Avoided Emissions and Generation Tool (AVERT)

Synapse
Energy Economics, Inc.

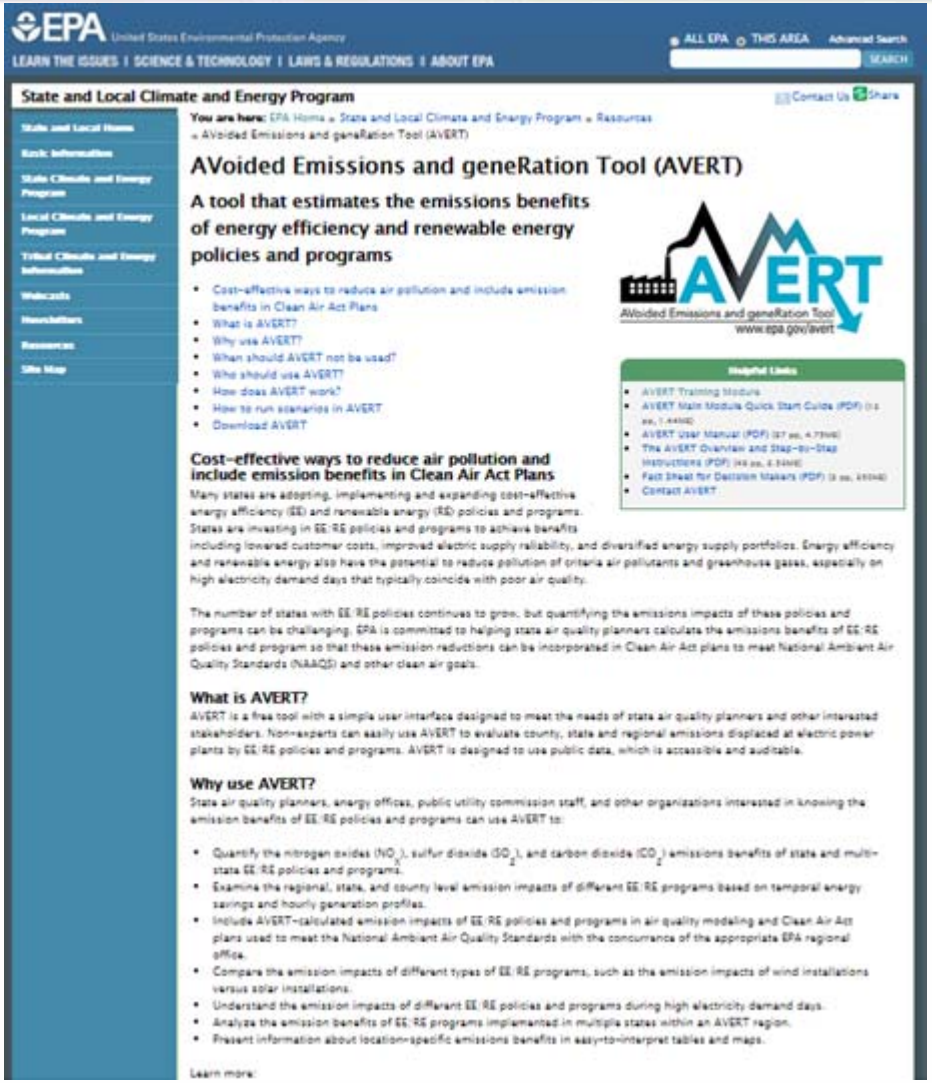
EPA United States Environmental Protection Agency

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



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

Basic Method

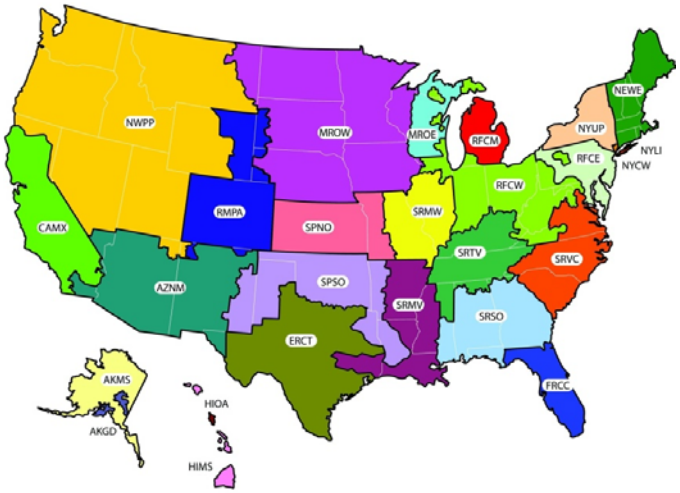
eGRID region non-baseload emission rates

