AVERT Main Module Quick Start Guide

AVoided Emissions and geneRation Tool (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 use AVERT to evaluate county-level emissions displaced at electric power plants by energy efficiency (EE) and renewable energy (RE) policies and programs.

Download Instructions

AVERT's Main Module requires Excel 2007 or newer to run in Windows. The Main Module can also be used in Excel 2011 for Mac. To download AVERT's Main Module, go to www.epa.gov/avert and save the following files to the same folder on a local computer or drive:

1. AVERT's Main Module workbook: "AVERT Main Module.xlsx".
2. The Regional Data File for the region under analysis.

Installation of AVERT's Statistical Module and AVERT's Future Year Scenario Template is not necessary to use AVERT's Main Module to estimate displaced emissions for EE/RE programs modeled in a historic base year. However, modeling displaced emissions with reference to user-created future years requires all three AVERT modules. Refer to the AVERT User Manual for additional installation instructions.

Step-by-Step Instructions

To begin using AVERT's Main Module, open the **AVERT Main Module.xlsx** file.

Enable Macros

Before making any selections or beginning calculations, macros must be enabled on your computer.

To enable macros in Excel 2007 for Windows:

- Click the Microsoft Office Button, and then click "Excel Options."
- Click "Trust Center," click "Trust Center Settings," and then click "Macro Settings."
- Click on "Enable all Macros."

To enable macros in Excel 2010 or Excel 2013 for Windows:

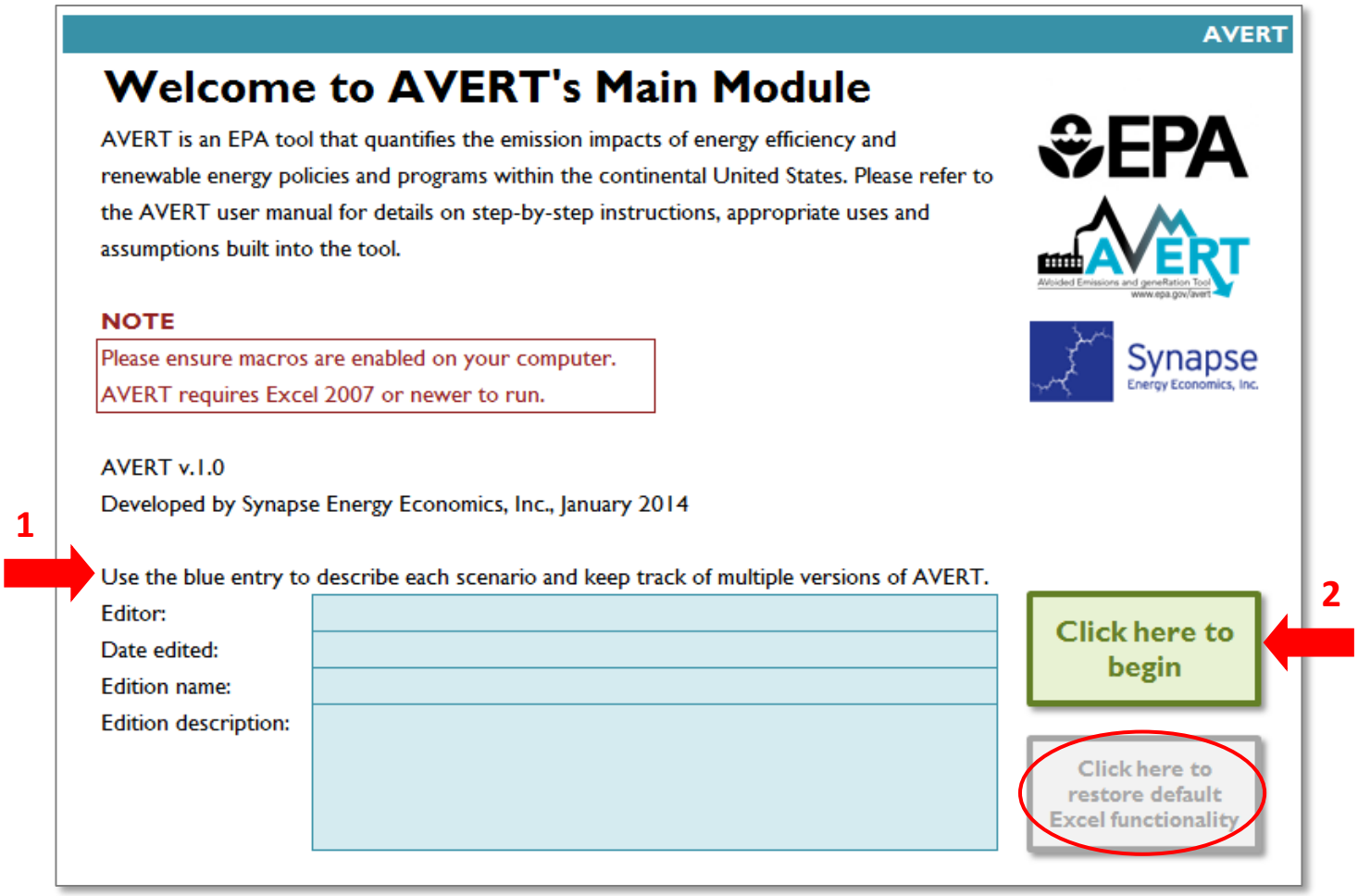
- Click the "File" menu (Office Backstage), and then click "Options" in the left sidebar.
- Click "Trust Center" on the left, and then click the "Trust Center Settings" button in the main window.
- Click "Macro Settings" in the left sidebar, then choose the "Enable All Macros" option and hit OK.

