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

# AVERT Overview and Step-by-Step Instructions

U.S. Environmental Protection Agency
State Energy and Environment Program
Updated May 2018

EPA United States Environmental Protection Agency

# Overview of AVERT Development for Energy Efficiency and Renewable Energy (EE/RE) Programs

- AVERT (AVoided Emissions and geneRation Tool) translates the energy impacts of EE/RE policies and programs into emission reductions ($PM_{2.5}$, $NO_x$, $SO_2$, and $CO_2$).
  - It aims to address a key reason states have not implemented previous EE/RE State Implementation Plan (SIP) guidance.
- 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.
- AVERT was first released in 2014 and is built to be:
  - user friendly
  - transparent
  - credible

For more information on EPA's EE/RE SIP Roadmap visit: https://www.epa.gov/energy-efficiency-and-renewable-energy-sips-and-tips/energy-efficiencyrenewable-energy-roadmap.

# AVERT's Evolution

**2014**
- Initial release of AVERT with data for $CO_2$, $NO_X$, and $SO_2$

**2015**
- Published first paper at U.S. EPA's International Emissions Inventory Conference comparing emissions from AVERT regions and EE/RE resources

**2016**
- Extensive training and outreach, including video tutorials

**2017**
- Addressed net vs. gross considerations by accounting for parasitic load and transmission and distribution line loss
- Added $PM_{2.5}$
- Generated emission factors to support quick analyses and program calculations

**2018**
- Added compatibility with EPA's COBRA tool
- Launch of web-based AVERT

**Ongoing activities**
- Annual data updates
- Enhancements
- Compatibility updates

# Emission Quantification Methods
# Basic to Sophisticated

**Basic Method**

eGRID region non-baseload emission rates

**Intermediate Method**

Historical hourly emission rates

**Sophisticated Method**

Energy modeling

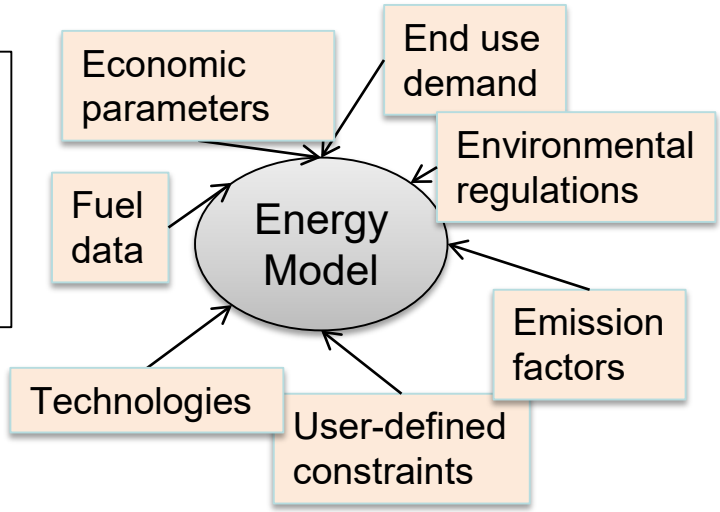
Dispatch or capacity expansion

eGRID

AVERT

AVoided Emissions and geneRation Tool

www.epa.gov/avert



# Applications for AVERT-Calculated Emissions

- SIP credit in a state's National Ambient Air Quality Standard (NAAQS) Clean Air Act Plan
- Compare emission impacts of varying levels of EE/RE programs, projects, and policies
- Calculate emission reductions in your state or county using AVERT's web-based edition
- Use AVERT-generated emission factors to estimate magnitude of emission reductions without running the tool
  - Four categories include wind, solar, portfolio EE, and uniform EE programs
- This is not a long-term projection tool
  - To conduct analysis more than five years from the baseline, users must use AVERT's statistical module and future year scenario template

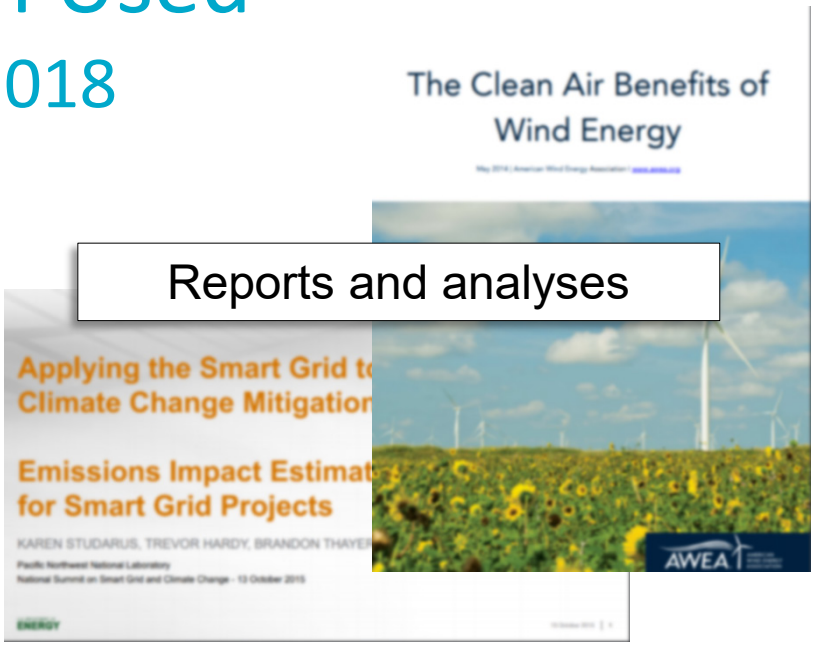
# How AVERT Has Been Used

## 80+ citations as of spring 2018


Peer-reviewed papers

- Environmental Research Letters
- Environmental Science and Technology
- Nature Energy
- Journal of Industrial Ecology
- Energy Policy

…and more




Reports and analyses


Resource pages and factsheets

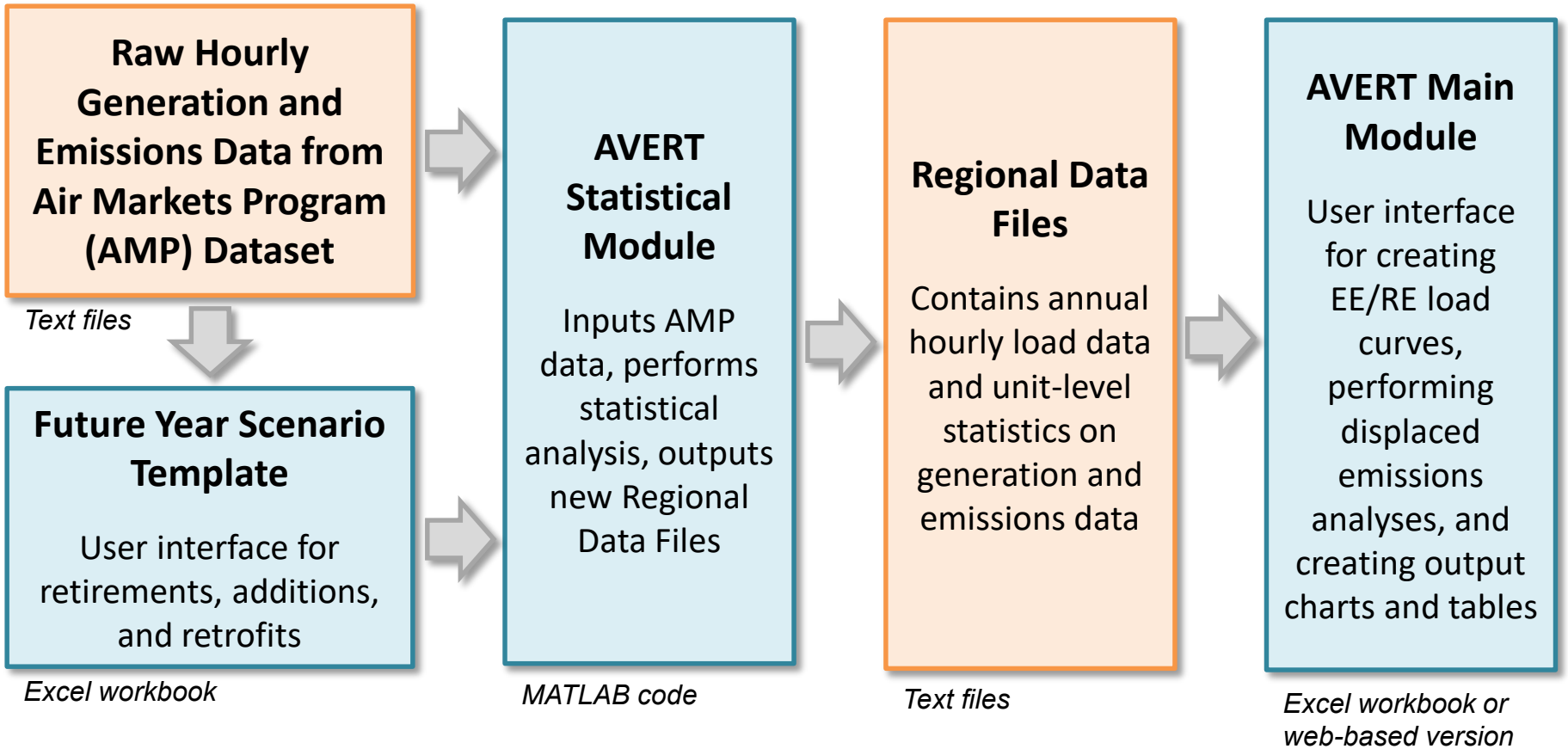
# Examples Using AVERT

- The Clean Air Benefits of Wind Energy (AWEA, May 2014)
- Maine Distributed Solar Valuation Study (Maine PUC, March 2015)
- CarbonCount™ Green Bonds Scores (Alliance to Save Energy, March 2015)
- Assessing Emission Benefits of Renewable Energy and Energy Efficiency Programs (U.S. EPA, April 2015)
- U.S. EPA's Ozone Advance Program - Clark County, NV's Paths Forward
- DOE's Online Smart Grid Calculator (PNNL, Fall 2015)
- Renewable Portfolio Standard (RPS) Benefits Report (LBNL and NREL, January 2016)
- Carbon Reductions and Health Co-benefits from U.S. Residential Energy Efficiency Measures (Levy et al., 2016)
- The Health and Environmental Benefits of Wind and Solar Energy in the United States, 2007-2015 (LBNL, January 2017)

# How AVERT Works

- AVERT's Main Module simulates the hourly changes in generation and air emissions ($PM_{2.5}$, $NO_x$, $SO_2$, and $CO_2$) at EGU resulting from EE/RE policies and programs.
- User input: MWhs saved from EE programs, or wind and solar generation (MW)
  - Multiple options are built into the tool
  - Users can manually enter hourly data of any EE/RE resource type
- User can retire, add and change emission rates of EGU and re-run simulation using AVERT's Future Year Scenario Template and Statistical Module.

# AVERT's Modules and Data Files




Most users will only need to use the Regional Data Files and AVERT Main Module to calculate emissions. The web version of the Main Module provides similar functionality without the need to download any files or software.

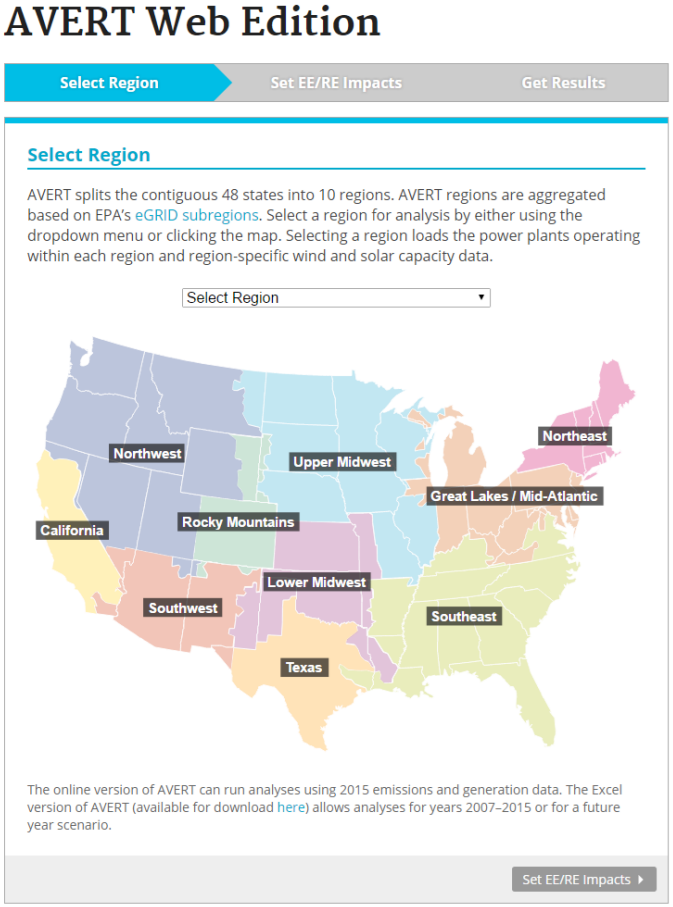
# AVERT's Data Driven Analysis

- AVERT uses a data-driven analysis to distinguish which EGU respond to marginal changes in load reduction.
  - AVERT analyzes EGU datasets from EPA's Air Markets and Program Data (hourly, unit-by-unit generation & emissions).
    - Dataset includes EGUs with capacity of 25 MWs or greater.
    - Supplemented with $PM_{2.5}$ data from EPA's National Emissions Inventory.
  - AVERT's Statistical Module gathers statistics on EGU operations under specific load conditions, and then replicates changes through a Monte Carlo analysis.
  - AVERT's Regional Data Files contain hourly and unit-level emissions and generation data.