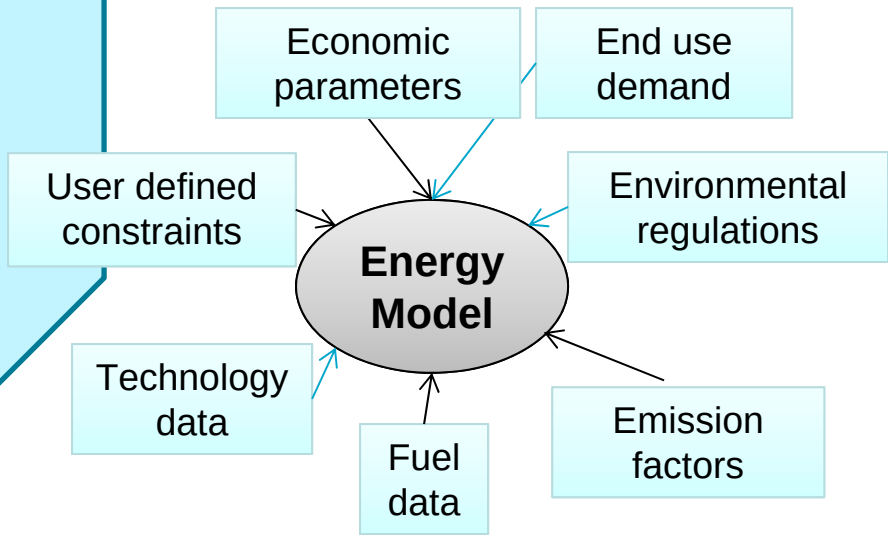
Intermediate Method

Historical hourly emission rates

Sophisticated Method

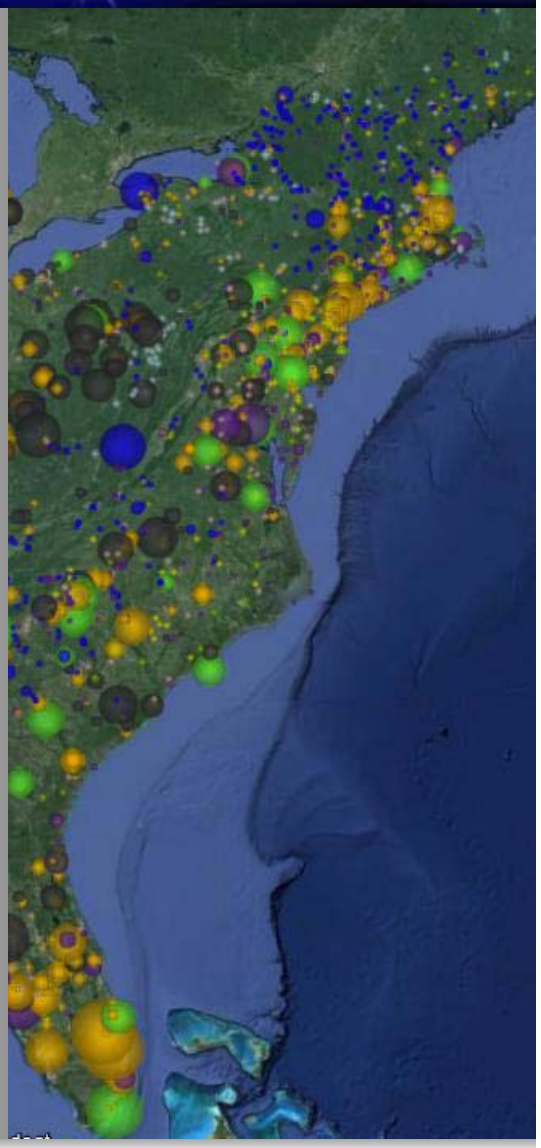
Energy Modeling



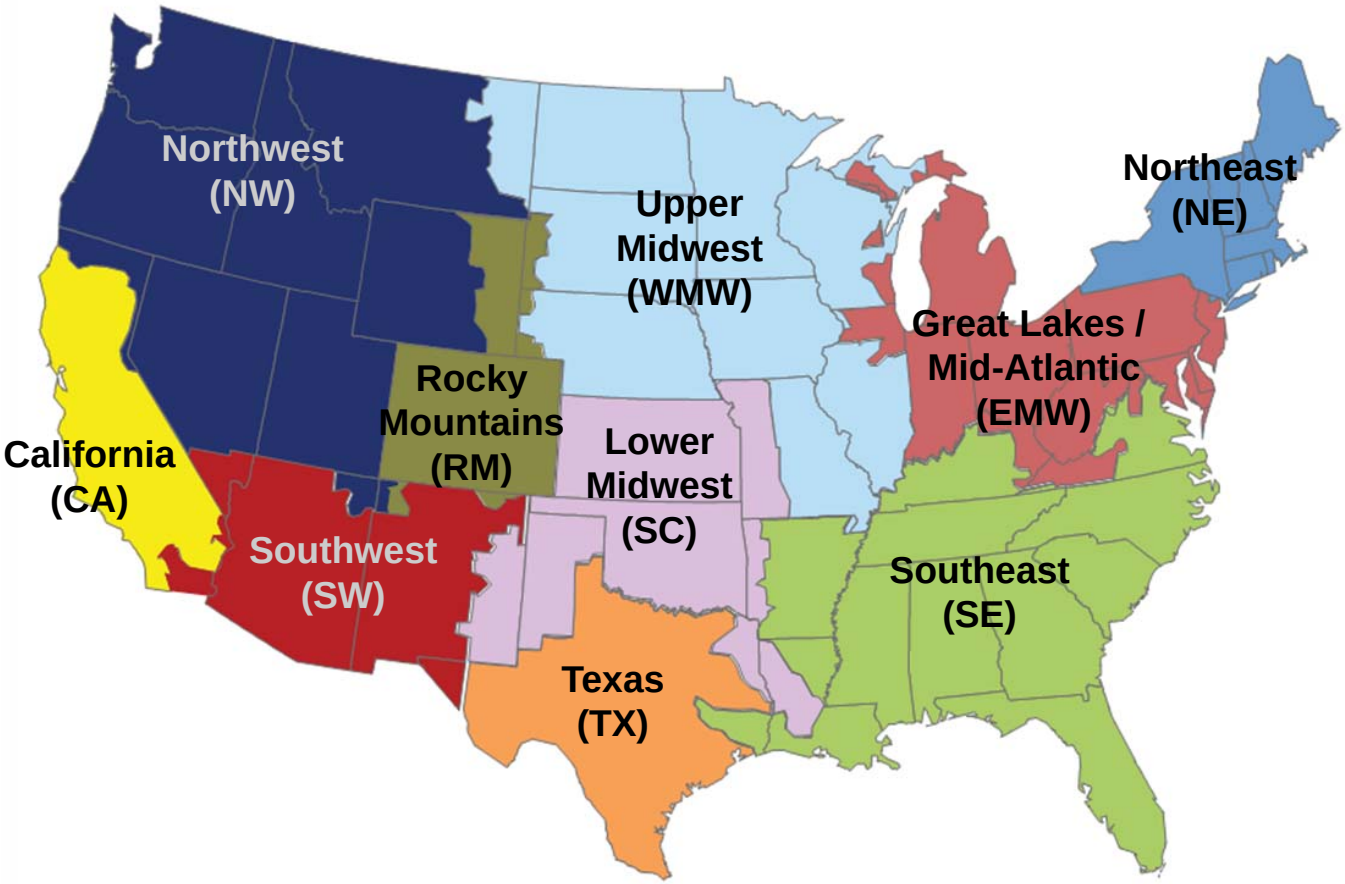


AVERT
AVoided Emissions and geneRation Tool
www.epa.gov/avert

- 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



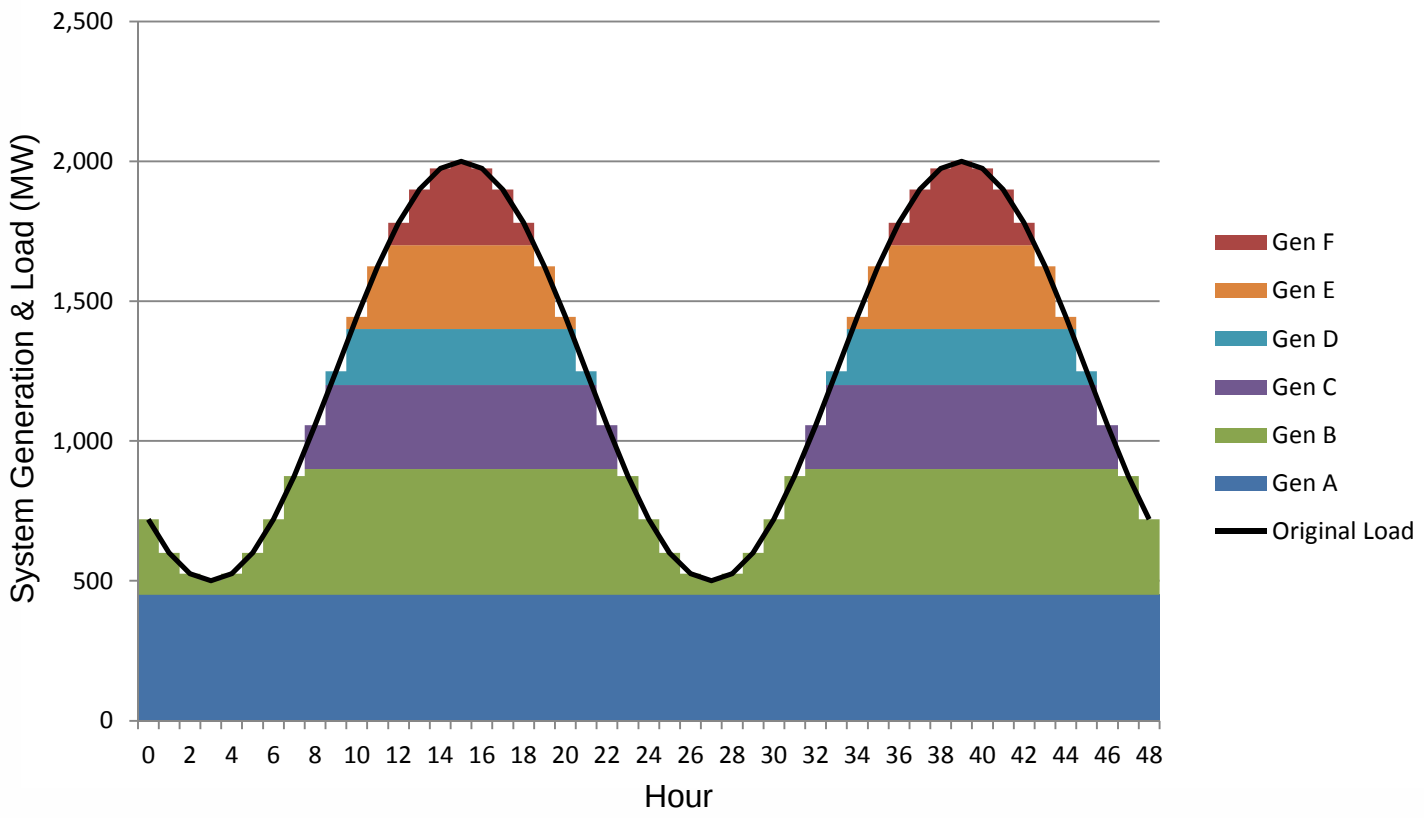
AVERT Main Module
Step 2. Selecting a region