To enable macros in Excel 2011 for Mac, select "Enable macros" in the dialog box that appears when opening the file.

Begin Using AVERT

When launched in Excel, AVERT's Main Module opens to its "Welcome" page.

1. Personalize the welcome page with details about the user, the date of use, and the EE/RE program for which displacements are to be estimated.
2. Click on the button labeled "Click here to begin" to move on to AVERT's first step.

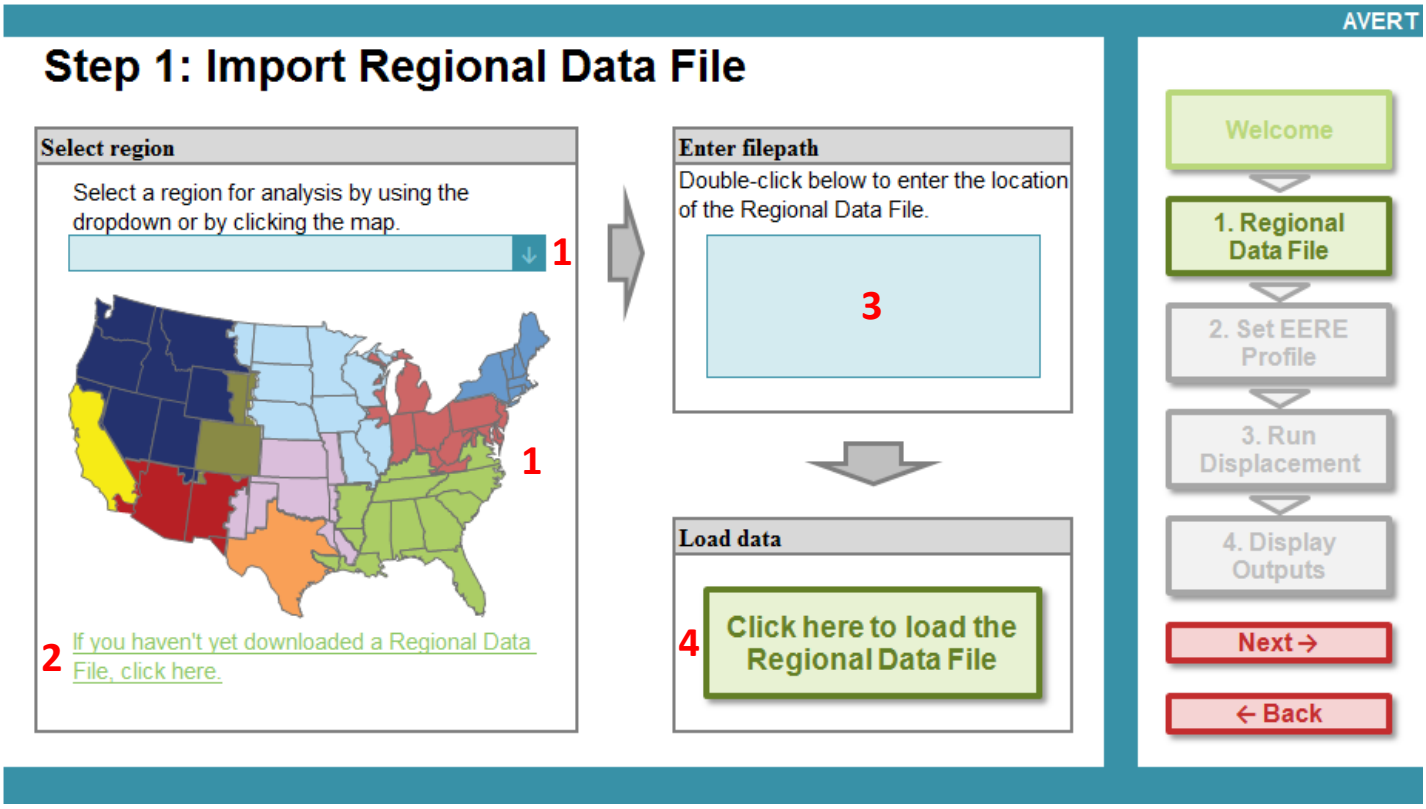


Note: The tabs that drive the calculations for AVERT are hidden to enhance the usability and appearance of the tool. For