



AVoided Emissions and geneRation Tool  
[www.epa.gov/avert](http://www.epa.gov/avert)

## Avoided Emissions and Generation Tool (AVERT)



**Jeremy Fisher**  
**Synapse Energy Economics**

**Robyn DeYoung**  
**U.S. EPA, State and Local  
Climate and Energy Program**

# What is AVERT?

- In 2012, EPA published EE/RE Roadmap: guide to incorporating energy efficiency and renewable energy into State Implementation Plans.
- Open question: how to quantify emissions impacts from EE/RE?
- States, efficiency providers, and stakeholders seeking accessible method with public data.
- EPA released AVERT in February, 2014

**AVoided Emissions and generation Tool (AVERT)**  
A tool that estimates the emissions benefits of energy efficiency and renewable energy policies and programs

- Cost-effective ways to reduce air pollution and include emission benefits in Clean Air Act Plans
- What is AVERT?
- Why use AVERT?
- When should AVERT not be used?
- Who should use AVERT?
- How does AVERT work?
- How to run scenarios in AVERT
- Download AVERT

**Cost-effective ways to reduce air pollution and include emission benefits in Clean Air Act Plans**  
Many states are adopting, implementing and expanding cost-effective energy efficiency (EE) and renewable energy (RE) policies and programs. States are investing in EE/RE policies and programs to achieve benefits including lowered customer costs, improved electric supply reliability, and diversified energy supply portfolios. Energy efficiency and renewable energy also have the potential to reduce pollution of criteria air pollutants and greenhouse gases, especially on high electricity demand days that typically coincide with poor air quality.

The number of states with EE/RE policies continues to grow, but quantifying the emissions impacts of these policies and programs can be challenging. EPA is committed to helping state air quality planners calculate the emissions benefits of EE/RE policies and program so that these emission reductions can be incorporated in Clean Air Act plans to meet National Ambient Air Quality Standards (NAAQS) and other clean air goals.

**What is AVERT?**  
AVERT is a free tool with a simple user interface designed to meet the needs of state air quality planners and other interested stakeholders. Non-experts can easily use AVERT to evaluate county, state and regional emissions displaced at electric power plants by EE/RE policies and programs. AVERT is designed to use public data, which is accessible and auditable.

**Why use AVERT?**  
State air quality planners, energy offices, public utility commission staff, and other organizations interested in knowing the emission benefits of EE/RE policies and programs can use AVERT to:

- Quantify the nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), and carbon dioxide (CO<sub>2</sub>) emissions benefits of state and multi-state EE/RE policies and programs.
- Examine the regional, state, and county level emission impacts of different EE/RE programs based on temporal energy savings and hourly generation profiles.
- Include AVERT-calculated emission impacts of EE/RE policies and programs in air quality modeling and Clean Air Act plans used to meet the National Ambient Air Quality Standards with the concurrence of the appropriate EPA regional office.
- Compare the emission impacts of different types of EE/RE programs, such as the emission impacts of wind installations versus solar installations.
- Understand the emission impacts of different EE/RE policies and programs during high electricity demand days.
- Analyze the emission benefits of EE/RE programs implemented in multiple states within an AVERT region.
- Present information about location-specific emissions benefits in easy-to-interpret tables and maps.

Learn more:

[www.epa.gov/AVERT](http://www.epa.gov/AVERT)



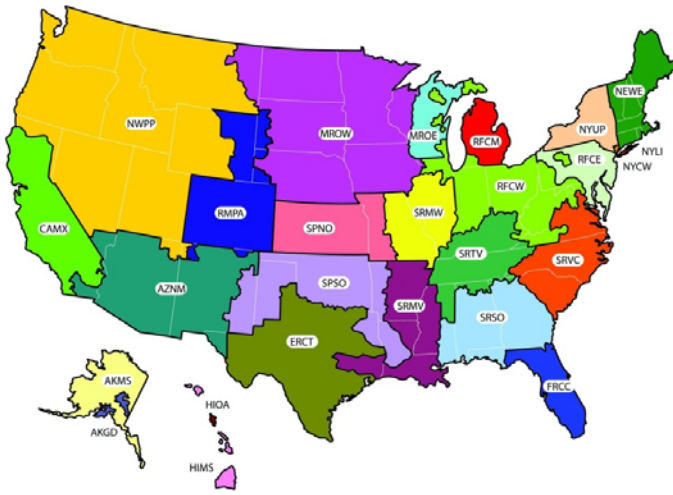
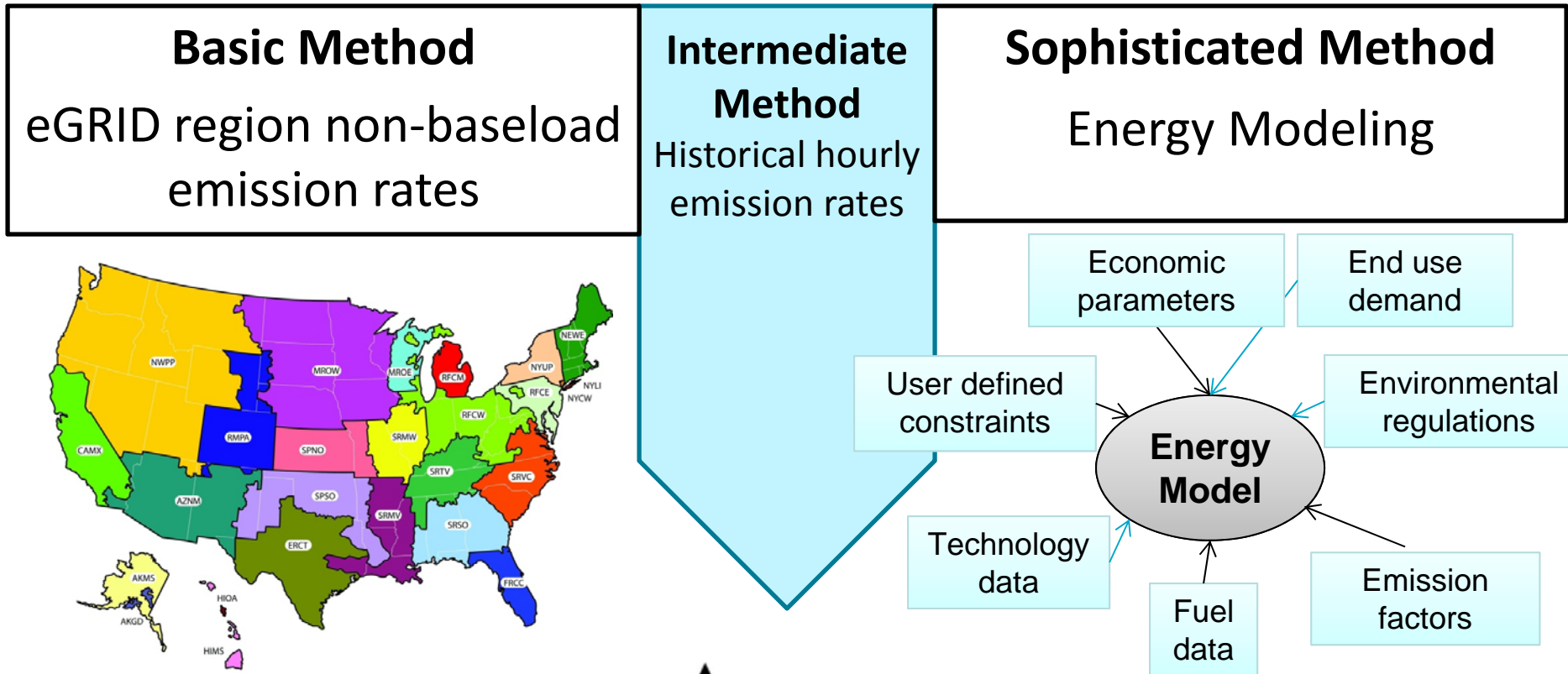
# Purpose of AVERT Development for Energy Efficiency and Renewable Energy Programs