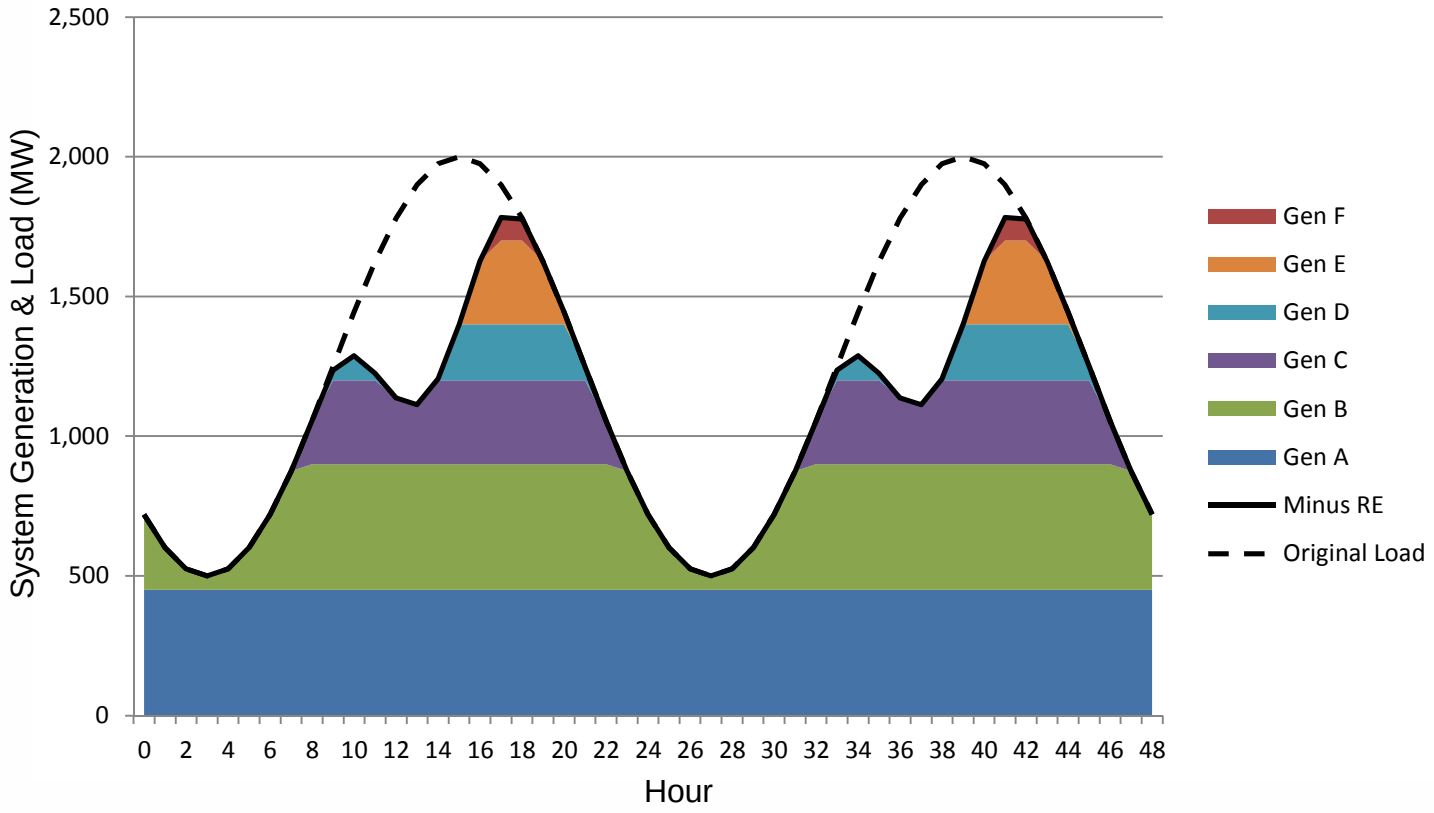
Regions represent relatively autonomous electricity production zones, and are based on EIA's electricity market module regions.