# Part I
# AVERT Main Module

# AVERT's Web-Based Main Module

- Users can choose between AVERT's Excel-based version or the web edition
- In 2018, EPA released AVERT's web-based version
  - The online platform allows users to quickly estimate EE/RE program impacts using current year dataset
  - Users can enter standard EE/RE settings
  - Results are shown in graphical form and savable formats




www.epa.gov/statelocalenergy/avert-web-edition

# AVERT's Excel-Based Main Module Step-by-Step Overview

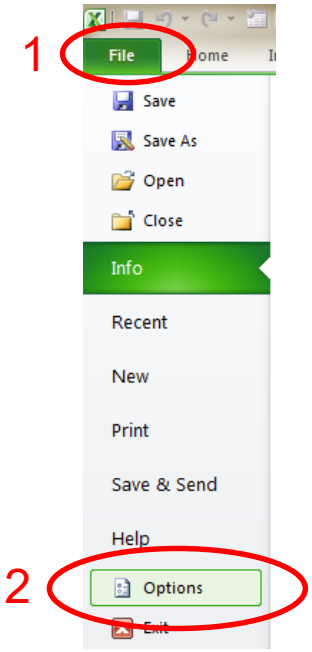
- Enabling Macros
- Using AVERT
- Step 1. Load Regional Data File
- Step 2. Set Energy Efficiency and Renewable Energy Data
- Step 3. Run Displacement
- Step 4. Display Outputs

# AVERT's Excel-Based Main Module Enabling Macros

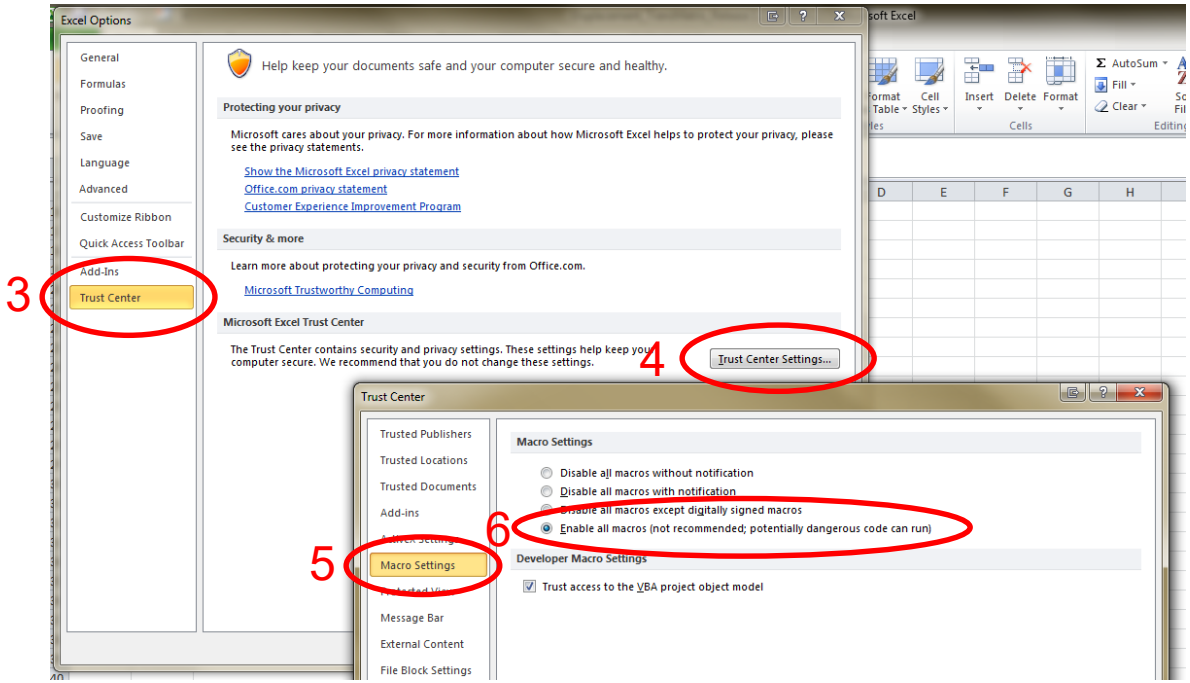
- In Windows, AVERT is compatible with Excel 2007 or newer versions.
- On a Mac, AVERT is compatible with Excel 2011 or newer versions.
  - Only the Main Module has been optimized for Mac. Other components (e.g., the Statistical Module) require Windows.
- You may want to revert to the default macro settings after using the model. Enabling macros in other Excel files may allow potentially dangerous code to run.

# AVERT's Excel-Based Main Module Enabling Macros in Windows*

In Excel 2010 or newer, click **File** > **Options**



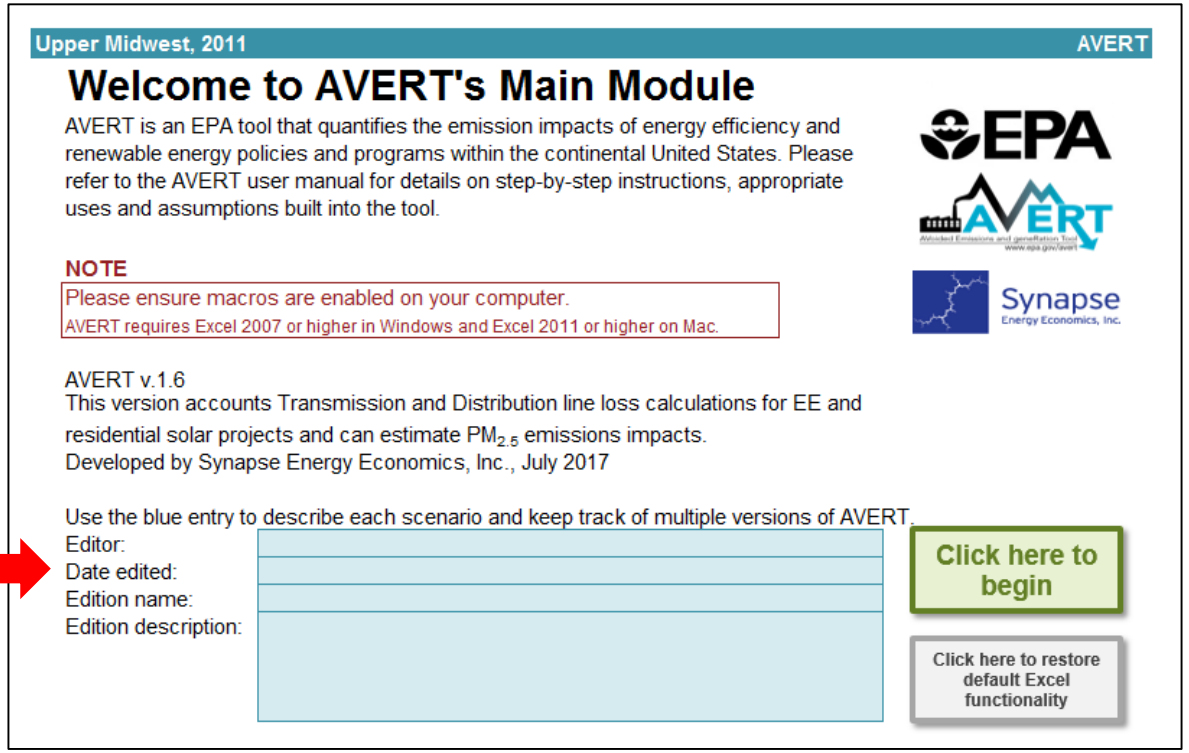

Next, click **Trust Center** > **Trust Center Settings** > **Macro Settings** > **Enable all macros**



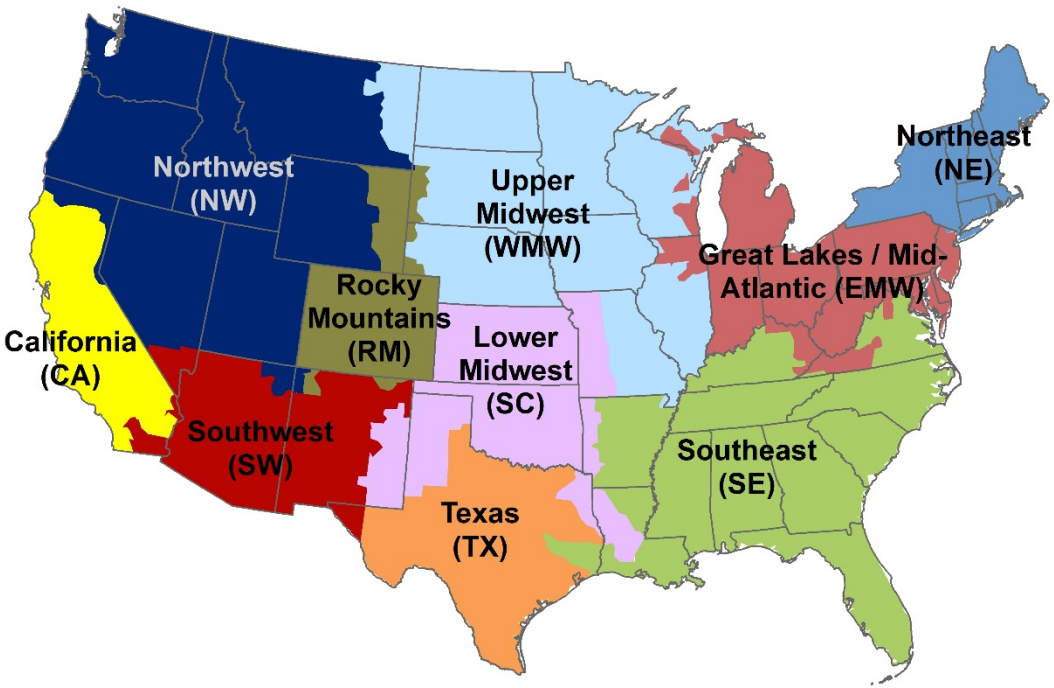

*If using Excel 2007, click the Microsoft Office Button: .
*If using Excel on a Mac, select "Enable macros" in the dialog box that appears when opening the file.

# AVERT's Excel-Based Main Module Using AVERT

- Add details about the user, the date, and the EE/RE program for which displacements are to be estimated.
- Click on the button labeled "Click here to begin".



# AVERT's Excel-Based Main Module
# Step 1. Load Regional Data File



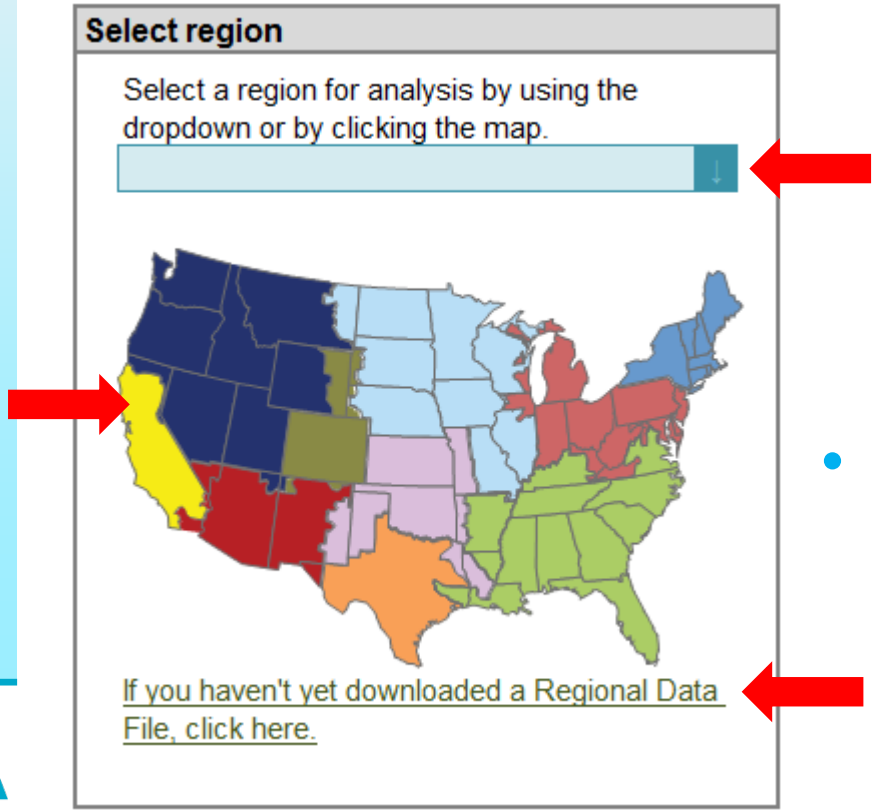

Regions represent relatively autonomous electricity production zones, and are based on electricity market module regions.