- AVERT complements EPA's Roadmap for Incorporating Energy Efficiency and Renewable Energy (EE/RE) Programs in State Implementation Plans (SIPs)
  - Appendix I of the EE/RE SIP Roadmap describes four quantification approaches states can use for NAAQS compliance planning
  - AVERT translates the energy savings of state EE policies into emission reductions
- AVERT addresses a key reason states have not implemented previous EE/RE SIP guidance
  - States are not clear what emission reductions from EE/RE programs are achievable
- AVERT is:
  - user friendly,
  - transparent, and
  - credible



For more information on EPA's EE/RE SIP Roadmap visit: <http://www.epa.gov/airquality/eere/manual.html>

# Emission Quantification Methods Basic to Sophisticated

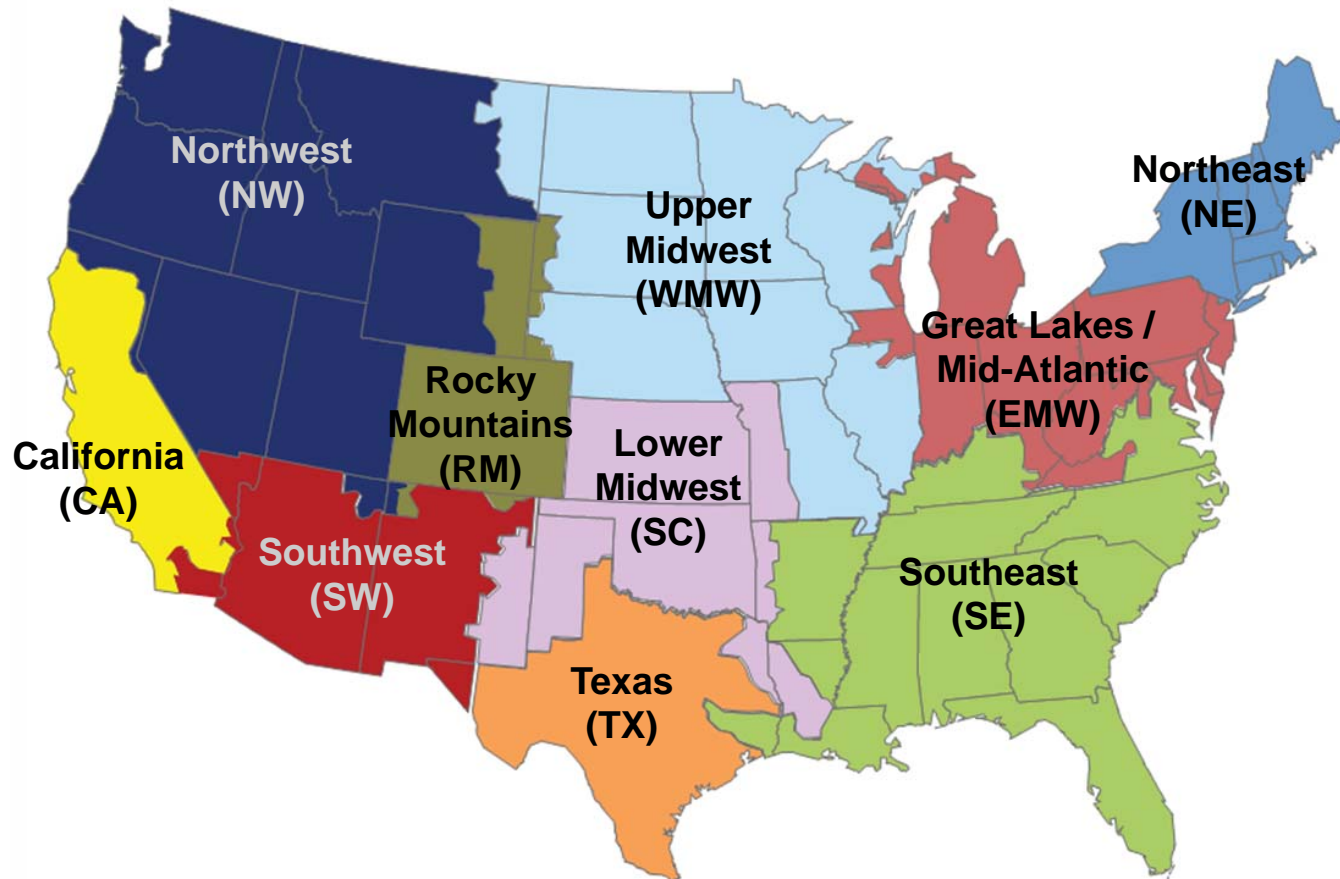


- Using data-driven analysis, how do we distinguish which EGU respond to changes in load reduction?
  - Rich dataset from EPA Clean Air Markets division (hourly, unit-by-unit generation & emissions)
  - Gather statistics on unit operations under specific load conditions, and then replicate changes through a Monte Carlo analysis
- Model divided between statistical core module, and user interface