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

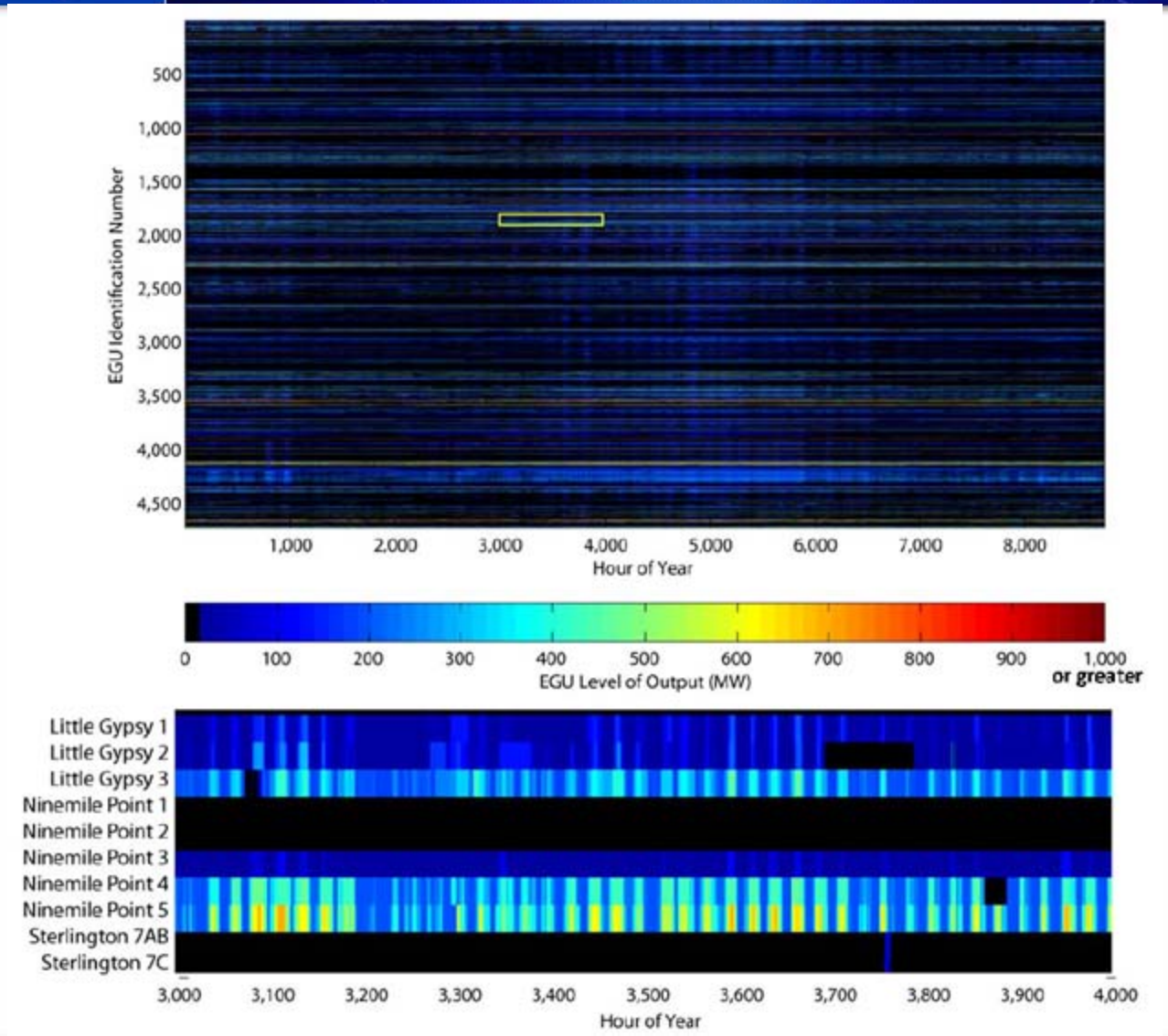
AVERT Overview
Example: Loading order



AVERT Overview
Example: Loading order



AVERT Overview
Underlying Data



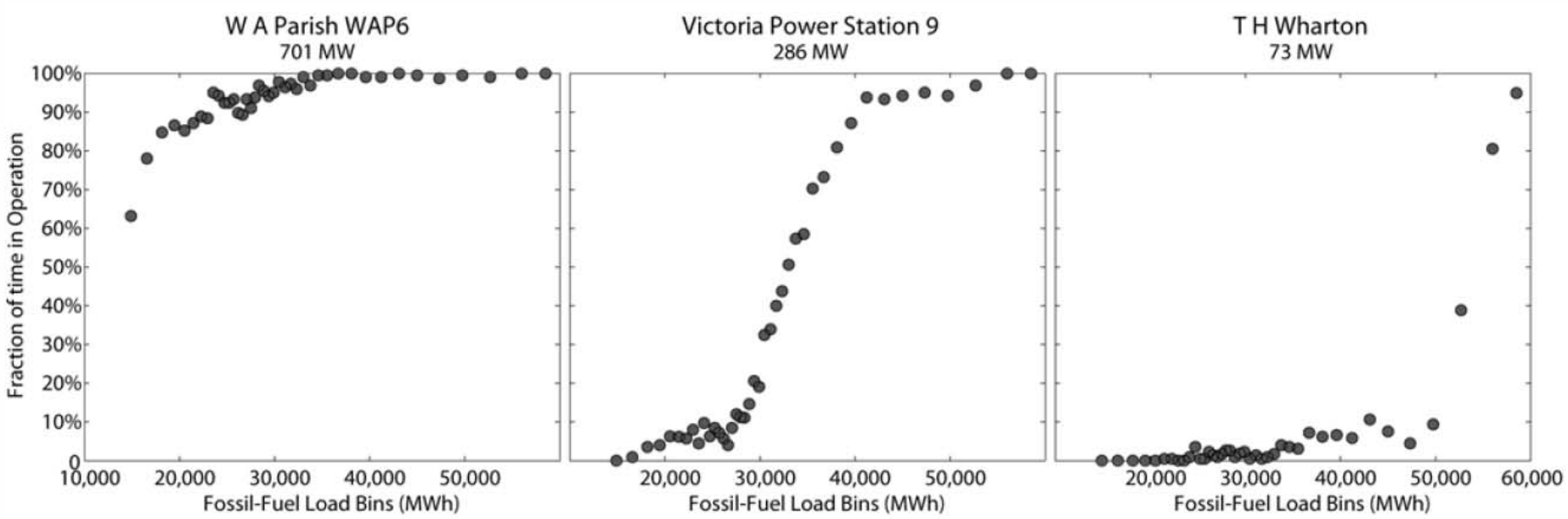
Continuous Emissions Monitoring (CEMS) data from Clean Air Markets Division (CAMD) @ EPA

Hourly generation and emissions of CO_2, SO_2, and NOx.

Fossil generators > 25 MW

Basis of AVERT Statistical Module
Gather Operating Statistics (1)

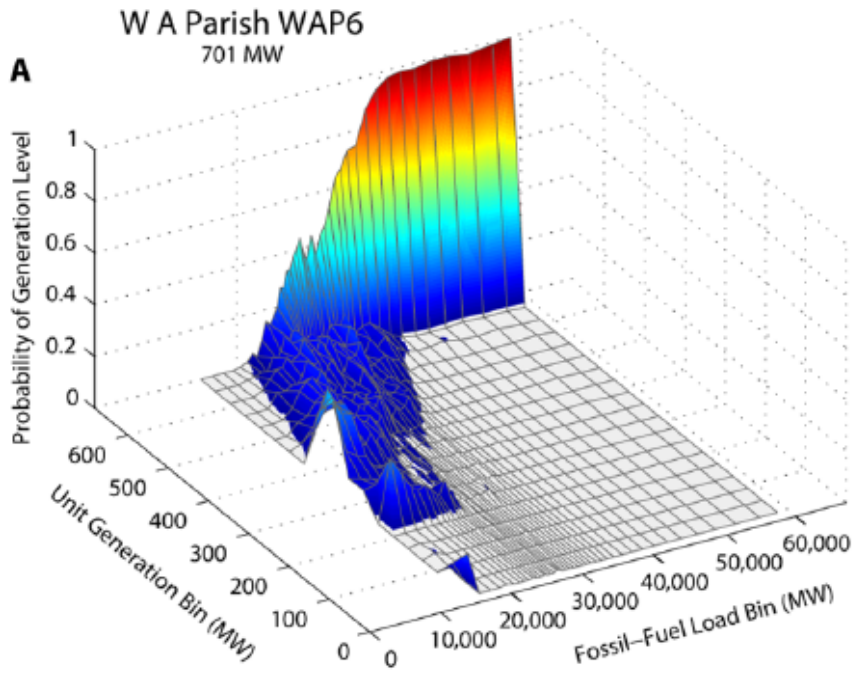
How often, and under what conditions, does an EGU generate power?