Regions include

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

# AVERT's Excel-Based Main Module Step 1. Load Regional Data File

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

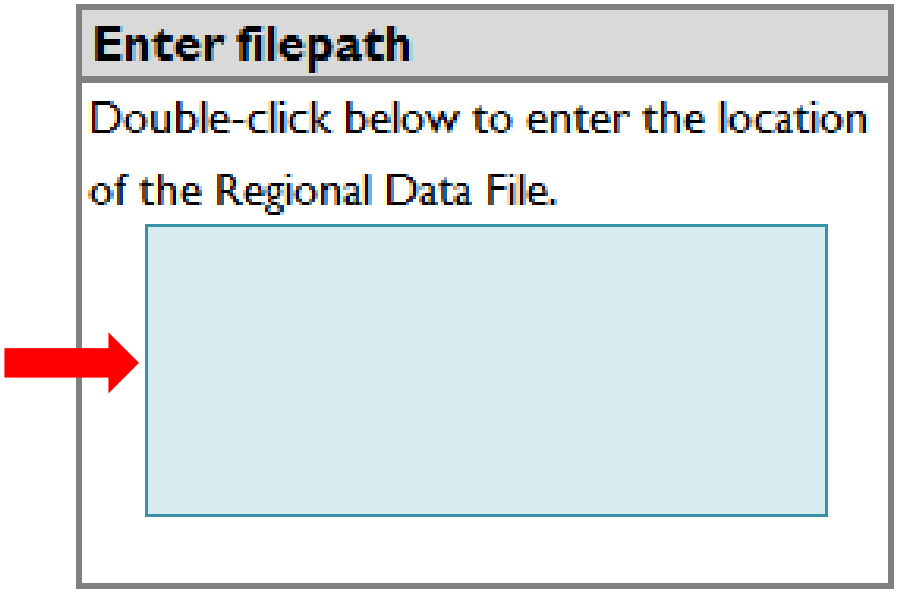



  - Selecting a region loads region-specific data for wind and solar capacity factors, and dynamically creates a hyperlink to that region's data on EPA's website.

- After selecting a region, click the link under the map to download it from EPA's website.

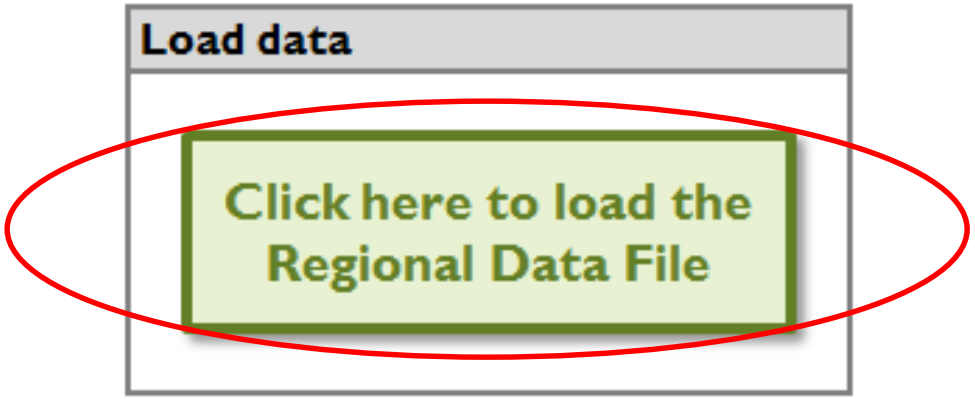
# AVERT's Excel-Based Main Module Step 1. Load Regional Data File

- In the box labeled "Enter filepath," double-click the blue area to navigate to the location of the downloaded regional data file.



# AVERT's Excel-Based Main Module Step 1. Load Regional Data File

- Click the button under "Load data" entitled:

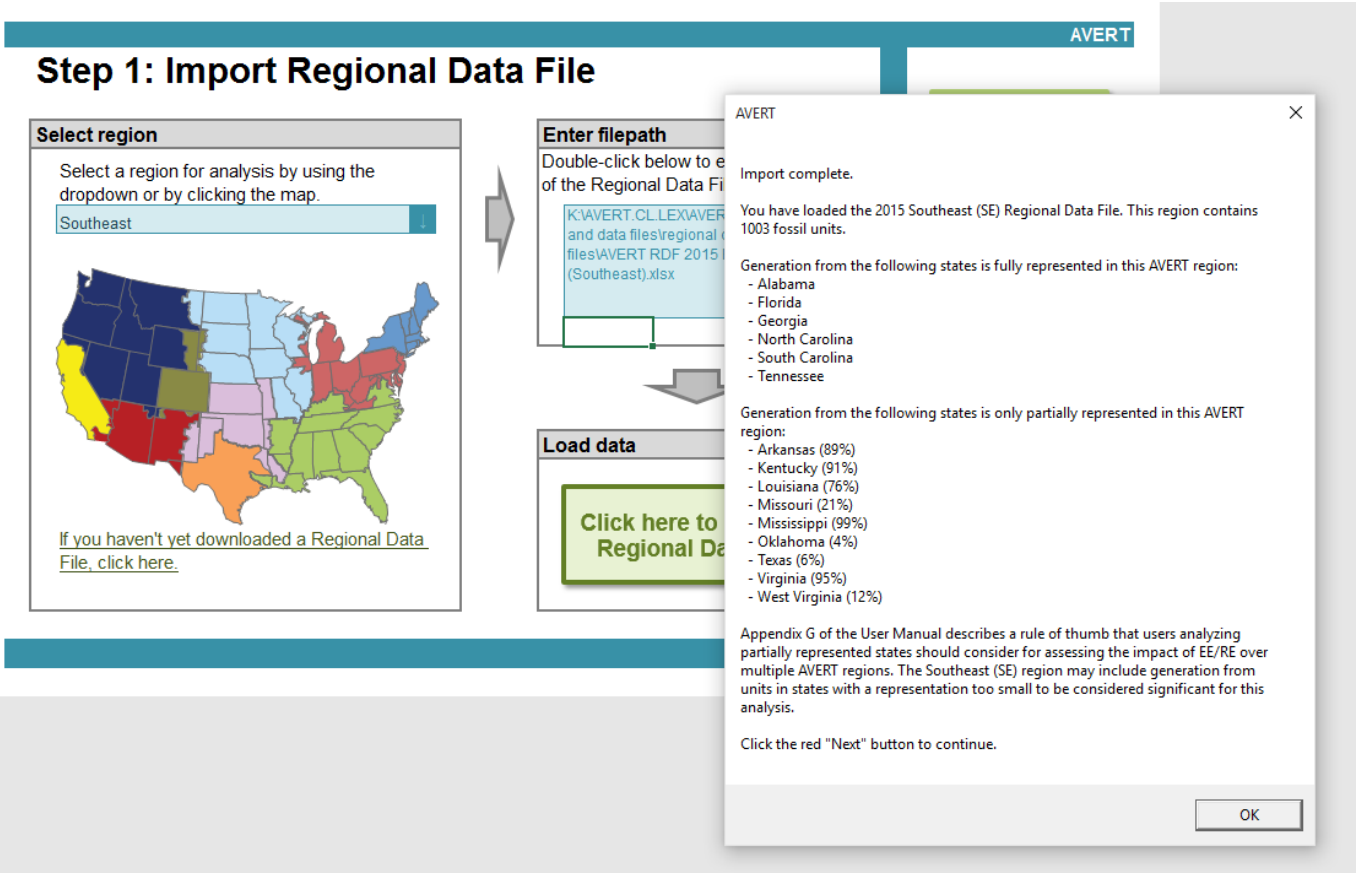



Clicking this button loads the following information from the regional data file:

- Hourly fossil load
- EGU information (e.g., location, fuel type)
- Typical EGU performance for generation and emissions at a given regional load

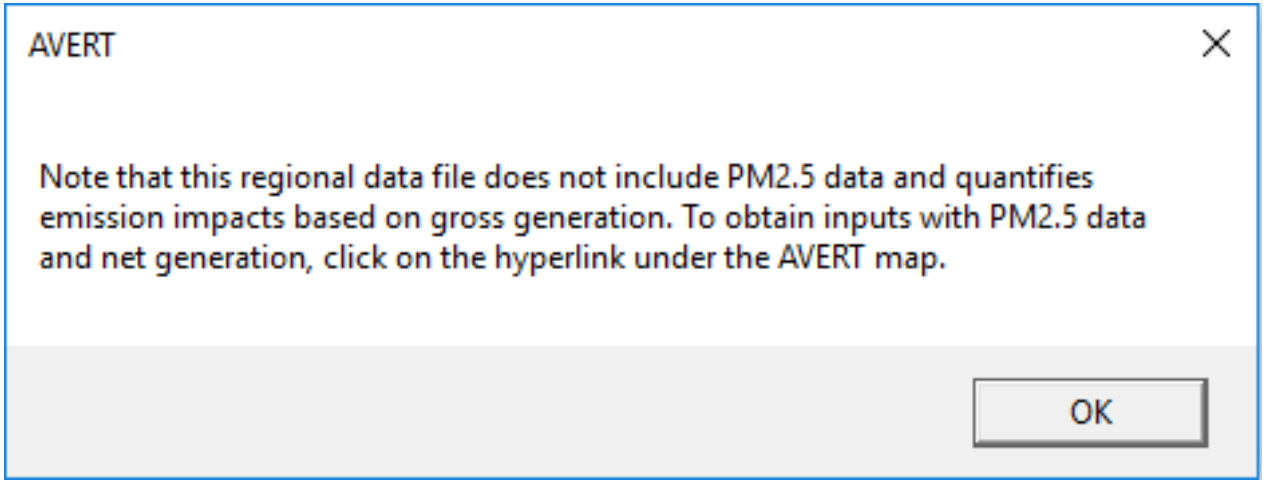
# AVERT's Excel-Based Main Module Step 1. Load Regional Data File

- A popup will indicate when the file has finished loading and remind you how to handle states that are split across multiple AVERT regions.



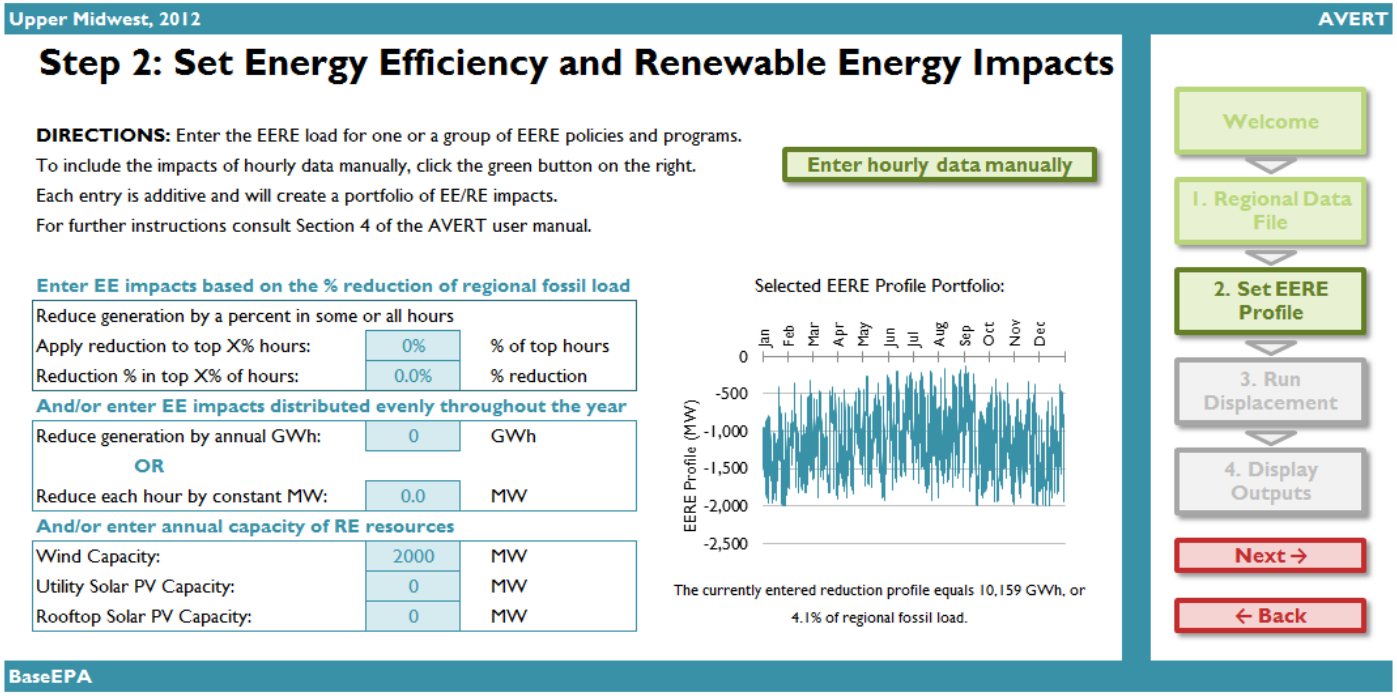
# Step 1. Load Regional Data File
# Regional Data File import pop-up

- Regional Data Files (RDFs) released before July 2017 do not have $PM_{2.5}$ emissions and they include net generation values to account for parasitic losses.
- If you are using an earlier RDF, another pop-up box will alert you and suggest that you download a newer RDF from EPA's website.