# AVERT Main Module

## Step 2. Selecting a region

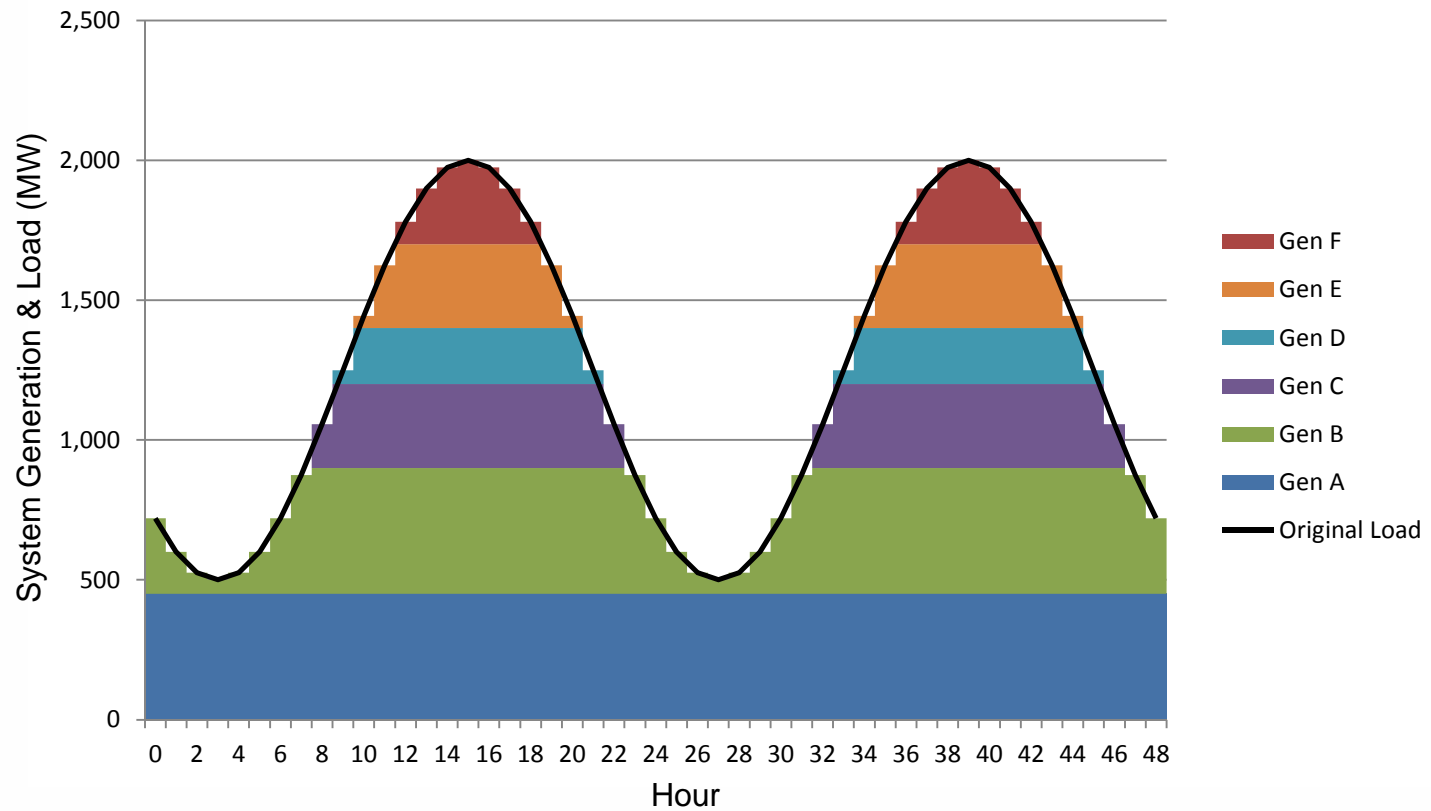


Regions represent relatively autonomous electricity production zones, and are based on EIA's electricity market module regions.

Regions include:  
California, Great Lakes / Mid-Atlantic, Lower Midwest, Northeast, Northwest, Rocky Mountains, Southeast, Southwest, Texas, and Upper Midwest