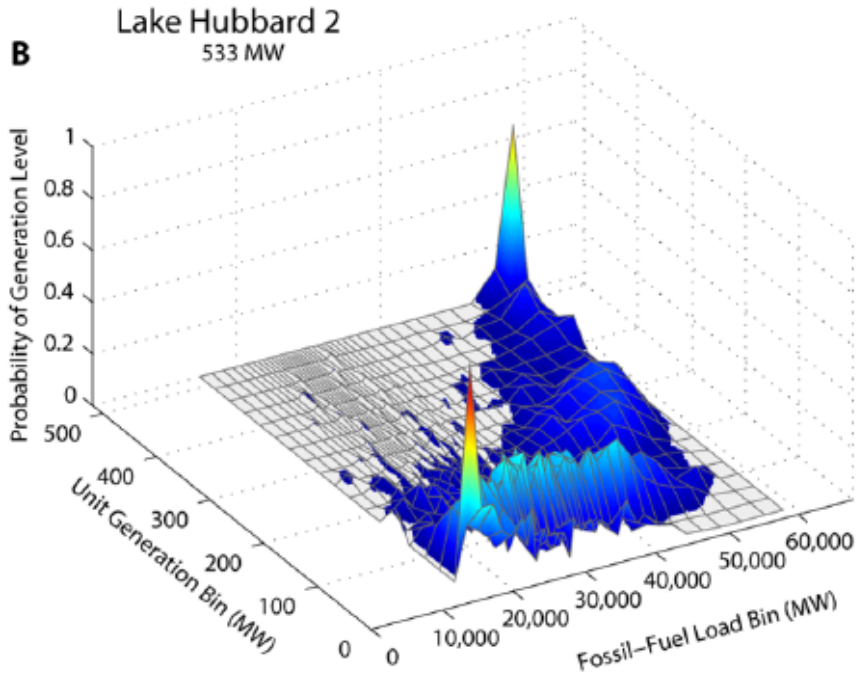
Baseload **Intermediate** **Peaker**

Basis of AVERT Statistical Module
Gather Operating Statistics (2)

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



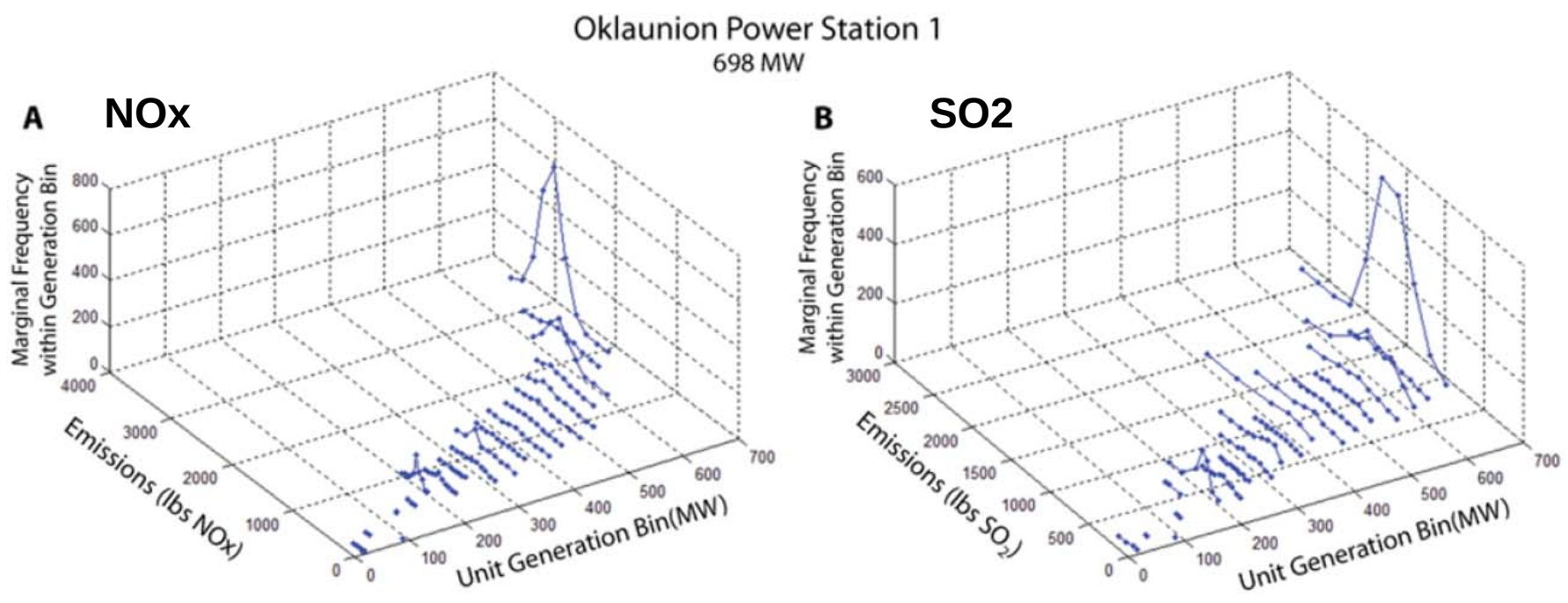
Baseload coal



Intermediate gas

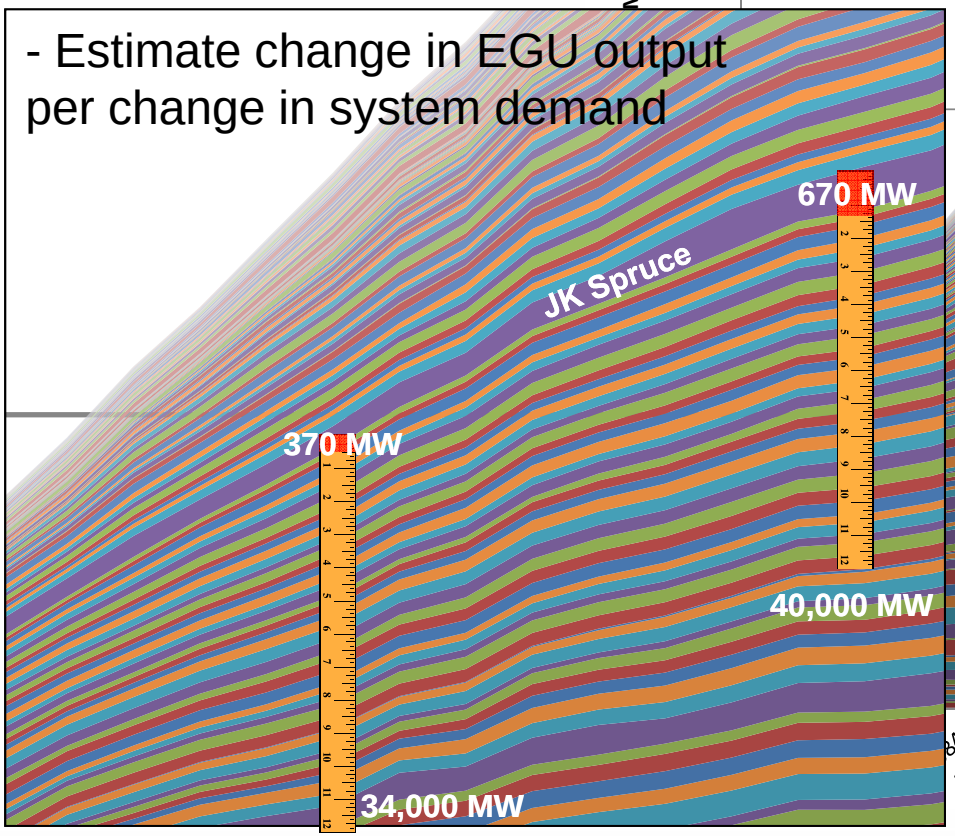
Basis of AVERT Statistical Module
Gather Operating Statistics (3)