users that prefer full Excel functionality, there is a button at the lower right-hand side of the welcome page that reads "Click here to restore default Excel functionality". Users may complete the steps required to estimate displaced emissions regardless of whether full Excel functionality is visible.

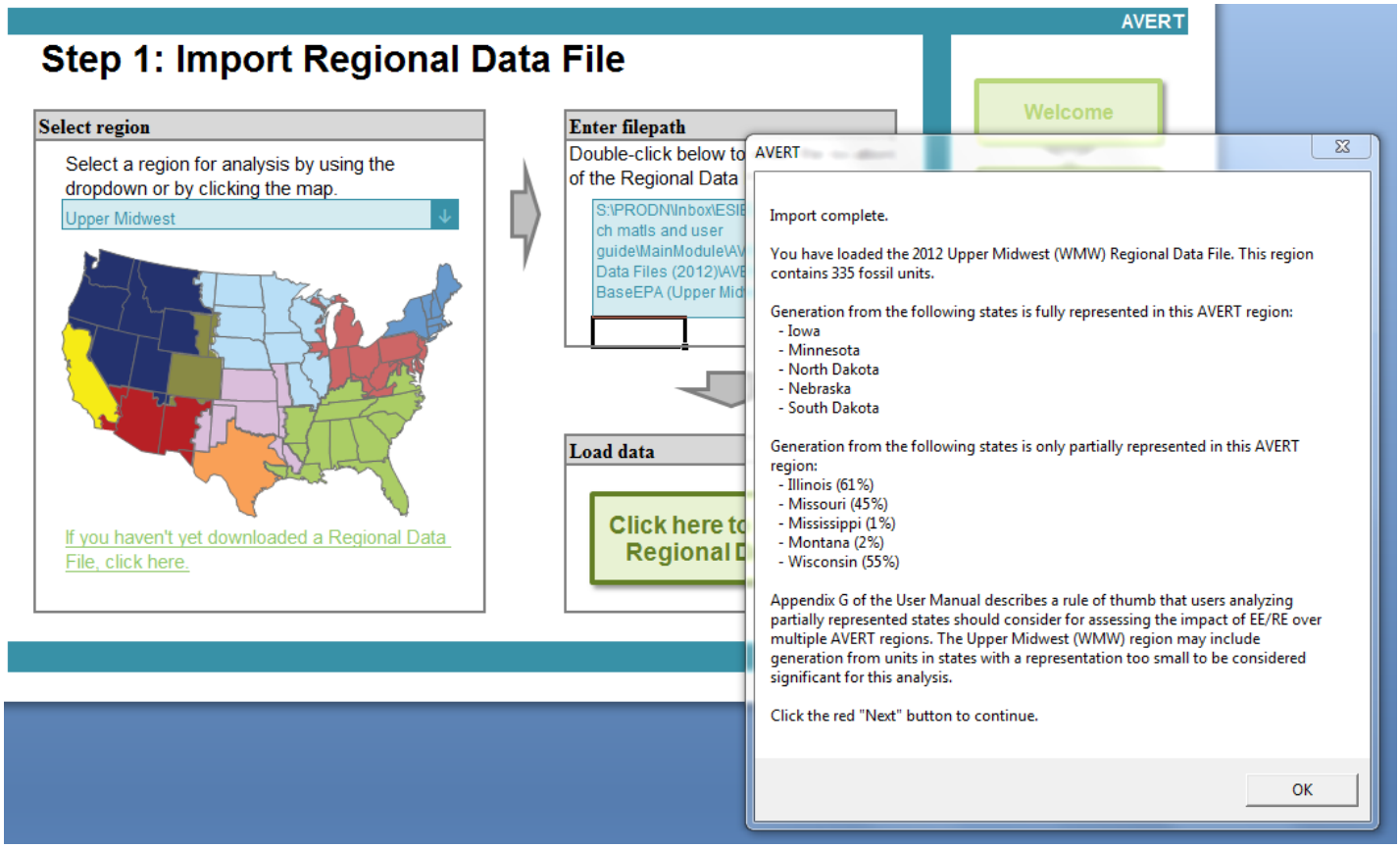
Step 1: Import Regional Data File

AVERT regions represent relatively autonomous electricity production zones, and are based on electricity market module regions. For more detailed information on the specific boundaries of each region, consult the AVERT User Manual.