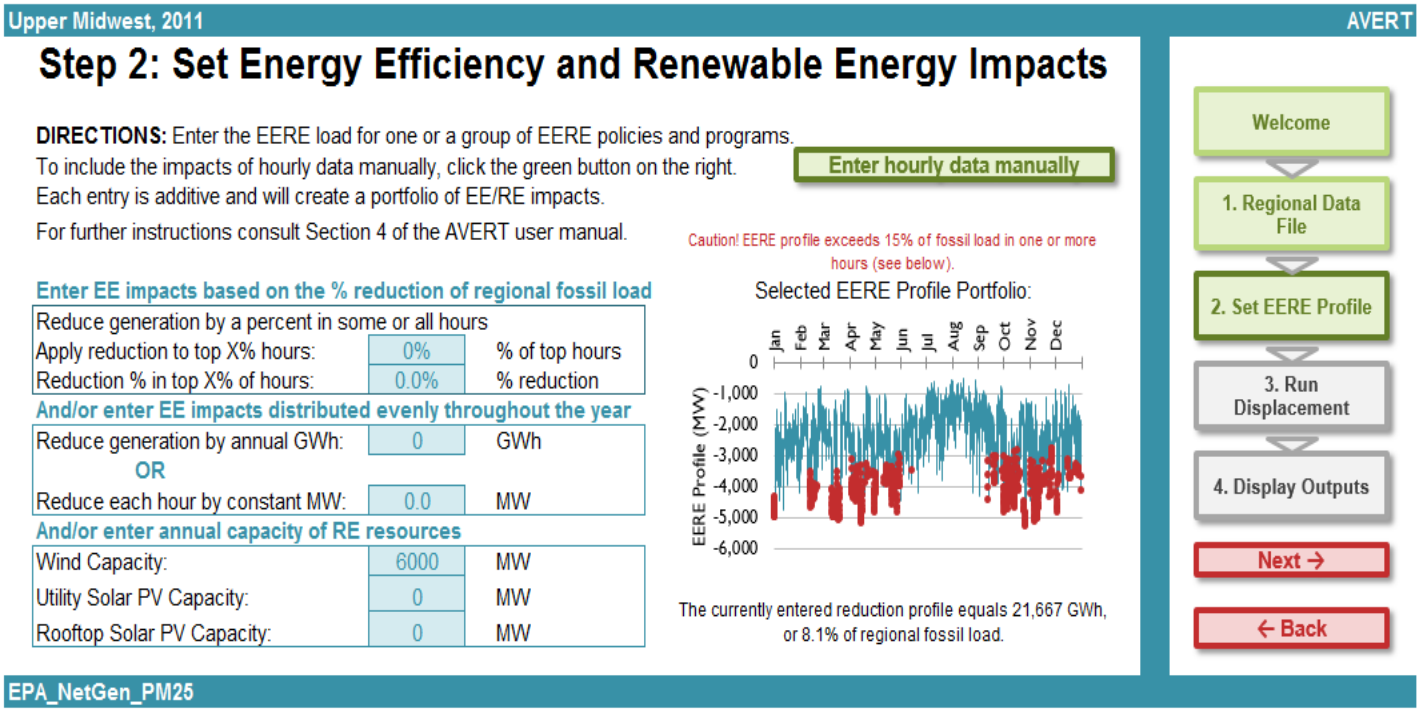
# AVERT's Excel-Based Main Module Step 2. Set EE and RE Data

- This page leads you through the process of creating a load impact profile depicting the load reductions expected from an EE/RE program.



# AVERT's Excel-Based Main Module Step 2. Set EE and RE Data

- If you enter an EE/RE program that exceeds 15% of regional fossil load in any given hour, you will be shown an alert highlighting the hours of exceedance, but you can still proceed with the calculations.



# AVERT's Excel-Based Main Module Step 2. Set EE and RE Data

- If the hourly load reductions expected from a particular EE/RE policy, program, or measure are known, a manual stream of load reduction values can be entered for every hour of the year by clicking the "Enter hourly data manually" button.


Northeast, 2012 AVERT

**Manual EERE Data Entry**

When complete, click here to return to
Step 2: Enter Energy Efficiency and Renewable Energy Data

| Date | Hour | Day of Wee | Regional Fossil Load (MW) | Manual EE RE Profile (MW | Total Change (MW) |
|---|---|---|---|---|---|
| 1/1/2012 | 1 | Sunday | 9,182 | | 0 |
| 1/1/2012 | 2 | Sunday | 8,084 | | 0 |
| 1/1/2012 | 3 | Sunday | 7,072 | | 0 |
| 1/1/2012 | 4 | Sunday | 6,666 | | 0 |
| 1/1/2012 | 5 | Sunday | 6,726 | | 0 |
| 1/1/2012 | 6 | Sunday | 6,986 | | 0 |
| 1/1/2012 | 7 | Sunday | 7,330 | | 0 |
| 1/1/2012 | 8 | Sunday | 7,051 | | 0 |
| 1/1/2012 | 9 | Sunday | 7,401 | | 0 |
| 1/1/2012 | 10 | Sunday | 7,841 | | 0 |
| 1/1/2012 | 11 | Sunday | 8,135 | | 0 |
| 1/1/2012 | 12 | Sunday | 8,445 | | 0 |
| 1/1/2012 | 13 | Sunday | 8,581 | | 0 |
| 1/1/2012 | 14 | Sunday | 8,615 | | 0 |

# AVERT's Excel-Based Main Module Step 2. Set EE and RE Data

This page also allows you to estimate a load reduction from basic characteristics:

- Reduce fossil-fuel generation by a percent in some or all hours
- Reduce fossil-fuel generation by total GWh
- Reduce each hour by a constant MW
- Renewable energy proxy
- Combination of EE/RE programs including combining pre-set options with manual entry

**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**

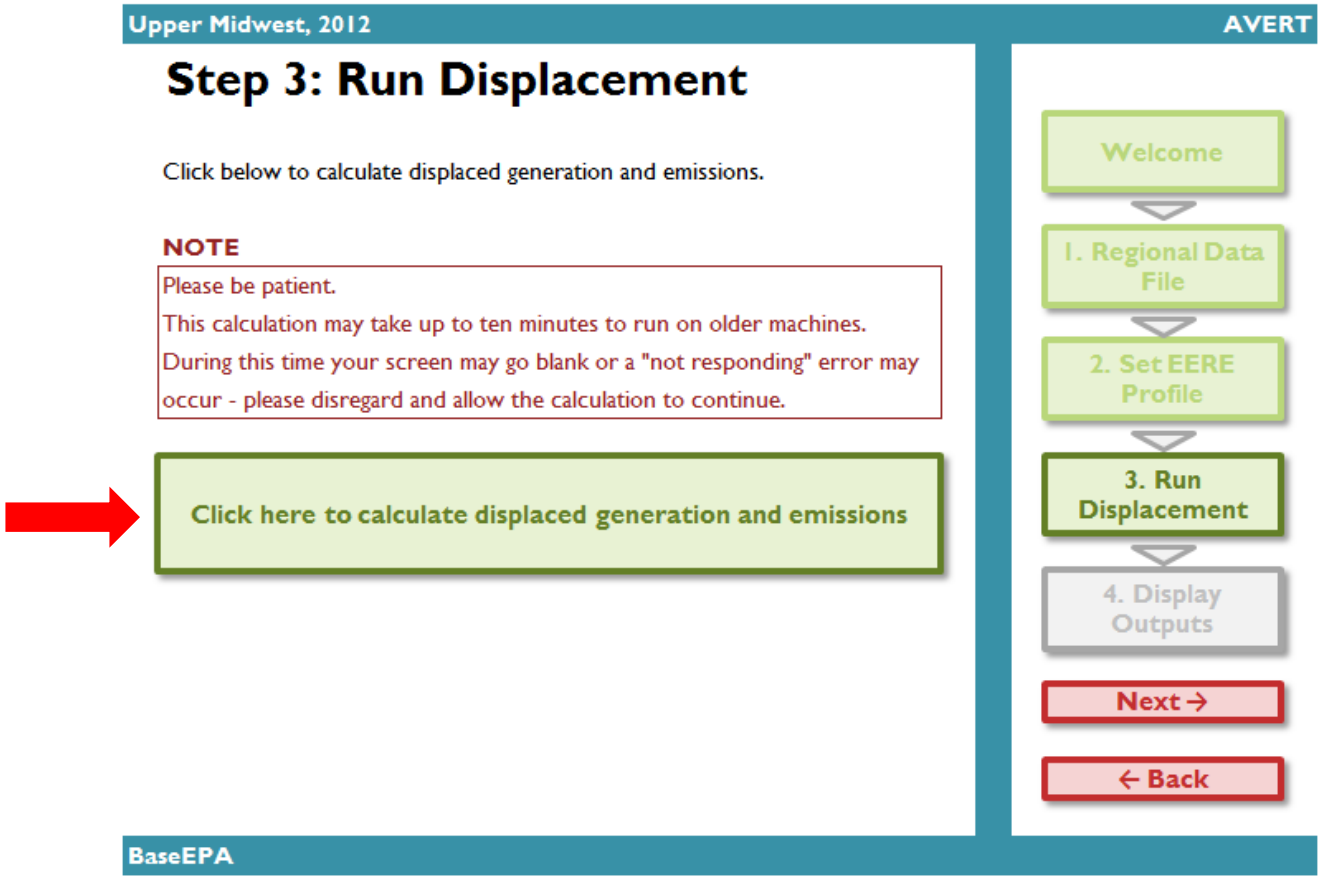
| | | |
|---|---|---|
| Reduce generation by annual GWh: | 0 | GWh |
| OR | | |
| Reduce each hour by constant MW: | 0.0 | MW |

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

| | | |
|---|---|---|
| Wind Capacity: | 2000 | MW |
| Utility Solar PV Capacity: | 0 | MW |
| Rooftop Solar PV Capacity: | 0 | MW |

# AVERT's Excel-Based Main Module Step 3. Run Displacement

- Run displacement by selecting the button entitled "Click here to calculate displaced generation and emissions."

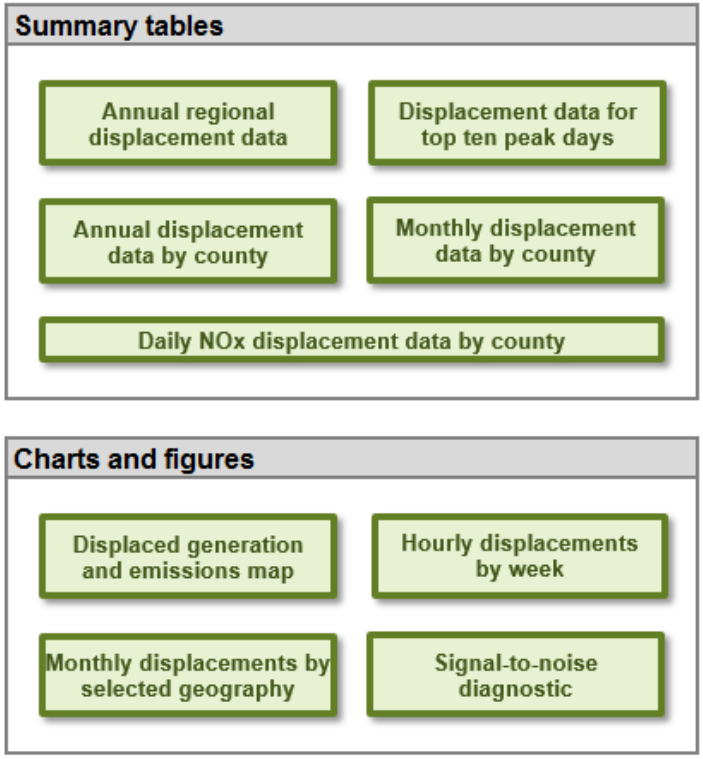


# AVERT's Excel-Based Main Module
# Step 3. Run Displacement

- This step calculates hourly displaced generation and emissions ($PM_{2.5}$, $SO_2$, $NO_X$, $CO_2$) for each fossil EGU within the selected region.
- Note that this is a processor-intensive step. When using an older computer, or when analyzing regions with many fossil EGU, this step may take up to ten minutes.

# AVERT's Excel-Based Main Module Step 4. Display Outputs

- The data generated in Step 3 are aggregated in two groups of charts and tables in Step 4.



# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Annual regional displacements*

- This table displays the total annual generation and emissions as reported for the region in the base year ("Original") and as calculated by AVERT's Main Module after the EE/RE reduction ("Post-EERE").

Upper Midwest, 2011 AVERT

## Output: Annual Regional Displacements

Click here to return to Step 4: Display Outputs

| | Original | Post-EERE | Impacts |
|---|---|---|---|
| Generation (MWh) | 267,436,050 | 260,240,200 | -7,195,850 |
| Total Emissions from Fossil Generation Fleet | | | |
| $SO_2$ (lbs) | 1,301,793,140 | 1,268,694,580 | -33,098,570 |
| $NO_x$ (lbs) | 540,761,980 | 527,072,950 | -13,689,030 |
| $CO_2$ (tons) | 300,935,610 | 293,707,130 | -7,228,480 |
| $PM_{2.5}$ (lbs) | 43,319,100 | 42,280,340 | -1,038,760 |
| Fossil Generation Fleet Emission Rates | | | |
| $SO_2$ (lbs/MWh) | 4.868 | 4.875 | |
| $NO_x$ (lbs/MWh) | 2.022 | 2.025 | |
| $CO_2$ (tons/MWh) | 1.125 | 1.129 | |
| $PM_{2.5}$ (lbs/MWh) | 0.162 | 0.162 | |

*Negative numbers indicate displaced generation and emissions.*

*All results are rounded to the nearest ten. A dash ("—") indicates a result greater than zero, but lower than the level of reportable significance.*

# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Annual displacement data by county*

- This table presents a summary of the displaced generation and emissions for each of the counties from each of the states contained within the region. A line for each county containing an EGU is displayed.