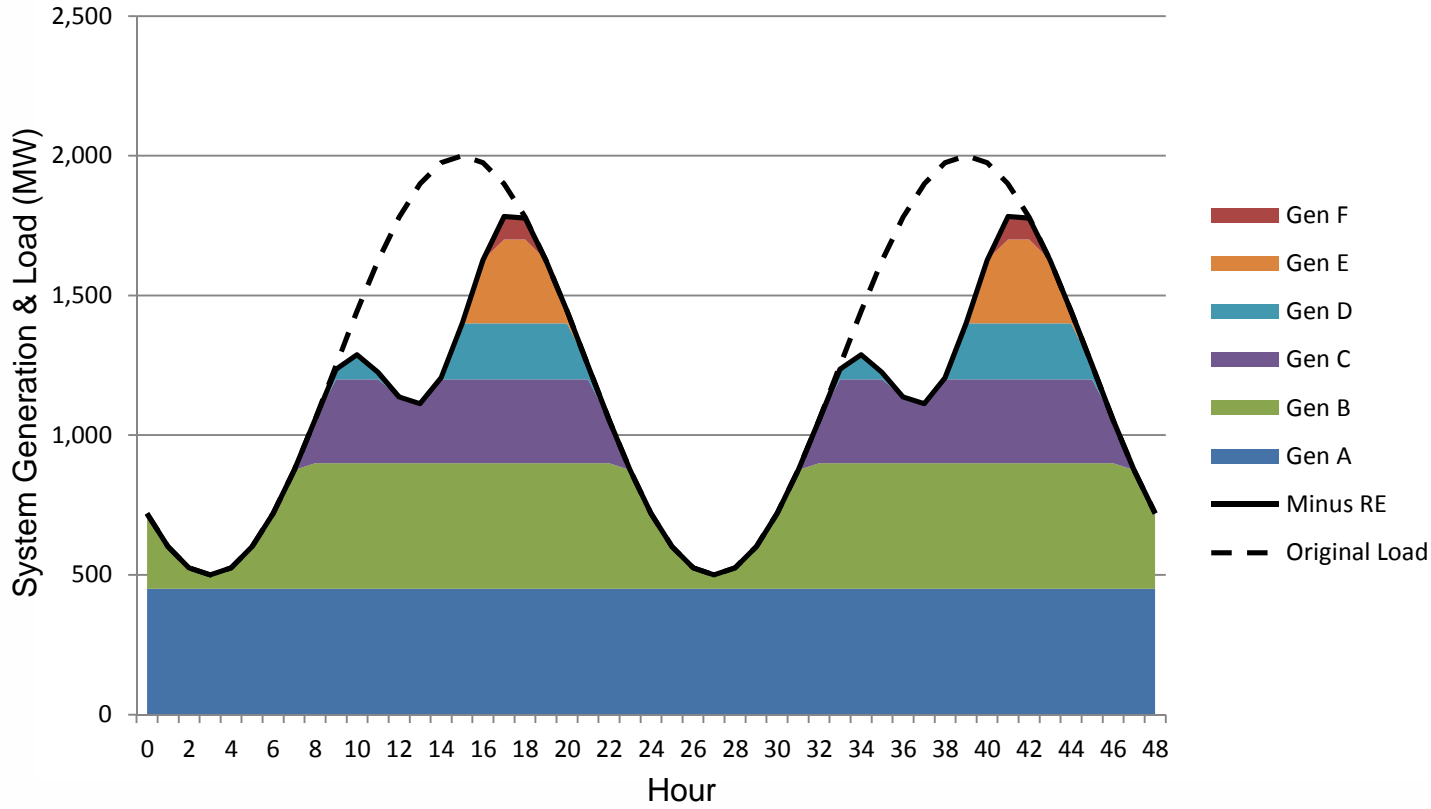
# AVERT Overview

## Example: Loading order



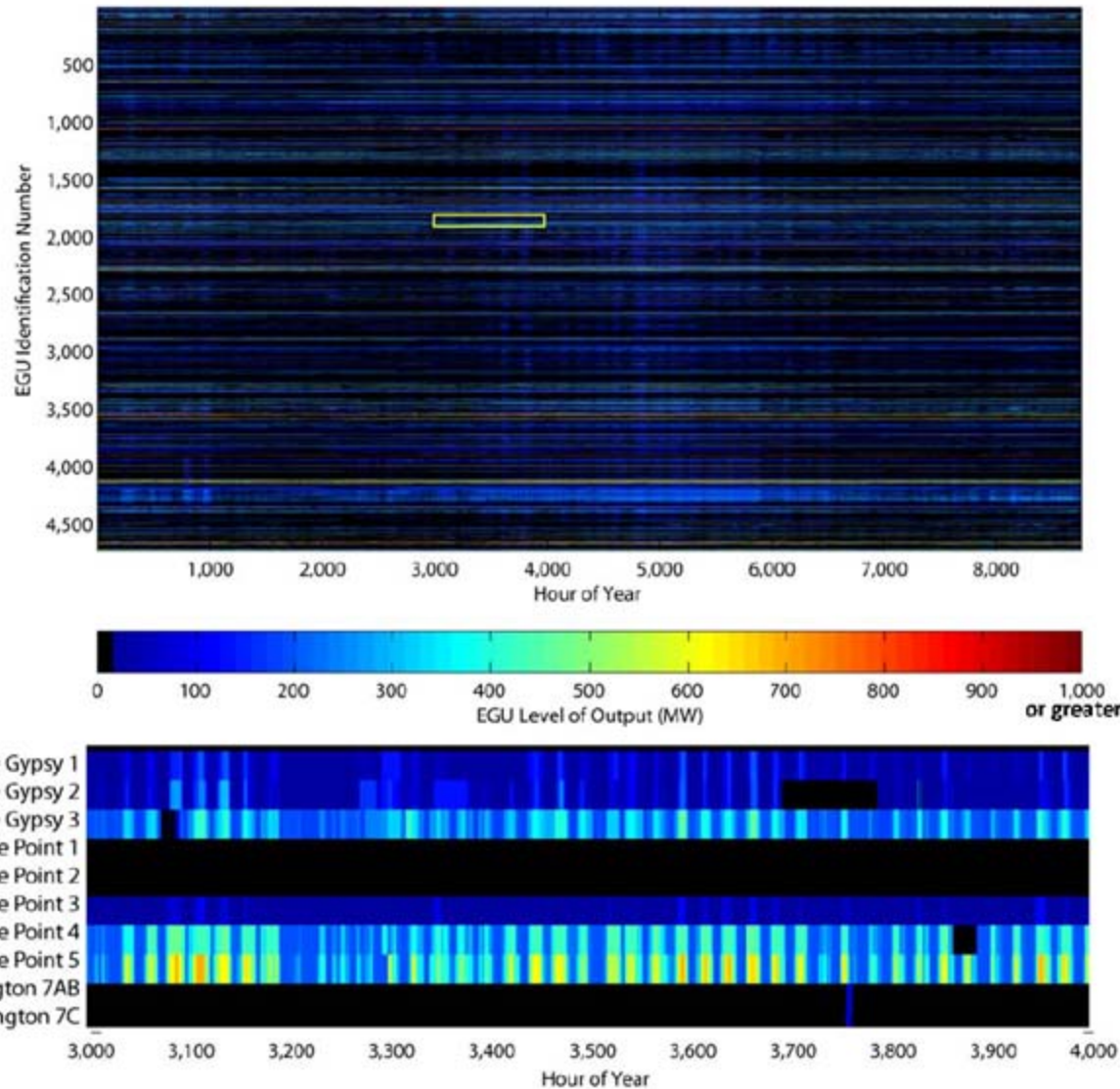
# AVERT Overview

## Example: Loading order





# AVERT Overview Underlying Data



Continuous Emissions Monitoring (CEMS) data from Clean Air Markets Division (CAMD) @ EPA

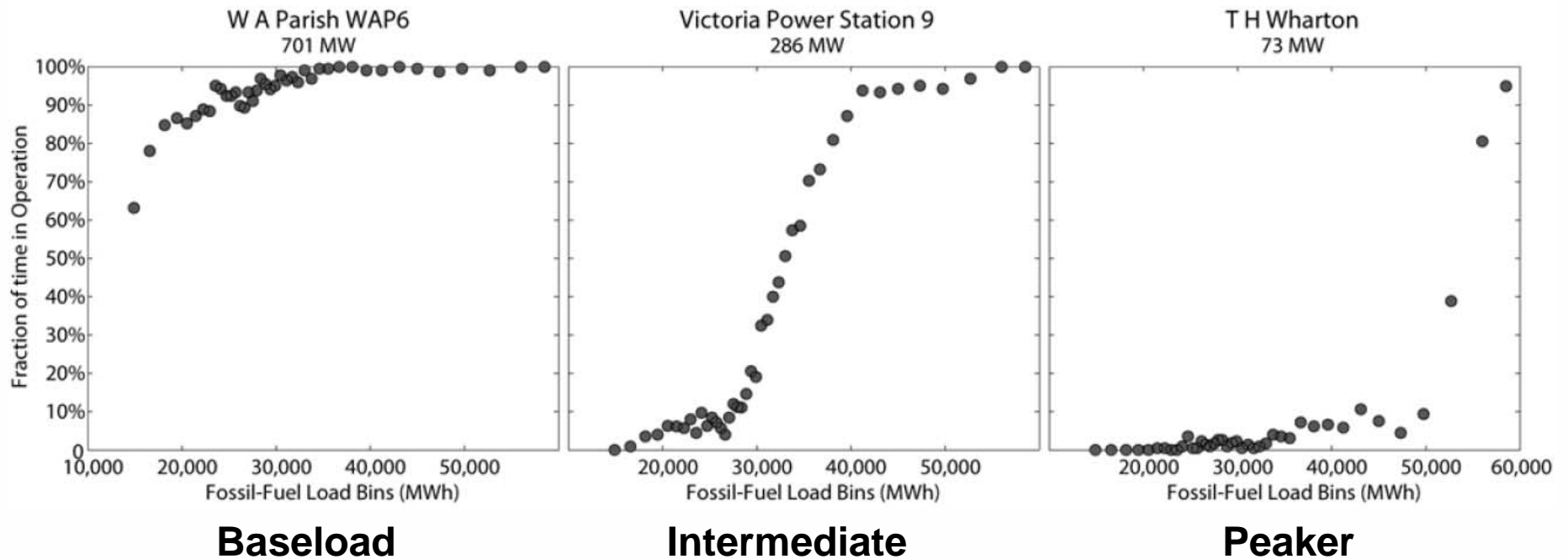
Hourly generation and emissions of CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>x</sub>.