1. Select a region for analysis by either using the dropdown menu or by clicking the map. Selecting a region loads region-specific data for wind and solar capacity factors.
2. If you have not already, click the link under the map to download the corresponding Regional Data File from EPA's website.
3. Once you have downloaded your Regional Data File, in the box labeled "Enter filepath," double-click the blue area to navigate to its location.
4. Click the button under "Load data" that reads, "Click here to load the Regional Data File." Clicking this button loads hourly fossil load, unit information, and typical unit performance for generation and emissions. This step may take several minutes to complete.



Once the Regional Data File has loaded, a pop-up box will appear. This pop-up confirms the region and data year and indicates the number of reporting fossil units. The pop-up lists the states that are fully represented in the selected region as well as those that are partially represented, as some states are divided between multiple AVERT regions. For example, parts of Illinois are considered to be in the Upper Midwest region, while other parts are in the Great Lakes / Mid-Atlantic Region. Consult Appendix G of the AVERT User Manual for guidance on determining the impact of EE/RE programs in states that are split across multiple AVERT regions.

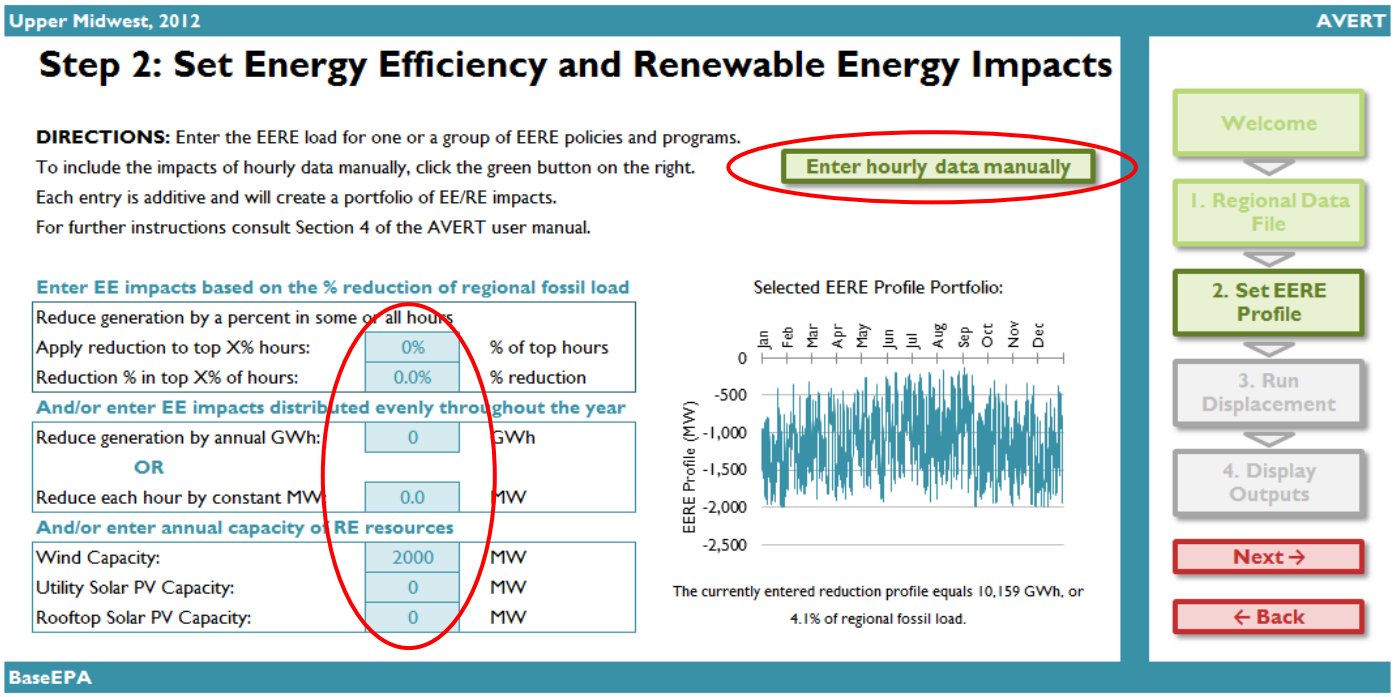


Step 2: Set Energy Efficiency (EE) and Renewable Energy (RE) Impacts

This page leads you through the process of creating a load impact profile depicting the load reductions expected from an EE/RE program. It 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 (flat)
- Reduce each hour by a constant MW each hour
- Renewable energy proxy
- Combination of EE/RE programs including combining pre-set options with manual entry

Each option is described in more detail in the AVERT User Manual. If more than one option (including manual entry) is chosen, the selected options will be combined into a portfolio of programs.