Upper Midwest, 2012

**Output: Annual Displacement Data by County**

Click here to return to Step 4: Display Outputs

| State | County | Peak Gross Generation, Post-EERE (MW) | Annual Gross Generation, Post-EERE (MWh) | Annual Displaced Generation (MWh | Annual Displac $SO_2$ (lbs) |
|---|---|---|---|---|---|
| IA | Allamakee | 250 | 1,152,800 | -91,800 | -639,700 |
| IA | Appanoose | 17 | 2,700 | -600 | -5,300 |
| IA | Audubon | 125 | 39,100 | -8,800 | – |
| IA | Black Hawk | 109 | 42,300 | -8,900 | -30,700 |
| IA | Cerro Gordo | 522 | 772,800 | -154,400 | -600 |
| IA | Clay | 30 | 11,000 | -2,300 | -21,000 |
| IA | Clinton | 143 | 583,900 | -30,500 | -195,700 |
| IA | Des Moines | 210 | 1,195,400 | -58,200 | -438,500 |
| IA | Dubuque | 42 | 91,300 | -1,600 | -500 |
| IA | Louisa | 770 | 5,304,300 | -197,800 | -642,500 |
| IA | Marshall | 57 | 32,500 | -1,700 | -200 |
| IA | Muscatine | 262 | 960,200 | -79,200 | -353,300 |
| IA | Polk | 481 | 343,100 | -59,900 | -2,100 |

*For each county, annual output statistics are given for:*

- Peak Gross Generation Post-EE/RE
- Annual Gross Generation Post-EE/RE
- Capacity Factor
- Annual Change in Generation
- Annual Change in Heat Input/ $PM_{2.5}$/$SO_2$/$NO_X$/$CO_2$
- Ozone Season Change in $SO_2$/$NO_X$
- Ozone Season, 10 Peak Days Change in $SO_2$/$NO_X$

# AVERT's Excel-Based Main Module
# Step 4. Display Outputs

*Displacement data for top ten peak days*

- This table displays a summary of the ten days in the region featuring the highest level of fossil fuel load.

Upper Midwest, 2011 AVERT

## Output: Displacement Data for Top Ten Peak Days

Click here to return to Step 4: Display Outputs

| Day Rank | Date | Total Fossil Generation (MWh) | Expected Displaced Generation (MWh) | Displaced Generation (MWh) | Displaced $NO_x$ (lbs) | Displaced $SO_2$ (lbs) | Displaced $CO_2$ (Tons) | Displaced $PM_{2.5}$ (lbs) |
|---|---|---|---|---|---|---|---|---|
| 1 | Jul 18 | 1,048,930 | -13,490 | -13,860 | -39,530 | -17,890 | -8,730 | -1,770 |
| 2 | Jul 19 | 1,039,940 | -17,190 | -17,270 | -61,370 | -25,000 | -13,150 | -2,440 |
| 3 | Jul 21 | 1,024,750 | -15,770 | -15,820 | -58,630 | -23,210 | -13,000 | -2,350 |
| 4 | Jul 20 | 1,018,680 | -16,810 | -16,810 | -57,920 | -22,360 | -13,410 | -2,590 |
| 5 | Jul 22 | 1,003,160 | -12,930 | -13,030 | -44,900 | -17,970 | -10,620 | -1,960 |
| 6 | Aug 02 | 993,440 | -12,690 | -12,700 | -46,380 | -18,640 | -10,370 | -1,860 |
| 7 | Aug 01 | 988,190 | -12,610 | -12,650 | -46,790 | -19,670 | -10,530 | -1,880 |
| 8 | Aug 03 | 983,760 | -12,070 | -12,110 | -34,960 | -14,660 | -9,550 | -1,830 |
| 9 | Jul 28 | 979,210 | -10,310 | -10,290 | -36,970 | -15,170 | -8,330 | -1,440 |
| 10 | Jul 29 | 975,520 | -8,010 | -8,130 | -25,300 | -10,340 | -6,580 | -1,210 |

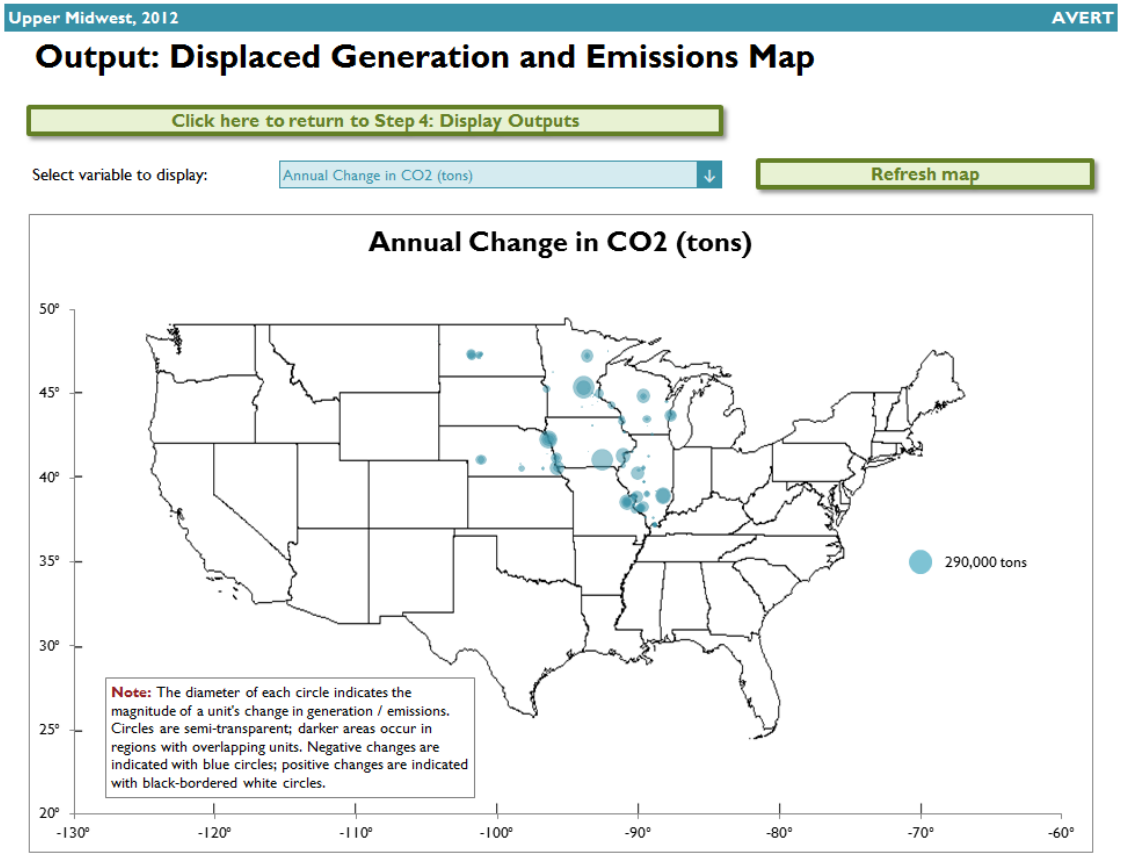
*Negative numbers indicate displaced generation and emissions.*

*All results are rounded to the nearest ten. A dash ("—") indicates a result greater than zero, but lower than the level of reportable significance.*

# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Displaced generation and emissions map*

- This dynamic map allows the user to view where emissions have been displaced within the selected region. Users can view changes in generation, heat input, $PM_{2.5}$, $SO_2$, $NO_X$, and $CO_2$.

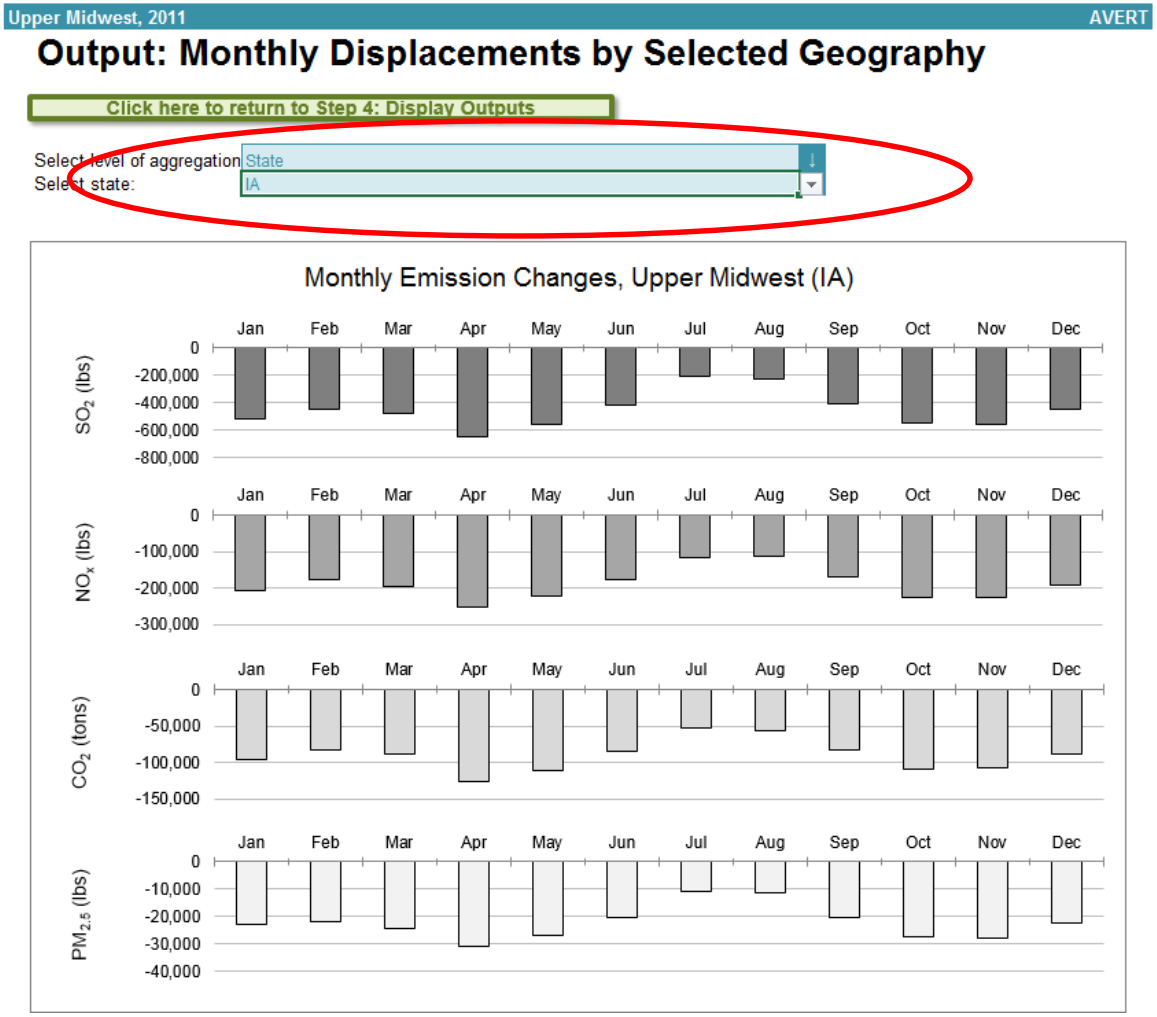


# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Displacement data by month*

Monthly output can be viewed over the entire region, or a specific state or county within the region.

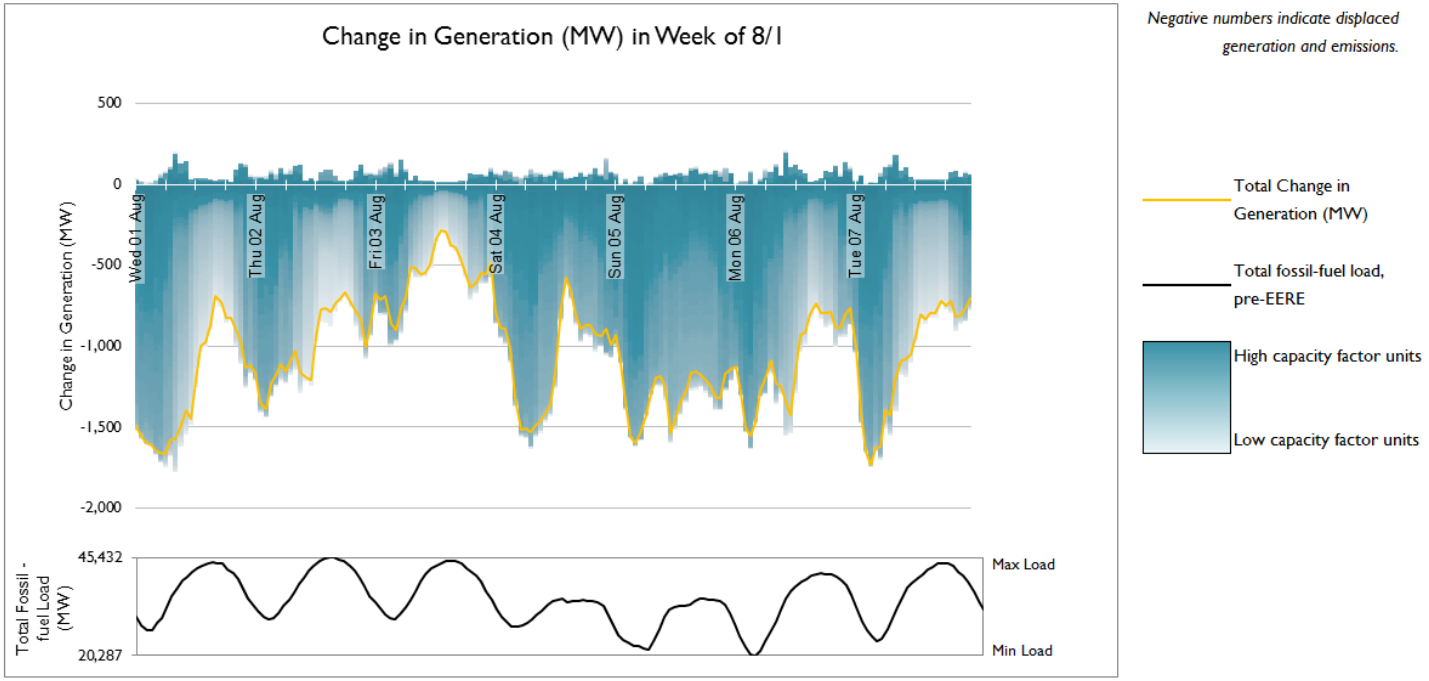
- First select region, state, or county in the top dropdown menu.
- If selecting a state, choose the state in the next dropdown menu.
- If selecting a county, choose both the state and the county in the next two dropdown menus.



# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Hourly displacements by week*

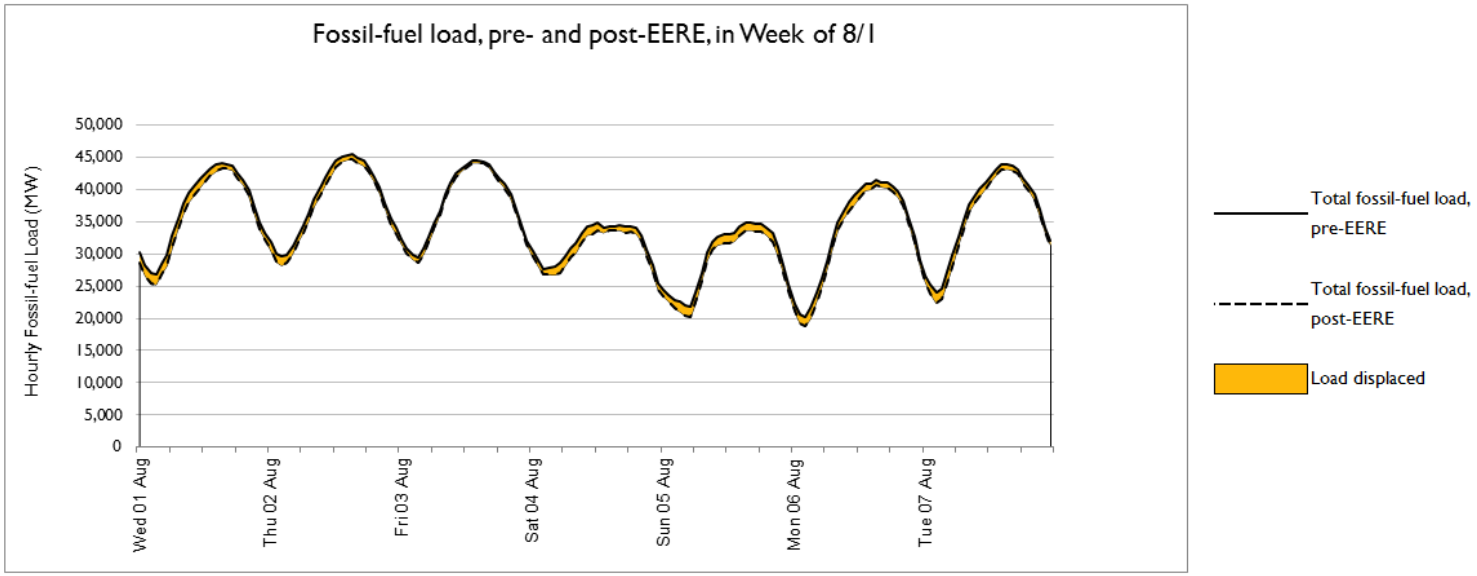
- This graph displays a dynamic representation of hourly displacement from each EGU in a region. Individual plants are stacked as gradated bar plots.



# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Hourly displacements by week*

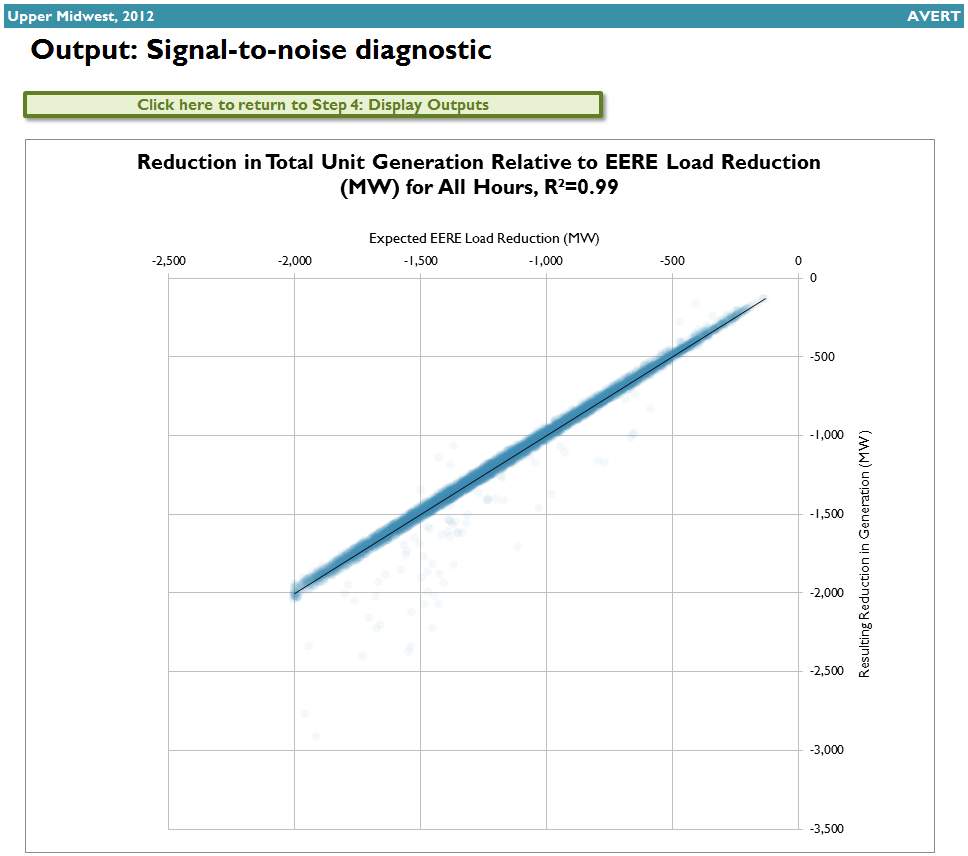
- The second figure shows the same week-long load impact profile, but presents the displaced load in reference to the total fossil-fuel load to illustrate the degree of change represented by the EE/RE program relative to the baseline.



# AVERT's Excel-Based Main Module Step 4. Display Outputs

*Signal-to-noise diagnostic*

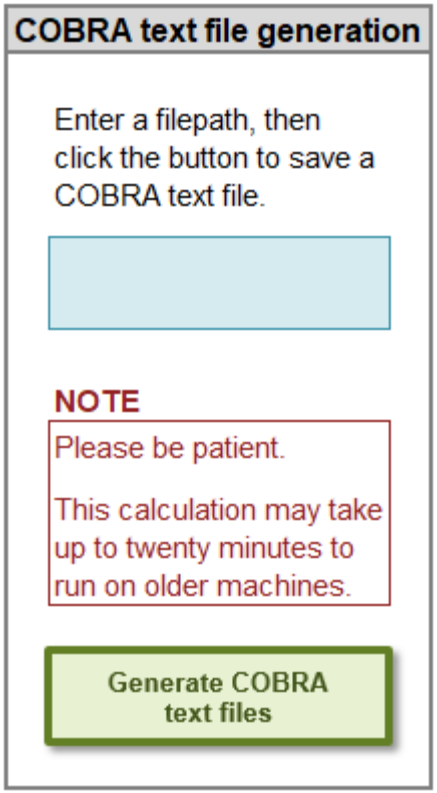
- This chart is a scatterplot of every hour of the year, showing calculated total generation reduction in each hour (y-axis) against the user-input EE/RE load reduction in each hour (x-axis).
- Ideally, AVERT perfectly matches unit generation reductions to the amount of EE/RE load reduction requested by the user.
- This graphic shows where that assumption holds, where it does not hold, and to what extent.



# AVERT's Excel-Based Main Module
# Step 4. Display Outputs

*COBRA Output*

- AVERT outputs may be used as inputs to EPA's CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool to assess EE/RE public health implications
- To download a COBRA-formatted file, double-click the blue box to enter a filepath and hit the green button to save a CSV file (example below)
- The file will contain county-level emission impacts for $PM_{2.5}$, $SO_2$, and $NO_X$, and will be ready for upload into COBRA




| | |
|---|---|
| 1 | FIPS,STATE,COUNTY,TIER1NAME,NOx_REDUCTIONS_TONS,SO2_REDUCTIONS_TONS,PM25_REDUCTIONS_TONS |
| 2 | 01001,Alabama,Autauga County,FUEL COMB. ELEC. UTIL.,-1.13,-0.05,-0.765 |
| 3 | 01015,Alabama,Calhoun County,FUEL COMB. ELEC. UTIL.,-0.315,-0.005,-0.06 |
| 4 | 01033,Alabama,Colbert County,FUEL COMB. ELEC. UTIL.,-3.23,-11.365,-0.13 |
| 5 | 01039,Alabama,Covington County,FUEL COMB. ELEC. UTIL.,-0.5,-0.005,-0.09 |
| 6 | 01047,Alabama,Dallas County,FUEL COMB. ELEC. UTIL.,-0.11,0,-0.01 |
| 7 | 01063,Alabama,Greene County,FUEL COMB. ELEC. UTIL.,-3.32,-12.685,-0.735 |
| 8 | 01073,Alabama,Jefferson County,FUEL COMB. ELEC. UTIL.,-5.835,-8.575,-0.07 |
| 9 | 01081,Alabama,Lee County,FUEL COMB. ELEC. UTIL.,-0.455,-0.01,-0.225 |
| 10 | 01085,Alabama,Lowndes County,FUEL COMB. ELEC. UTIL.,-0.05,0,-0.025 |
| 11 | 01097,Alabama,Mobile County,FUEL COMB. ELEC. UTIL.,-5.89,-9.695,-0.265 |
| 12 | 01103,Alabama,Morgan County,FUEL COMB. ELEC. UTIL.,-0.395,-0.025,-0.15 |
| 13 | 01113,Alabama,Russell County,FUEL COMB. ELEC. UTIL.,-3.465,0,-0.195 |
| 14 | 01117,Alabama,Shelby County,FUEL COMB. ELEC. UTIL.,-3.57,-15.625,-0.22 |
| 15 | 01121,Alabama,Talladega County,FUEL COMB. ELEC. UTIL.,-0.13,0,-0.01 |
| 16 | 01123,Alabama,Tallapoosa County,FUEL COMB. ELEC. UTIL.,-0.12,-0.01,-0.08 |
| 17 | 01127,Alabama,Walker County,FUEL COMB. ELEC. UTIL.,-17.395,-15.505,-0.11 |
| 18 | 01129,Alabama,Washington County,FUEL COMB. ELEC. UTIL.,-7.16,-1.605,-0.415 |
| 19 | 05031,Arkansas,Craighead County,FUEL COMB. ELEC. UTIL.,-0.105,0,-0.005 |
| 20 | 05059,Arkansas,Hot Spring County,FUEL COMB. ELEC. UTIL.,-2.365,-0.015,-0.28 |
| 21 | 05063,Arkansas,Independence County,FUEL COMB. ELEC. UTIL.,-15.845,-39.095,-0.46 |
| 22 | 05069,Arkansas,Jefferson County,FUEL COMB. ELEC. UTIL.,-19.94,-42.335,-0.415 |
| 23 | 05093,Arkansas,Mississippi County,FUEL COMB. ELEC. UTIL.,-0.755,-1.515,-0.035 |

# Part II
# AVERT Statistical Module Operation

# AVERT Statistical Module Overview

- Purpose
  - Basis of AVERT analysis
  - Processes raw CAMD data to determine behavioral characteristics of fossil-fired EGU
  - Returns expected generation and emissions behavior to AVERT Main Module
  - Allows users to alter EGU characteristics, retire and add EGU with Future Year Template
- Advanced use of AVERT
  - Most users will not require the Statistical Module
  - Based in MATLAB
  - Executable version available for public use
  - Requires MATLAB Compiler Runtime (MCR) to be installed (free from Mathworks) **R2012b (8.0).**
  - Requires Windows
- Output file can be used directly in Main Module

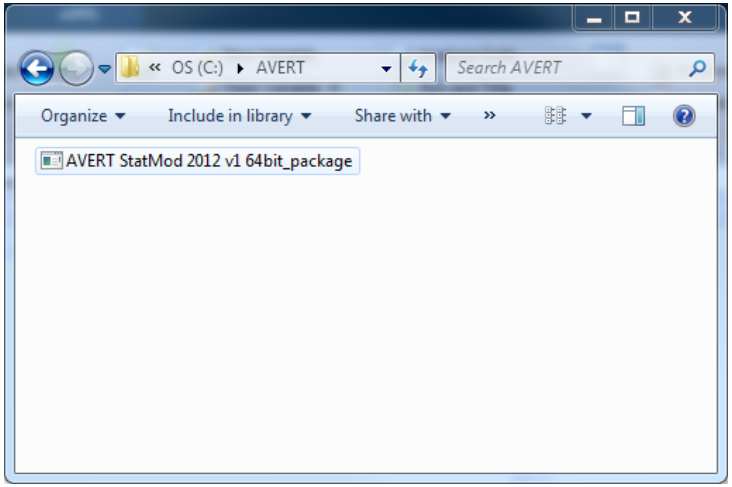
# AVERT Statistical Module Obtain Correct Version

- AVERT Statistical Module requires is sensitive to PC specifications.
- 32-bit and 64-bit operating system versions available.
- Obtain correct version of AVERT Statistical Module.
- Obtain correct version of MCR from Mathworks: **R2012b (8.0).**
  - **Use the exact version noted on the AVERT website and in the user guide. An older or newer version will give you an error when you try to run the analysis.**

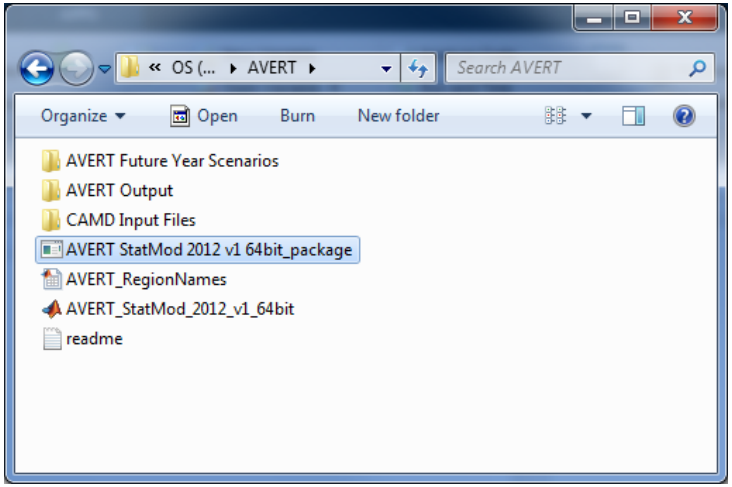
- Determine if your Windows system operates in a 32-bit or 64-bit environment.
  - Find this information in "properties" of "My Computer" in Windows XP, or "Computer" in Windows Vista, Windows 7, or Windows 8.
  - Follow these instructions: https://support.microsoft.com/en-us/help/15056/windows-7-32-64-bit-faq.

