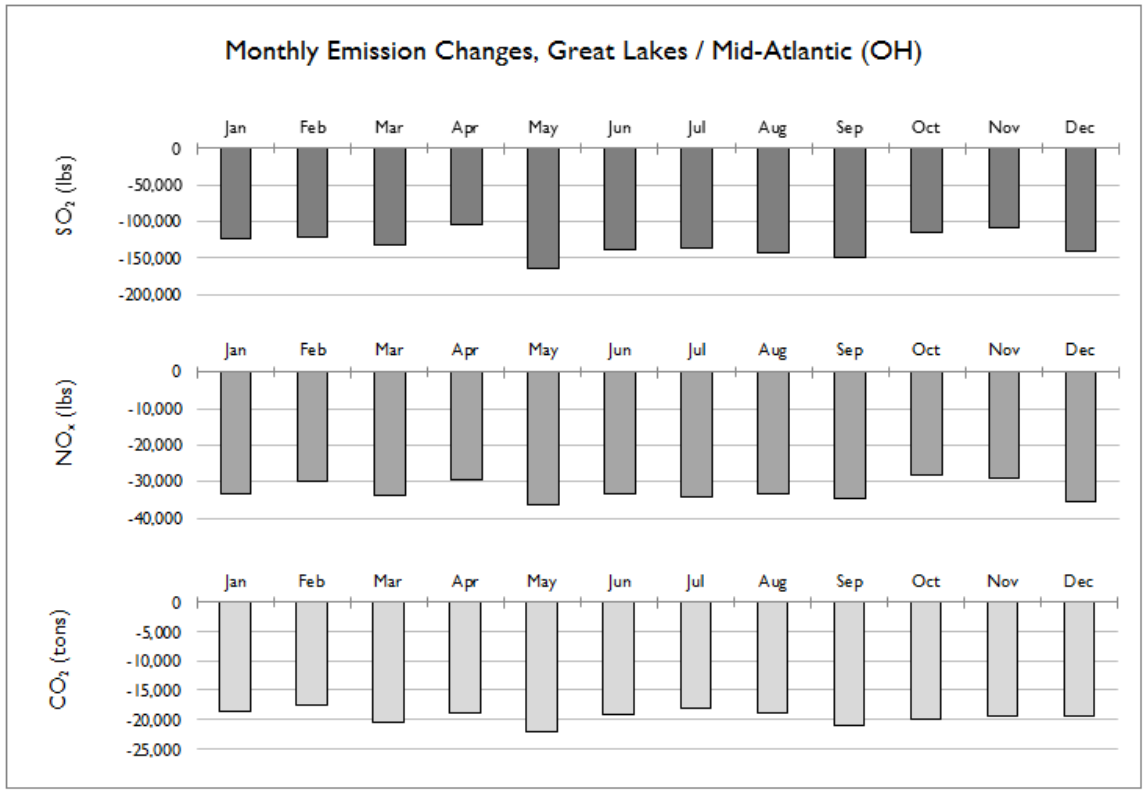
Great Lakes / Mid-Atlantic, 2013 AVERT

Output: Monthly Displacements by Selected Geography

Click here to return to Step 4: Display Outputs

Select level of aggregation: State

Select state: OH



AVERT Caveats

- AVERT is not a projection tool and is not intended for analysis more than five years from selected baseline
- AVERT is currently split into ten hard-coded regions aggregating several hundred EGUs each
  - These regions were compiled based on knowledge of actual electrical interactions
  - AVERT does not account for actual interregional electrical transfers and effects

How is AVERT currently being used?

How is AVERT currently being used?

- AVERT is currently being used by:
  - State air quality planners
  - State energy offices
  - Public utility commission staff
  - Other organizations
- Quantifying emission benefits of state EE/RE policies and programs
- Generating emission impacts to be used for NAAQS modeling and SIP roadmap compliance

How can AVERT be used for 111(d)?

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- Exchange rate calculations
- Planning for compliance

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 energy efficiency yields:

1,541 lbs of CO_2 reductions in Ohio

1,288 lbs of CO_2 reductions in Texas

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

Planning for Compliance

- Under 111(d), states can use "building blocks" to achieve their target emission rates for compliance
- But, the blocks were constructed in isolation from one another (i.e., increasing generation from renewables or EE does not automatically decrease generation from the marginal resource)
- AVERT can't be used for compliance itself, but it can help state DEPs understand and predict the system-wide effects of renewables and EE
- For example, AVERT shows that 200 MW of baseload EE in Ohio reduces:
  - Ohio coal generation by 202 GWh (192,059 tons CO_2)
  - Ohio natural gas generation by 95 GWh (41,458 tons CO_2)

Where can I get AVERT?

On the EPA website: epa.gov/avert/

Soon, on the new Synapse website: www.synapse-energy.com

Other Synapse tools:

- **CAVT (Coal Asset Valuation Tool):** Free, open-source tool used for calculating the costs of complying with upcoming environmental regulations for coal plants (contact pknight@synapse-energy.com for more information)
- **EPA 111(d) Cost Estimate Tool:** Excel workbook breaking down each state's 111(d) building blocks and accompany cost estimates (available at http://www.synapse-energy.com/Downloads/SynapseReport.2014-07.0.111(d)-Cost-Estimate-Tool.14-026.xlsm)