Fossil generators > 25 MW

# Basis of AVERT Statistical Module

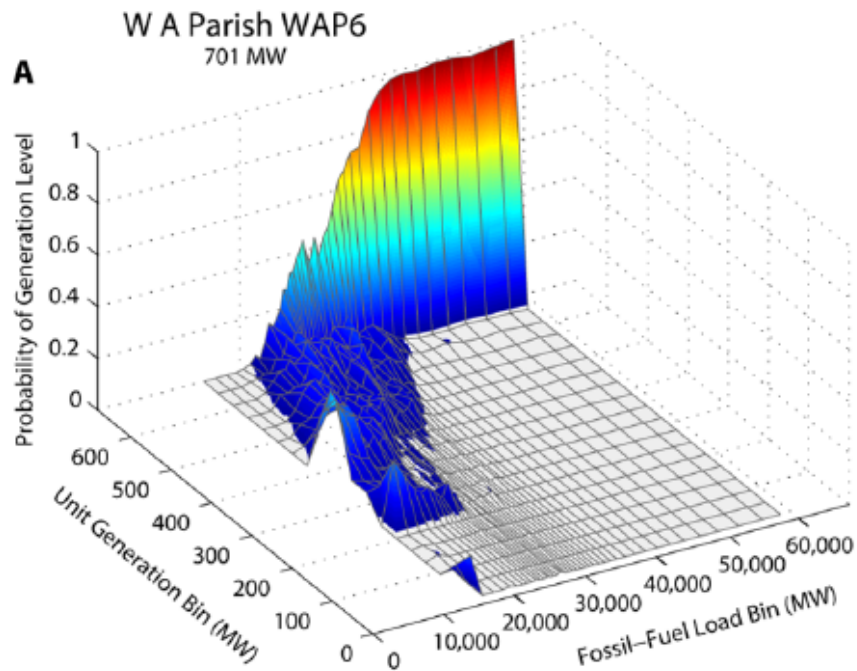
## Gather Operating Statistics (1)

How often, and under what conditions, does an EGU generate power?

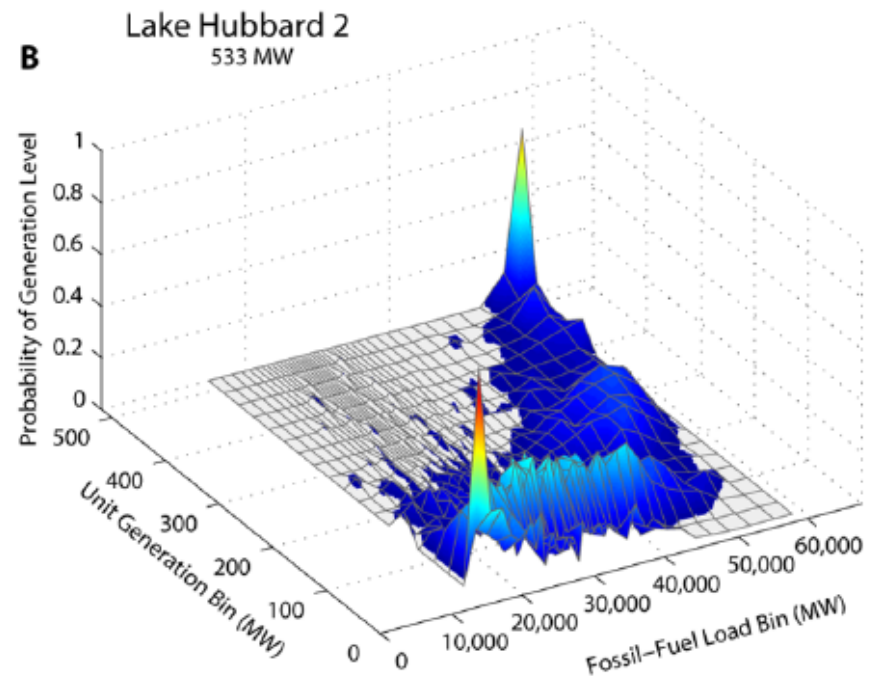


# Basis of AVERT Statistical Module Gather Operating Statistics (2)

When an EGU is on, how much does it produce under various load conditions?