# AVERT Statistical Module Unpacking and Startup

- Download the AVERT Statistical Module package.



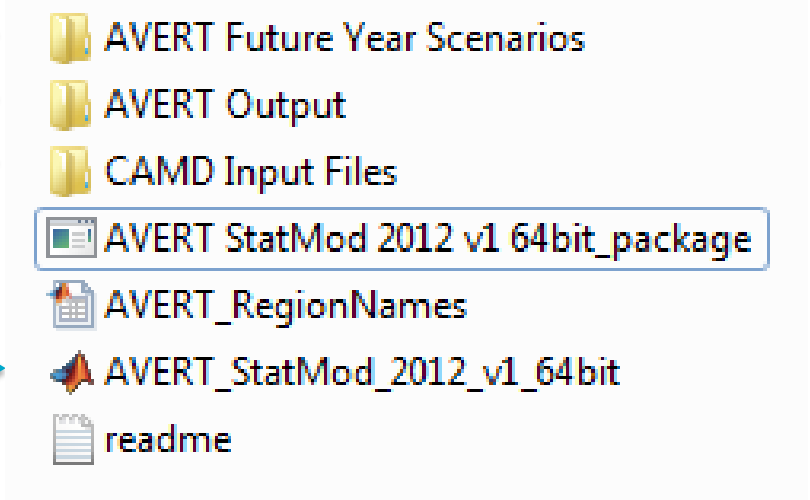

- Run the executable to decompress the package to three files and three subfolders.




To obtain historical base years, visit https://www.epa.gov/statelocalenergy/download-avert and obtain both the CAMD input file and the Future Year Scenario Template for that same year.

# AVERT Statistical Module File Structure

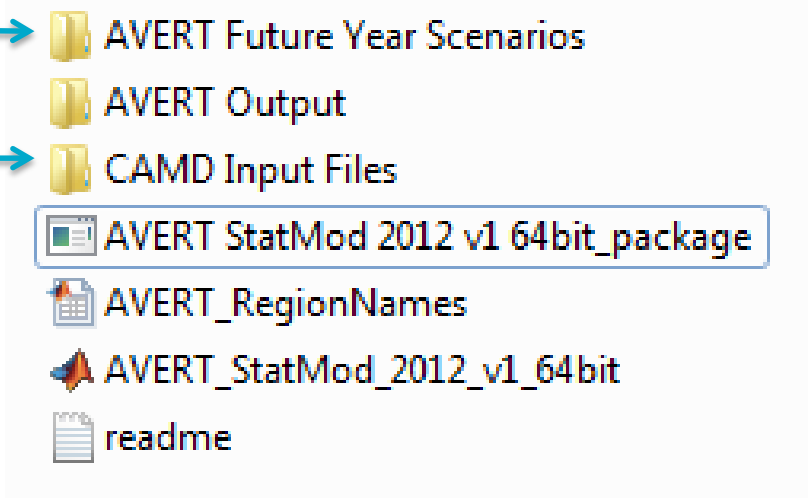
- **AVERT Future Year Scenarios**
  - Excel-based input files for altering EGU
- **AVERT Output**
  - Statistical Module output files
  - These become Main Module input files
- **CAMD Input Files**
  - Processed CAMD data files
  - New versions expected 2nd quarter annually
- **AVERT_StatMod_ 2012_v1_64bit**
  - Executable



# Obtaining Other Base Years

To obtain additional historical base year data, visit: https://www.epa.gov/statelocalenergy/download-avert.

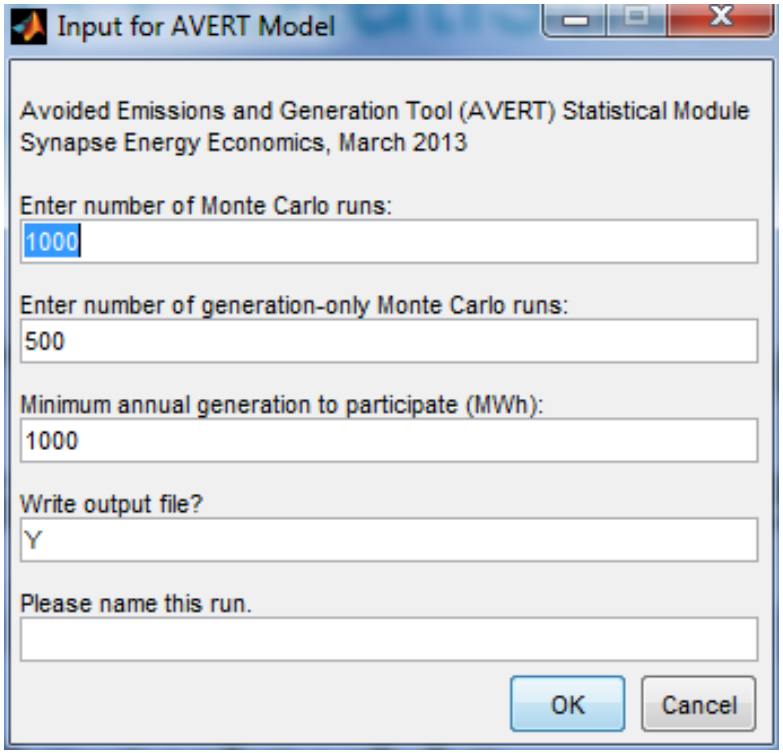
- Download AVERT Future Year Scenario for the same historical base year.
  - Place the file in "AVERT Future Year Scenarios"
- Download the CAMD input file for the historical base year.
  - Place the file in "CAMD Input Files"




**Note:** Historical base years must match up with the Future Year Scenario Template.

# AVERT Statistical Module Input Parameters

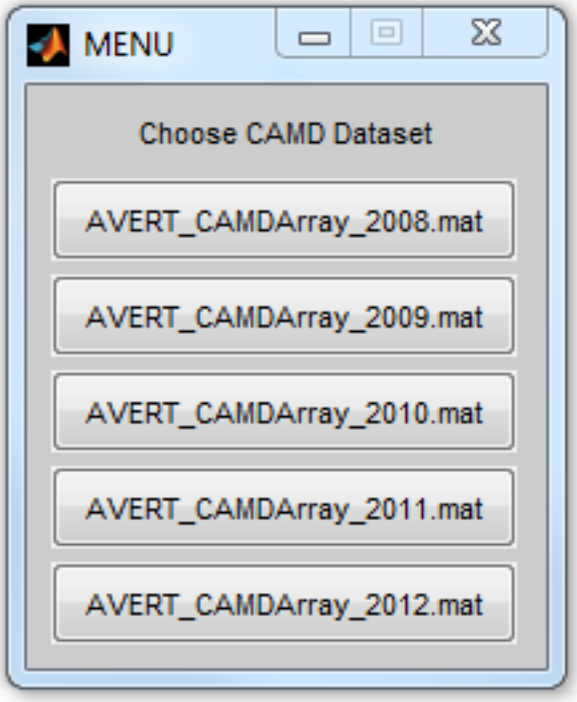
- Higher number of Monte Carlo (MC) runs reduces noise.
  - For test runs, use a low number of MC runs (10) and generation-only MC runs (5).
  - For final runs, use a high number of MC runs (1,000) and generation-only MC runs (500).
- Select "Y" to write output and save runs.




*Use letters and numbers only.*
*No special characters and no spaces.*

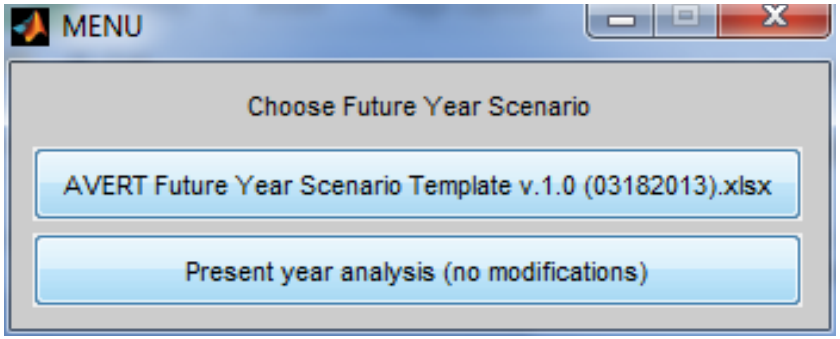
# AVERT Statistical Module Choose Data File

- Choose base year for analysis.
  - Data from 2007 through 2017 are available.
  - New data will be ready by the second quarter of the next year.
    - Requires data to be vetted by EPA and post-processed.



# AVERT Statistical Module
# Choose Future Year Scenario

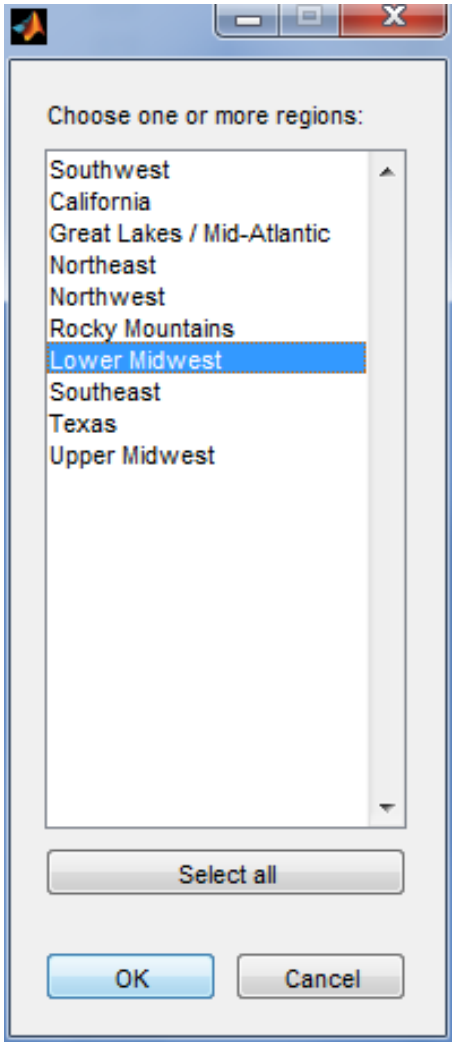
- Select either
  - Saved future year scenario
  - Present year analysis



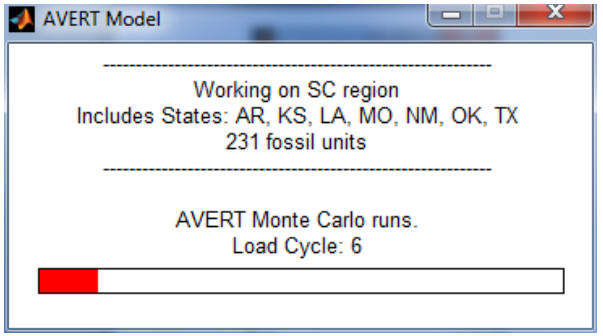

Present year analysis makes no modifications to the AVERT dataset.

  - Uses EGU that exist in data year
  - No changes in emissions rates

# AVERT Statistical Module
# Choose Region(s) of Interest




- Choose region (or multiple regions) of interest.
- Same regions as in AVERT Main Module
- Once you hit "OK", the program will run uninterrupted until completion.
  - Program returns updated run status on a regular basis.
  - Output graphic and file indicate successful completion.



# Part III

# AVERT Future Year Scenario Template

# AVERT Future Year Scenario Overview

- Purpose
  - AVERT is not forward-looking: cannot predict EGU retirements, new additions, or emissions modifications.
  - Future Year Scenarios allow users to
    - Remove EGU from analysis.
    - Include additional proxy EGU.
    - Modify emissions characteristics.
- Advanced use of AVERT
  - Excel spreadsheet
  - Read into AVERT Statistical Module
- Each spreadsheet becomes a scenario.
  - Spreadsheet becomes input file for AVERT Statistical Module.
  - Each future year scenario template is specifically designed to match the same historical base year.

# Use AVERT Future Year Scenario in Statistical Module

- Obtain Future Year Scenario Template (slides 41-44).
- Modify Future Year Scenario Template (slides 52-54).
- Save Future Year Scenario Template with a meaningful name.
- Run Statistical Module (slides 45-48).
  - Provide a unique name for the statistical module run (slide 45).
  - Choose saved future year scenario (slide 47).