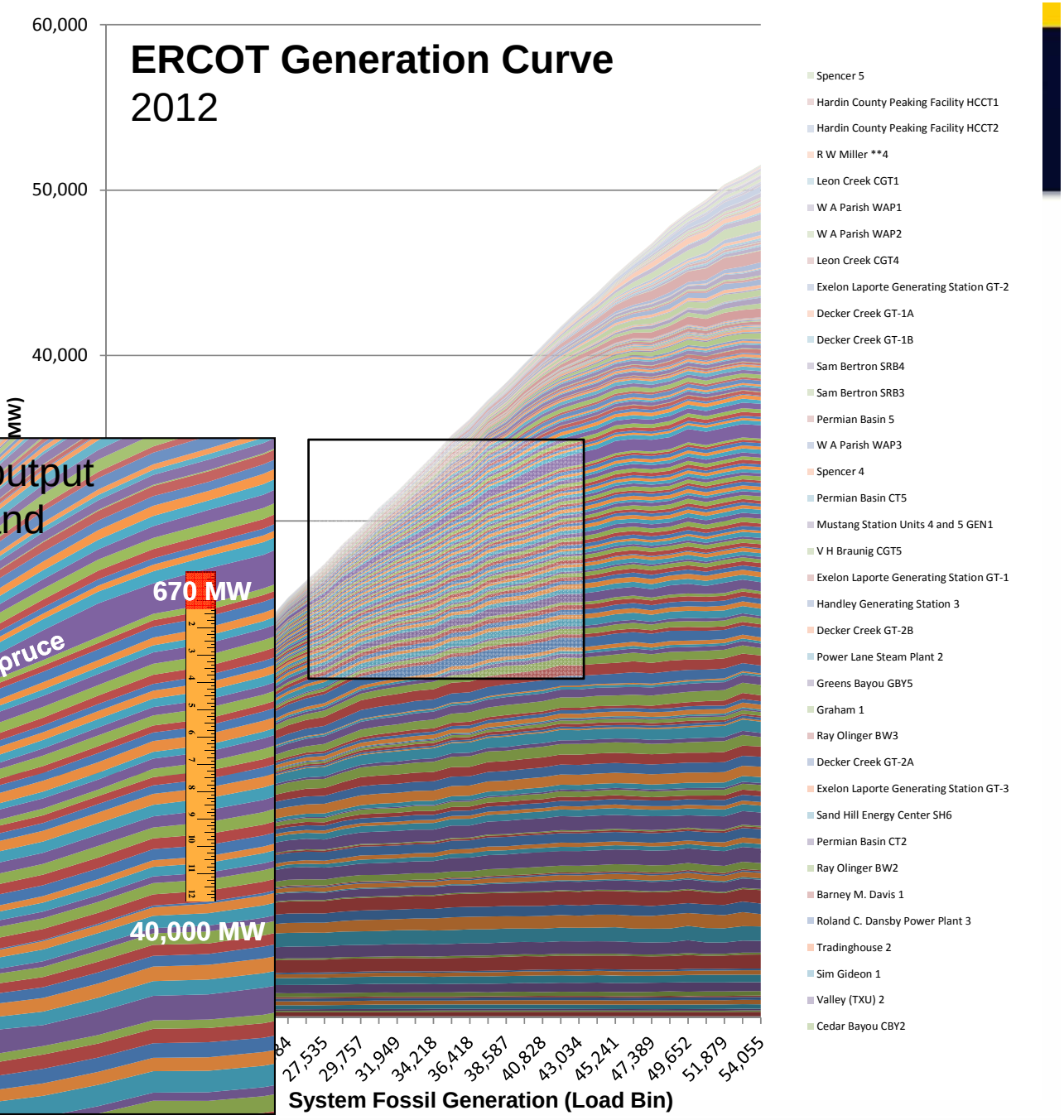
How much emissions are released by an EGU at different levels of generation?



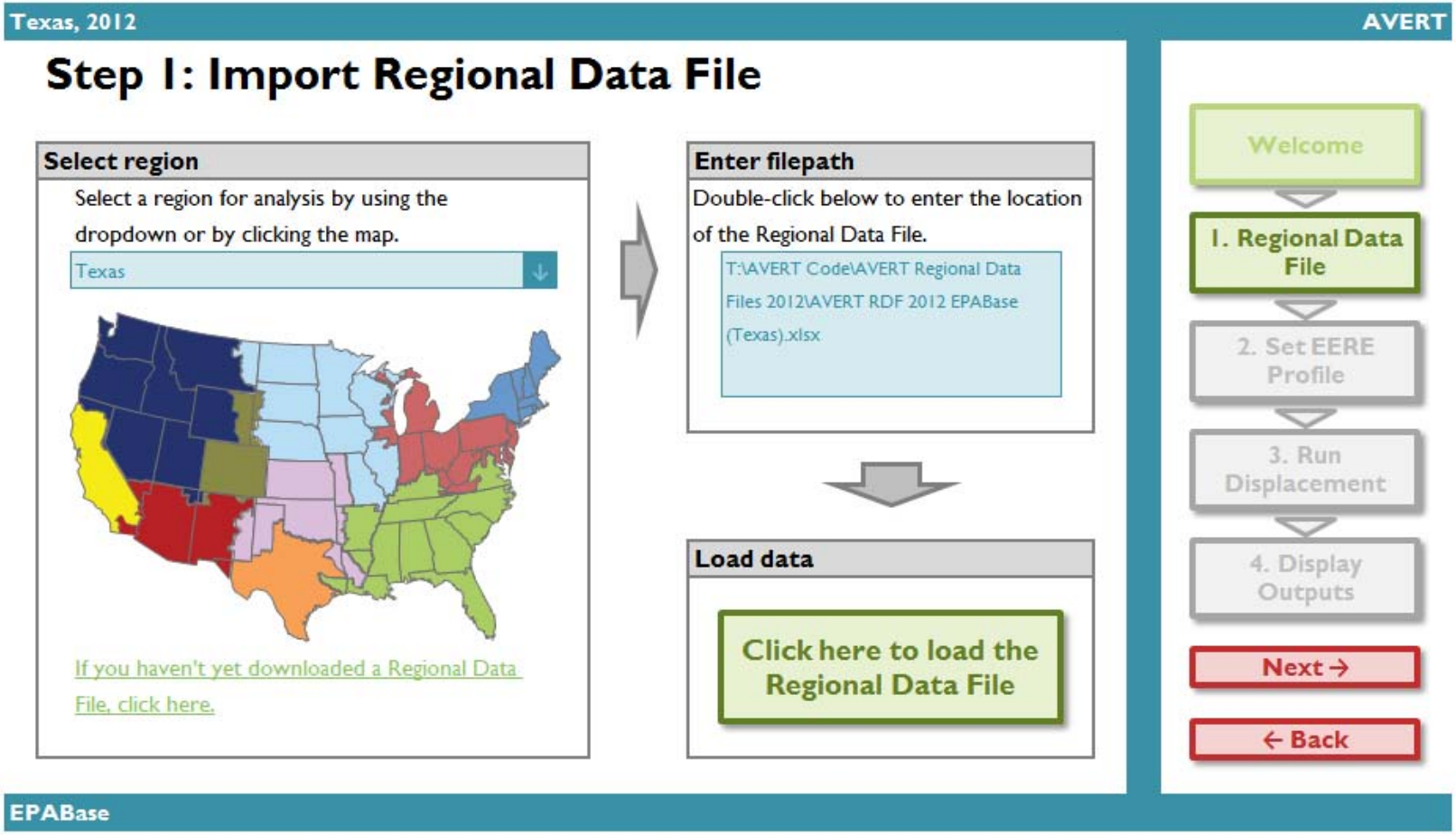
- Estimate average EGU generation and emissions through Monte Carlo simulation.