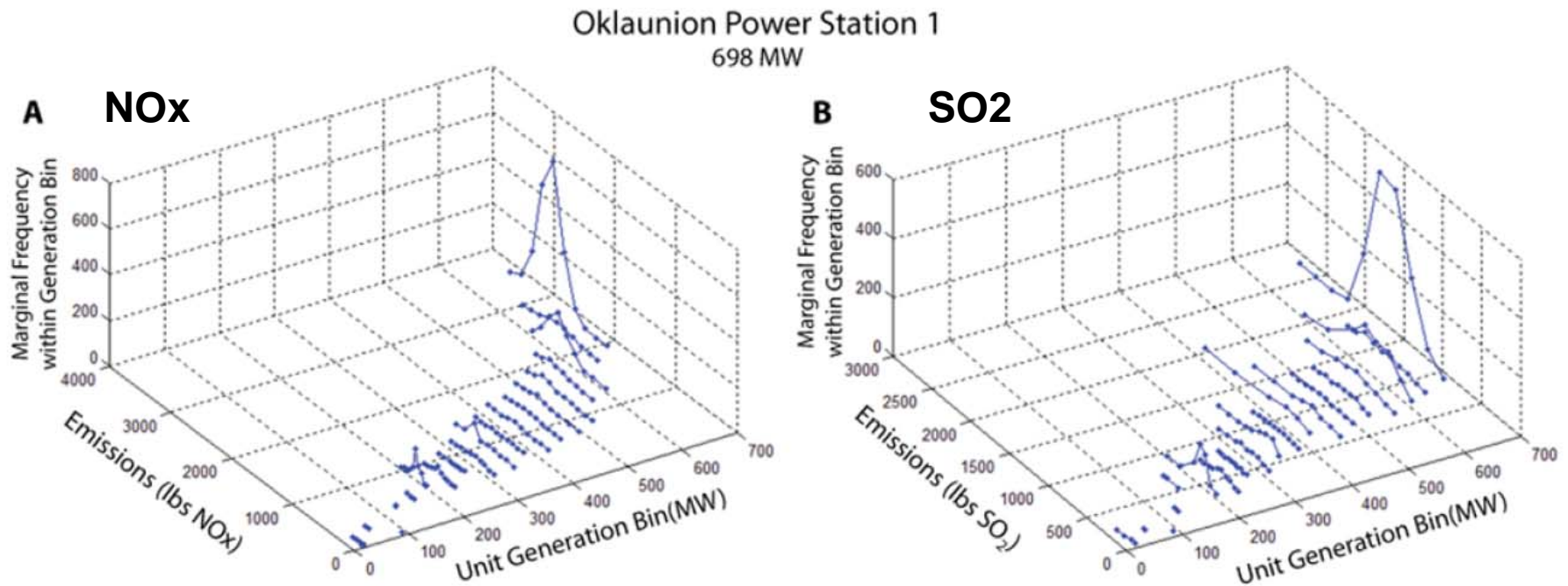
**Baseload coal**



**Intermediate gas**

# Basis of AVERT Statistical Module Gather Operating Statistics (3)

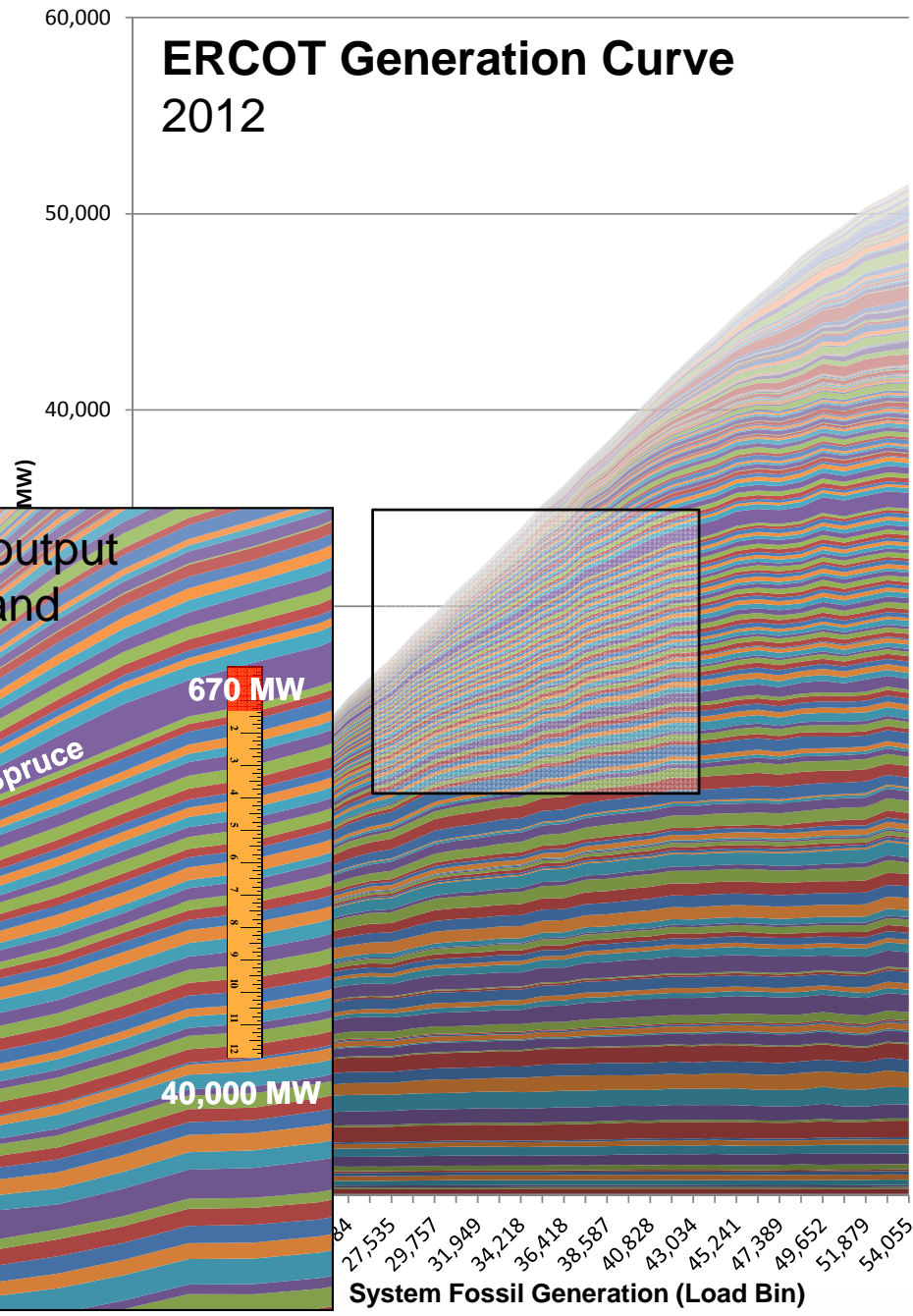
How much emissions are released by an EGU at different levels of generation?





- Estimate average EGU generation and emissions through Monte Carlo simulation.

- Estimate change in EGU output per change in system demand



- Spencer 5
- Hardin County Peaking Facility HCCT1
- Hardin County Peaking Facility HCCT2
- R W Miller \*\*4
- Leon Creek CGT1
- W A Parish WAP1
- W A Parish WAP2
- Leon Creek CGT4
- Exelon Laporte Generating Station GT-2
- Decker Creek GT-1A
- Decker Creek GT-1B
- Sam Bertron SRB4
- Sam Bertron SRB3
- Permian Basin 5
- W A Parish WAP3
- Spencer 4
- Permian Basin CT5
- Mustang Station Units 4 and 5 GEN1
- V H Braunig CGT5
- Exelon Laporte Generating Station GT-1
- Handley Generating Station 3
- Decker Creek GT-2B
- Power Lane Steam Plant 2
- Greens Bayou GBY5
- Graham 1
- Ray Olinger BW3
- Decker Creek GT-2A
- Exelon Laporte Generating Station GT-3
- Sand Hill Energy Center SH6
- Permian Basin CT2
- Ray Olinger BW2
- Barney M. Davis 1
- Roland C. Dansby Power Plant 3
- Tradinghouse 2
- Sim Gideon 1
- Valley (TXU) 2
- Cedar Bayou CBY2

Texas, 2012

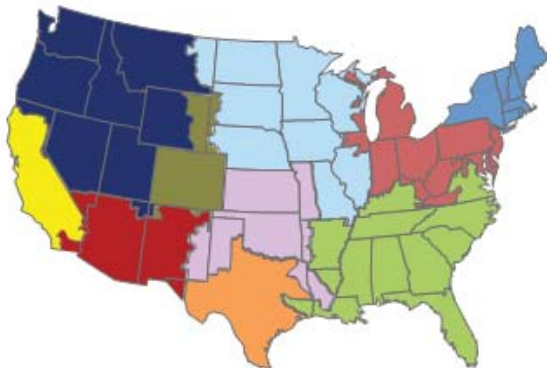
AVERT

## Step 1: Import Regional Data File

### Select region

Select a region for analysis by using the dropdown or by clicking the map.