# AVERT Future Year Scenario Retires and Modifications

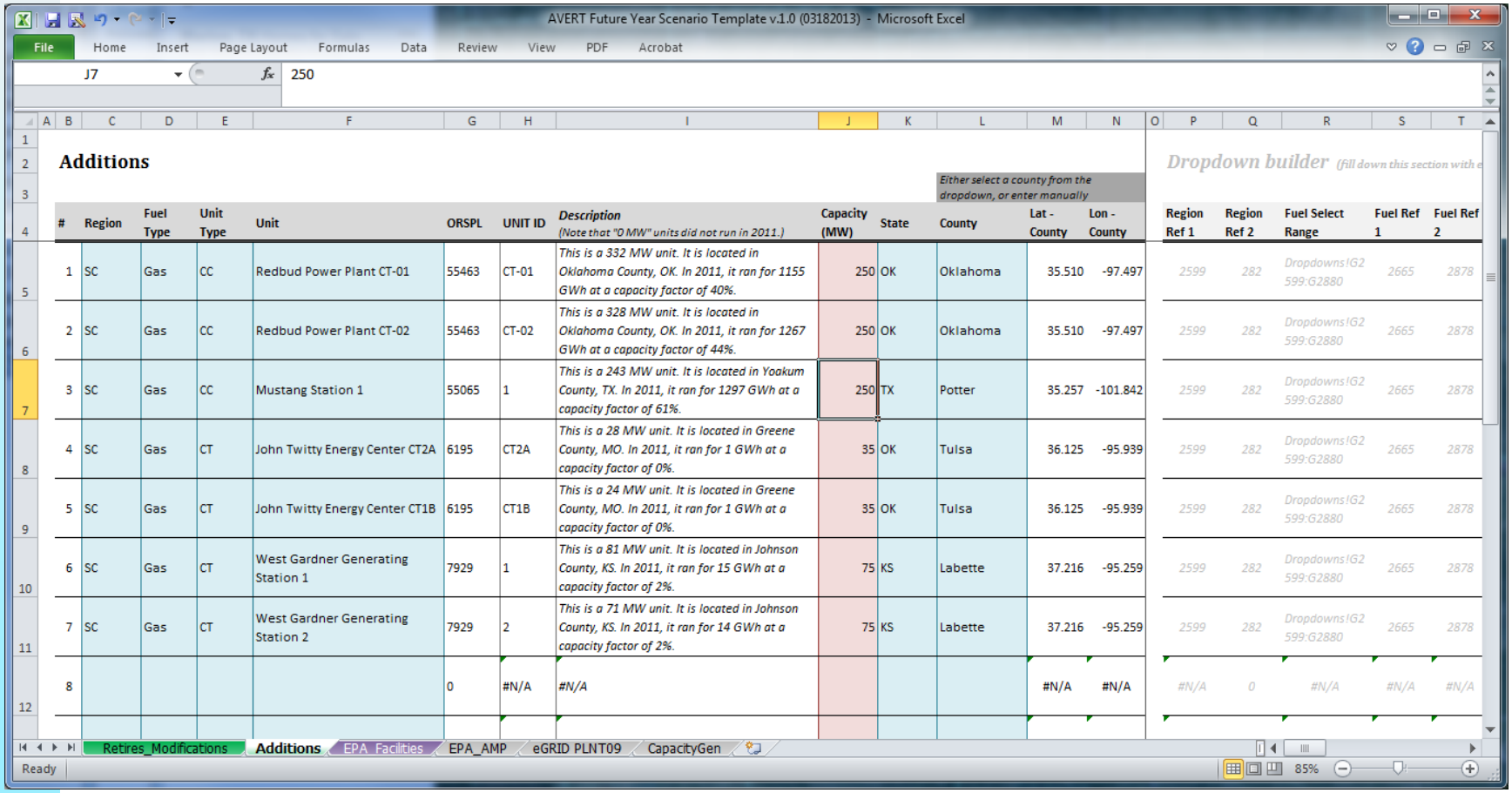
**Retiring Units / Emission Modifcations**

Enter an option manually in blue cells

| Facility Name | ORSPL | UnitID | Retire? | Retire (binary) | Revise Emissions Rates? | Revise (binary) | Revised SO2 Rate (lbs/MWh) | Revised NOx Rate (lbs/MWh) | Revised CO2 Rate (Tons/MWh) | Revised PM2.5 Rate (Tons/MMBTU) | AVERT Region | capacity | unit type | CF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Healy Power Plant | 6288 | 1 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0 | 0 | Coal | 0% |
| Healy Power Plant | 6288 | 2 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0 | 0 | Other | 0% |
| AMEA Sylacauga Plant | 56018 | 1 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 49 | Gas | 6% |
| AMEA Sylacauga Plant | 56018 | 2 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 49 | Gas | 5% |
| Ascend (Decatur Plant) | 880041 | X015 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 0 | Coal | 0% |
| Ascend (Decatur Plant) | 880041 | Z005 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 0 | Coal | 0% |
| Ascend (Decatur Plant) | 880041 | Z006 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 0 | Coal | 0% |
| Barry | 3 | 1 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 58 | Gas | 2% |
| Barry | 3 | 2 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 56 | Gas | 2% |
| Barry | 3 | 4 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 354 | Coal | 36% |
| Barry | 3 | 5 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 791 | Coal | 46% |
| Barry | 3 | 6A | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 291 | Gas | 83% |
| Barry | 3 | 6B | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 288 | Gas | 78% |
| Barry | 3 | 7A | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 288 | Gas | 82% |
| Barry | 3 | 7B | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 288 | Gas | 83% |
| Calhoun Energy Center | 55409 | CT1 | Yes | 1 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 163 | Gas | 4% |
| Calhoun Energy Center | 55409 | CT2 | Yes | 1 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 164 | Gas | 2% |
| Calhoun Energy Center | 55409 | CT3 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 165 | Gas | 3% |
| Calhoun Energy Center | 55409 | CT4 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 161 | Gas | 5% |
| Charles R Lowman | 56 | 1 | No | 0 | Yes | 1 | 1.000 | 1.000 | 1.000 | 1.000 | Southeast | 80 | Coal | 3% |
| Charles R Lowman | 56 | 2 | No | 0 | Yes | 1 | 1.000 | 1.000 | 1.000 | 1.000 | Southeast | 239 | Coal | 30% |
| Charles R Lowman | 56 | 3 | No | 0 | Yes | 1 | 1.000 | 1.000 | 1.000 | 1.000 | Southeast | 241 | Coal | 43% |
| Colbert | 47 | 1 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 170 | Coal | 16% |
| Colbert | 47 | 2 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 156 | Coal | 17% |
| Colbert | 47 | 3 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 164 | Coal | 11% |
| Colbert | 47 | 4 | No | 0 | No | 0 | 0.000 | 0.000 | 0.000 | 0.000 | Southeast | 163 | Coal | 9% |

- Find EGU of interest, or filter by state or region.
- To retire, select “Yes” in the “Retire?” column.
- To change emissions rate, select “Yes” in the “Revise Emissions Rates?” column and enter new rate(s) in columns I, J, K, or L.

# AVERT Future Year Scenario Additions

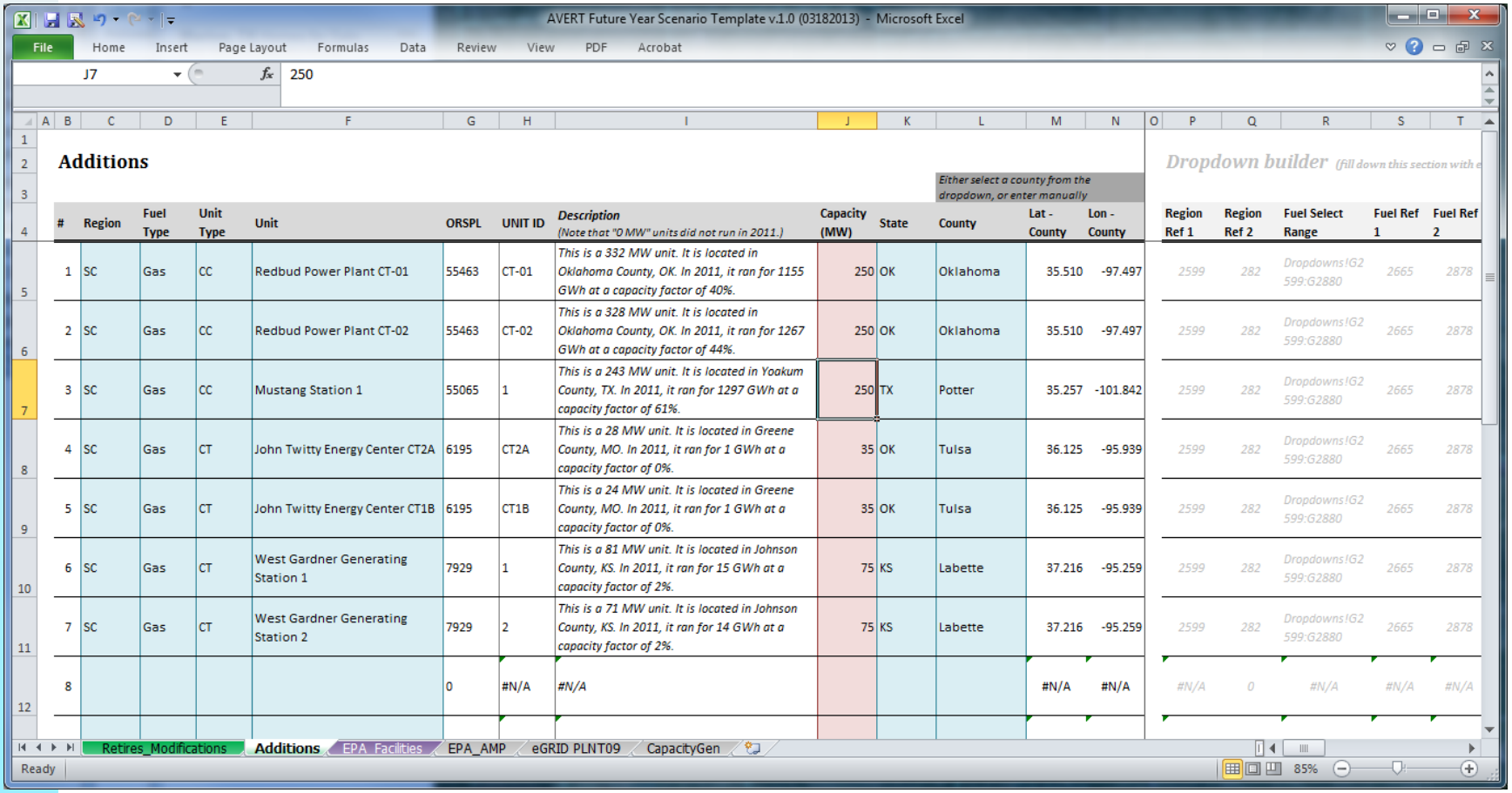



In order

1. Select region
2. Select fuel type
3. Select generator type
4. Select specific EGU (unit)

Description will appear about EGU type automatically.

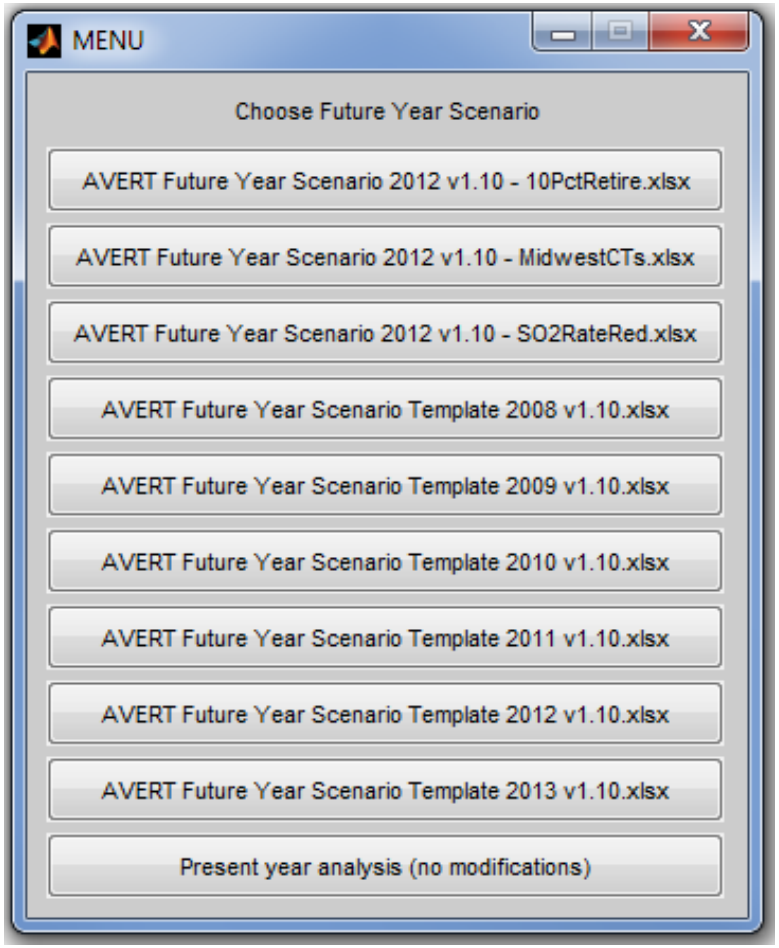
# AVERT Future Year Scenario Additions




- Choose proxy unit capacity (will scale all other factors)
- Choose state (within region)
- Choose county (within region)
- Save file

# Use AVERT Future Year Scenario in Statistical Module

- Run Statistical Module (slides 45-48).
- Provide a unique name for the statistical module run (slide 45).
- Choose saved future year scenario (slide 47).



# For More Information

- Visit the AVERT website at www.epa.gov/avert.
- Contact EPA at avert@epa.gov.