- Estimate change in EGU output per change in system demand





AVERT User Interface



AVERT User Interface

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

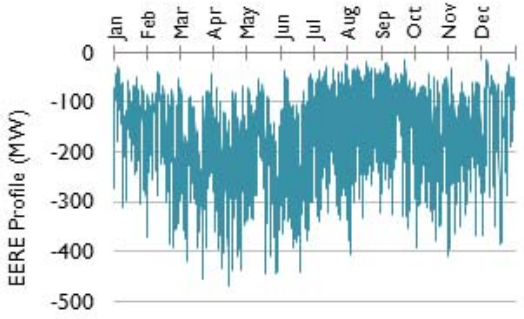
And/or enter EE impacts distributed evenly throughout the year

Reduce generation by annual GWh:	0	GWh
OR		
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:



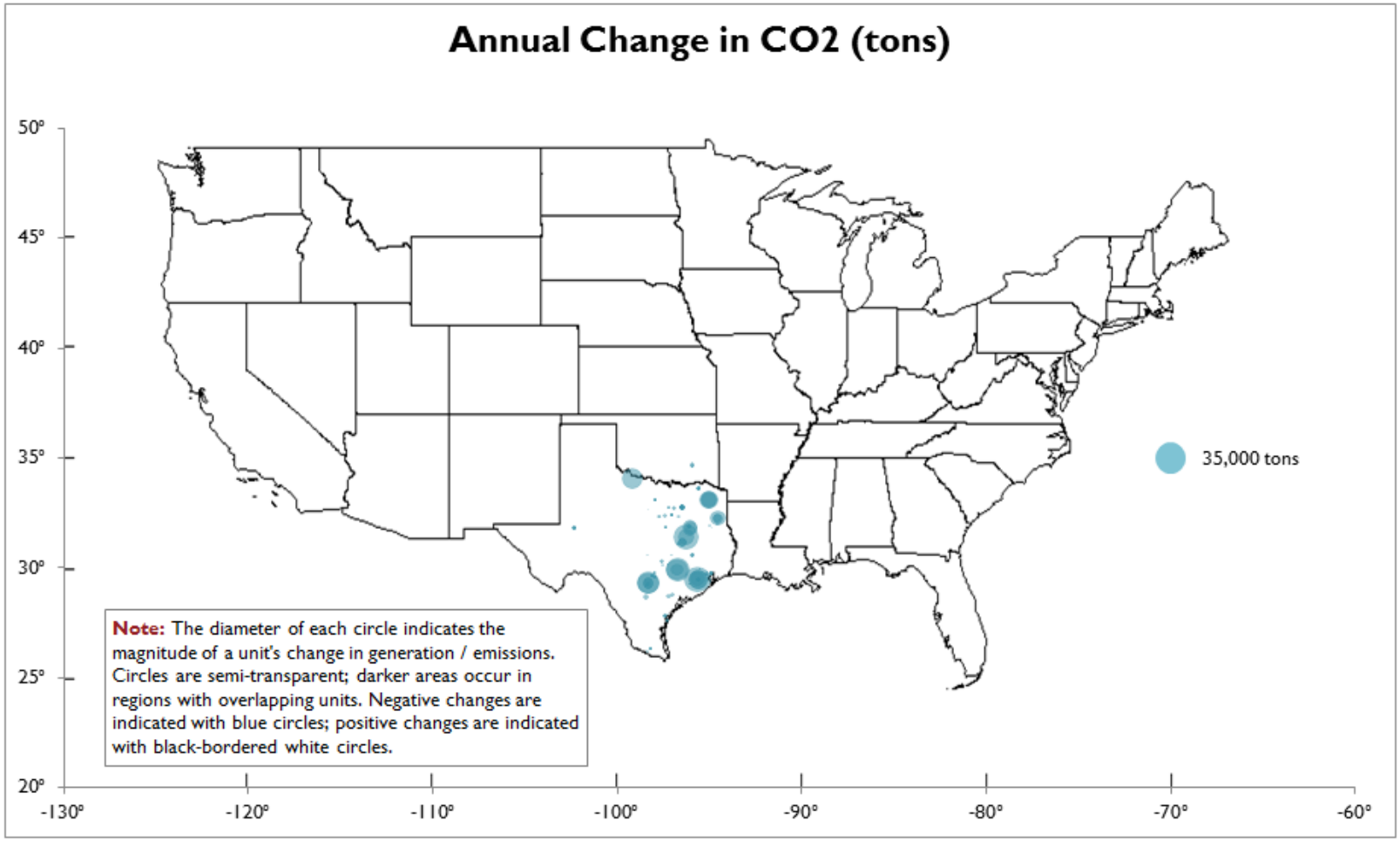
The currently entered reduction profile equals 1,485 GWh, or 0.6% of regional fossil load.