Texas



[If you haven't yet downloaded a Regional Data File, click here.](#)

### Enter filepath

Double-click below to enter the location of the Regional Data File.

T:\AVERT Code\AVERT Regional Data Files 2012\AVERT RDF 2012 EPABase (Texas).xlsx

### Load data

Click here to load the Regional Data File

Welcome

1. Regional Data File

2. Set EERE Profile

3. Run Displacement

4. Display Outputs

Next →

← Back

EPABase

Texas, 2012

AVERT

## Step 2: Set Energy Efficiency and Renewable Energy Impacts

**DIRECTIONS:** Enter the EERE load for one or a group of EERE policies and programs. To include the impacts of hourly data manually, click the green button on the right. Each entry is additive and will create a portfolio of EE/RE impacts. For further instructions consult Section 4 of the AVERT user manual.

Enter hourly data manually

### Enter EE impacts based on the % reduction of regional fossil load

Reduce generation by a percent in some or all hours		
Apply reduction to top X% hours:	0%	% of top hours
Reduction % in top X% of hours:	0.0%	% reduction

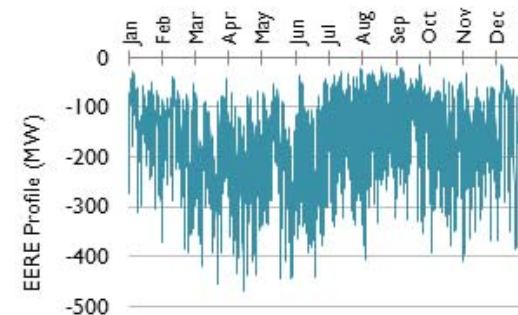
### And/or enter EE impacts distributed evenly throughout the year

Reduce generation by annual GWh:	0	GWh
<b>OR</b>		
Reduce each hour by constant MW:	0.0	MW

### And/or enter annual capacity of RE resources

Wind Capacity:	500	MW
Utility Solar PV Capacity:	0	MW
Rooftop Solar PV Capacity:	0	MW

Selected EERE Profile Portfolio:



The currently entered reduction profile equals 1,485 GWh, or 0.6% of regional fossil load.



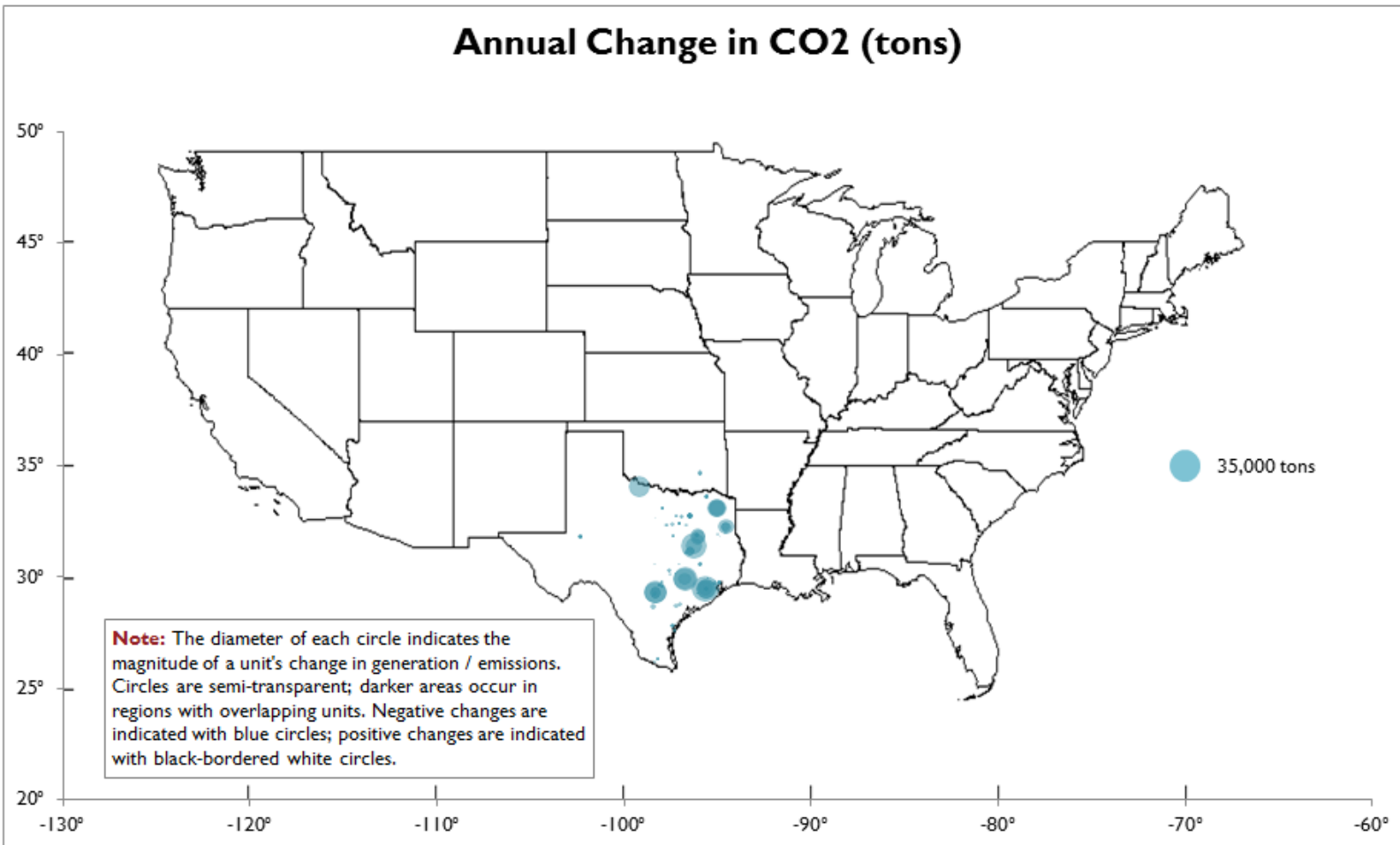
EPABase

# AVERT Outputs

Select variable to display:

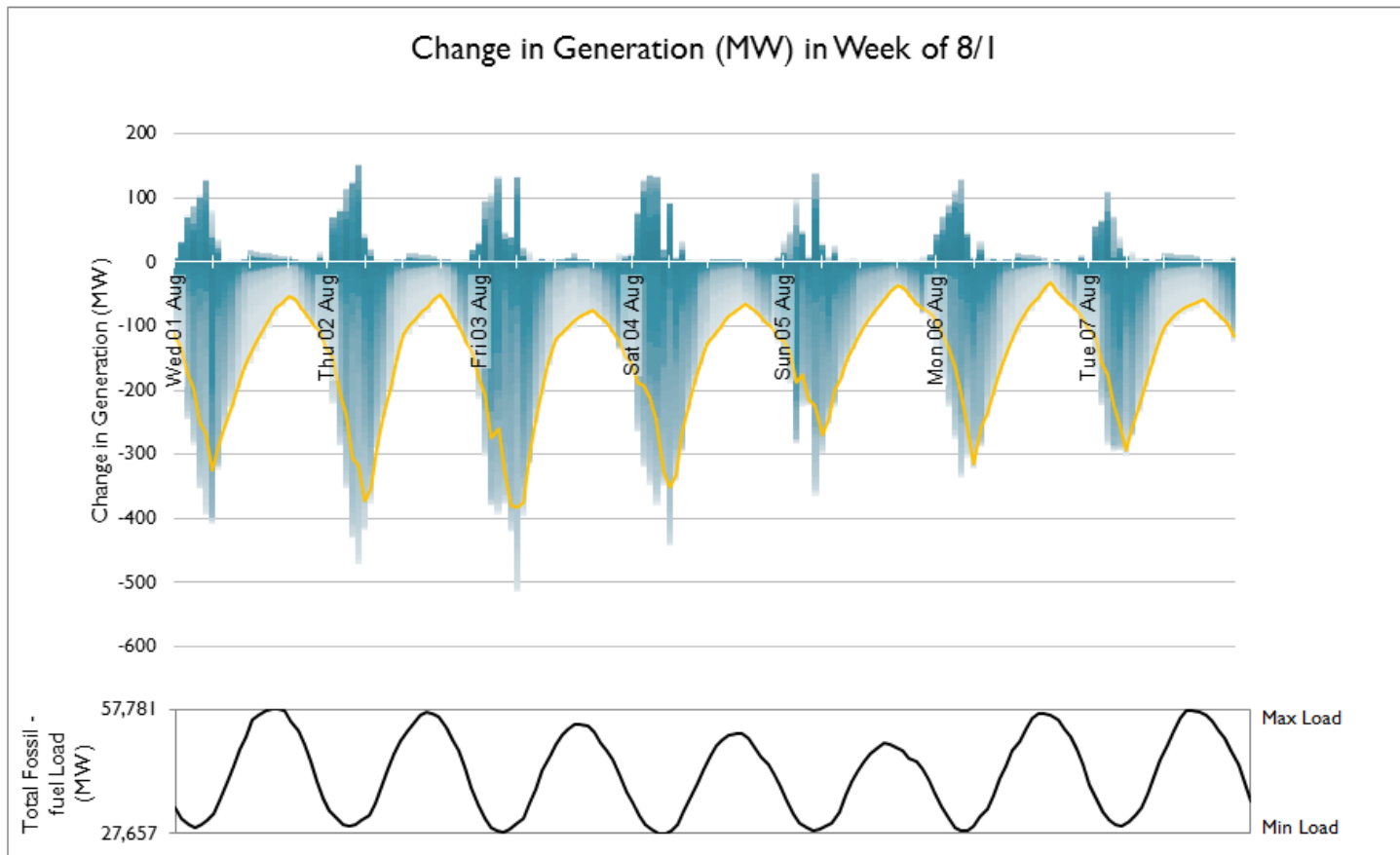
Annual Change in CO2 (tons) ↓

Refresh map





# AVERT Outputs



Negative numbers indicate displaced generation and emissions.

- Based completely on historic data; no embedded assumptions.
- Reflects historic dispatch and economics; limited options for long-term projections
- No transmission; hard regional boundaries.

# Where is AVERT Used?

- Ozone Advance Program
- Value of renewable energy (ME, AWEA)
- Quantify emissions impacts of EE (WI, UT)
- Listed in EPA CPP Toolbox

**Clean Power Plan Toolbox for States**

**Resources to help develop state plans**

As co-regulators, states will develop plans to meet the guidelines in the [Clean Power Plan \(CPP\)](#). The resources below provide information on state plan development and can help states determine the most cost-effective approaches to reducing greenhouse gas emissions from the power sector. Please check this page for frequent updates.

**Clean Power Plan Documents and Resources**

- [Proposed CPP for existing power plants](#)
- [Technical support documents](#)
- [Clean Power Plan State Goal Visualizer \(Excel\)](#) (10 pp, 233 K)

**Additional Resources:**

- [Greenhouse Gas Reporting Program](#)

**Technical Resources for Reducing CO<sub>2</sub> from Power Plants**

- [Combined heat and power technology options](#)
- [Combined heat and power project development resources](#)

**Policies and Programs for Reducing CO<sub>2</sub> from the Power Sector**

- [Existing state programs](#)
- [Energy efficiency portfolio planning with ENERGY STAR](#)
- [Utility incentives for energy efficiency \(PDF\)](#) (116 pp, 1.2 MB)
- [Market-based mechanisms: design and operation \(PDF\)](#) (78 pp, 1.1 MB)
- [Market-based mechanisms: key insights \(PDF\)](#) (47 pp, 1.1 MB)
- [Clean Energy Environment Guide to Action](#)

**Estimating Potential Energy Efficiency and Renewable Energy (EE/RE) Impacts**

- [Avoided Emissions & generation Tool \(AVERT\)](#)
- [Assessing the multiple benefits of EE/RE](#)
- [Combined Heat and Power Partnership](#)
- [U.S. DOE Building Technologies Office](#)
- [U.S. DOE Advanced Manufacturing Office – Technical Assistance Activities](#)
- [State & Local Energy Efficiency Action Network](#)
- [Industrial energy efficiency resources for](#)

**Clean Power Plan**

EPA is taking its first steps under President Obama's Climate Action Plan to reduce carbon pollution from power plants - the largest stationary source of carbon pollution in the United States.

[Learn more about EPA's proposed Clean Power Plan](#)

**EPA Webinars on the Proposed Clean Power Plan**

[Watch past presentations](#) to learn more about EPA's proposed Clean Power Plan.

**Get Involved**

- [Comment on the Clean Power Plan proposal](#)

You will

[www2.epa.gov/cleanpowerplantoolbox](http://www2.epa.gov/cleanpowerplantoolbox)

# Questions?

## Jeremy Fisher

Principal Consultant

Synapse Energy Economics

[jfisher@synapse-energy.com](mailto:jfisher@synapse-energy.com)

## Robyn DeYoung

State and Local Climate and Energy  
Program

US EPA

[avert@epa.gov](mailto:avert@epa.gov)



[www.epa.gov/avert](http://www.epa.gov/avert)



# AVERT Overview

## Example: Generation Statistics