Welcome
1. Regional Data File
2. Set EERE Profile
3. Run Displacement
4. Display Outputs
Next →
← Back

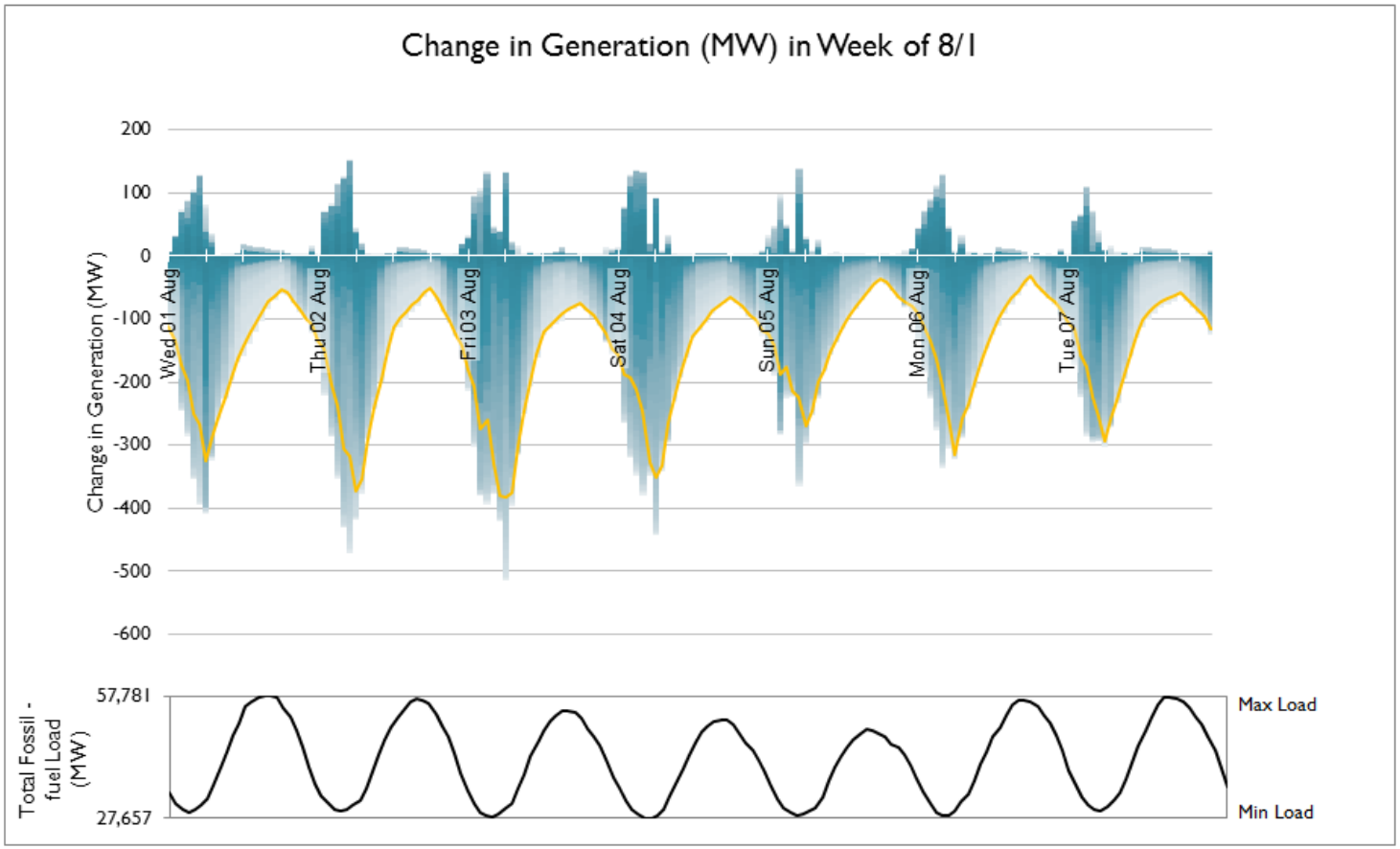
EPABase

AVERT Outputs

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



AVERT Outputs



Negative numbers indicate displaced generation and emissions.

Total Change in Generation (MW)

Total fossil-fuel load, pre-EERE

High capacity factor units

Low capacity factor units

AVERT Caveats

- 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

www2.epa.gov/cleanpowerplantoolbox

Questions?

Jeremy Fisher
Principal Consultant
Synapse Energy Economics
jfisher@synapse-energy.com

Robyn DeYoung
State and Local Climate and Energy Program
US EPA
avert@epa.gov

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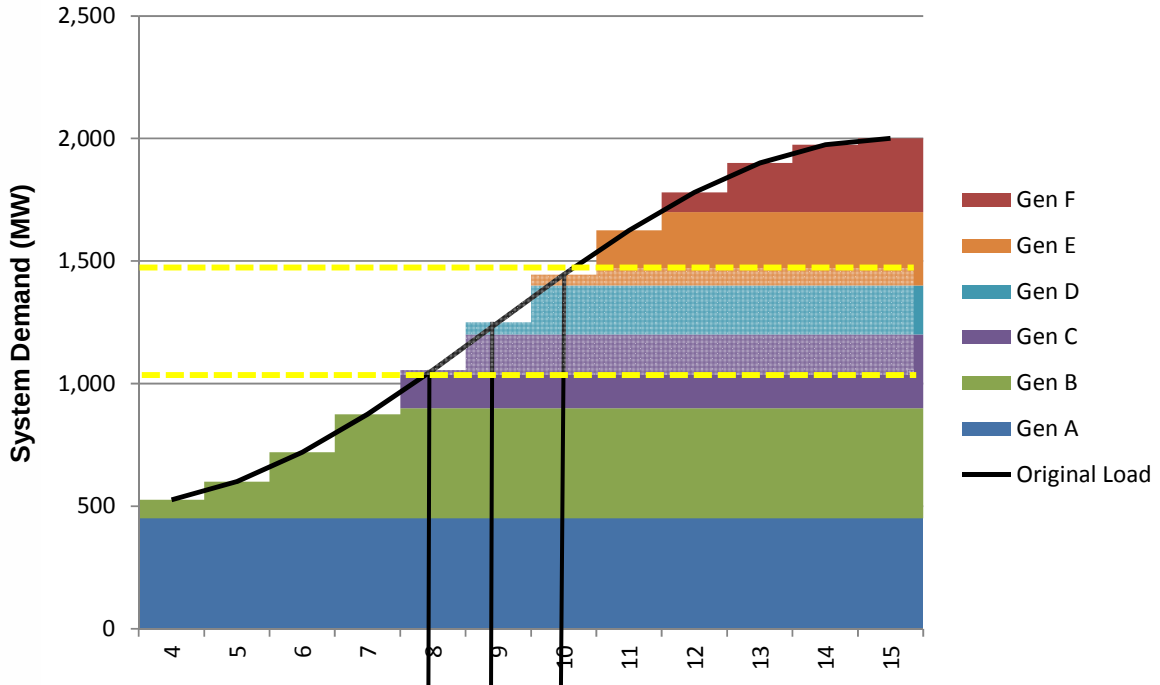
AVERT Overview
Example: Generation Statistics



Gen A at 450 MW (100%)
Gen B at 450 MW (100%)
Gen C at 300 MW (100%)
Gen D at 200 MW (100%)
Gen E at 44 MW (15%)

Gen A at 450 MW (100%)
Gen B at 450 MW (100%)
Gen C at 300 MW (100%)
Gen D at 50 MW (25%)

Gen A at 450 MW (100%)
Gen B at 450 MW (100%)
Gen C at 156 MW (52%)

When demand = 1,000-1,500 MW:
Gen A = 450 MW (100%)
Gen B = 450 MW (100%)
Gen C = 252 MW (84%)
Gen D = 83 MW (42%)
Gen E = 15 MW (5%)
Gen F = 0 MW (0%)