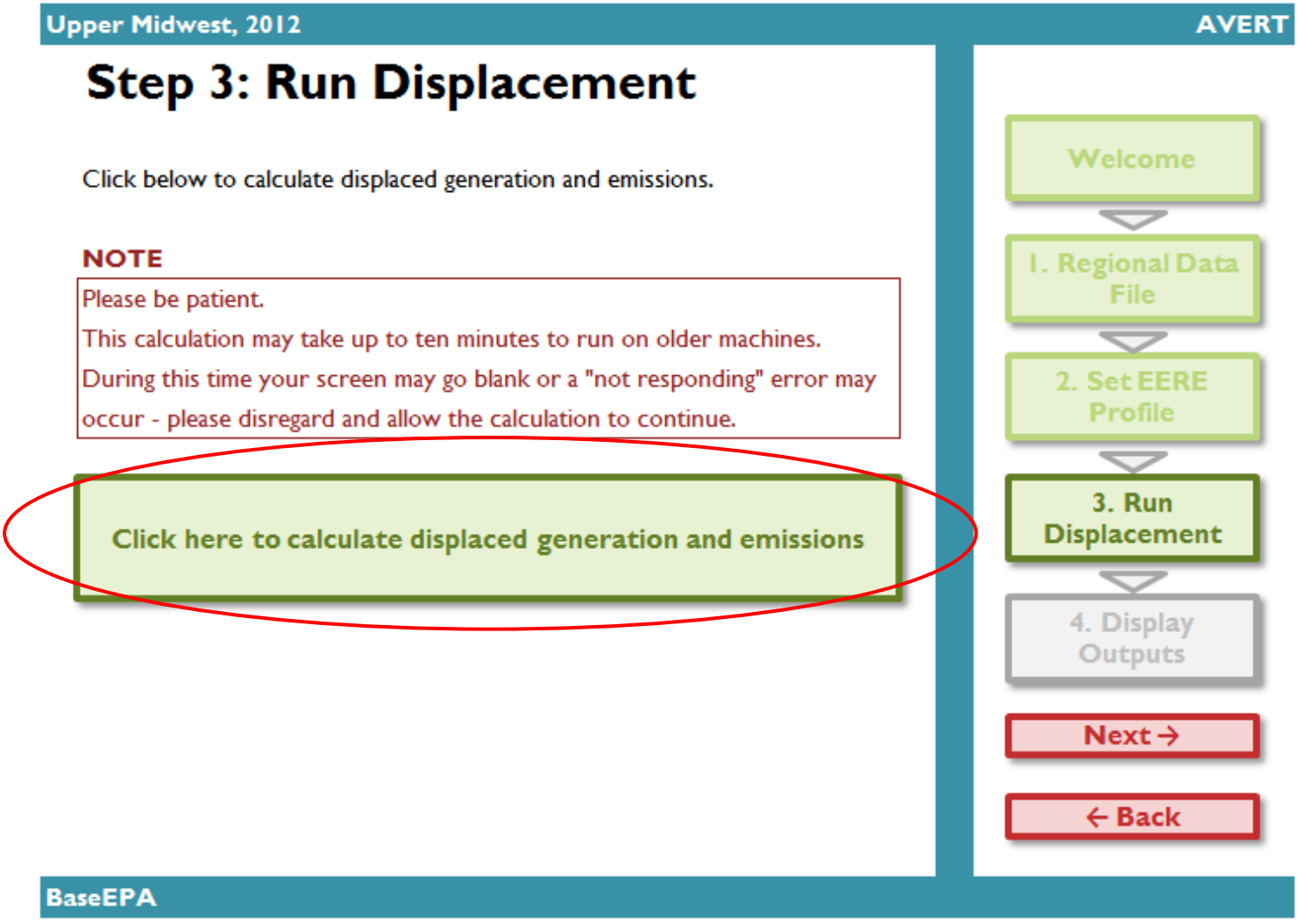
For hourly load reductions expected from a particular EE/RE policy, program, or measure, values can be input manually. Click the "Enter hourly data manually" button, which will allow you to enter a manual stream of load reduction values for every hour of the year.

Step 3: Run Displacement

This step calculates hourly displaced generation and emissions (SO_2, NO_x, CO_2) for each fossil unit within the selected region.

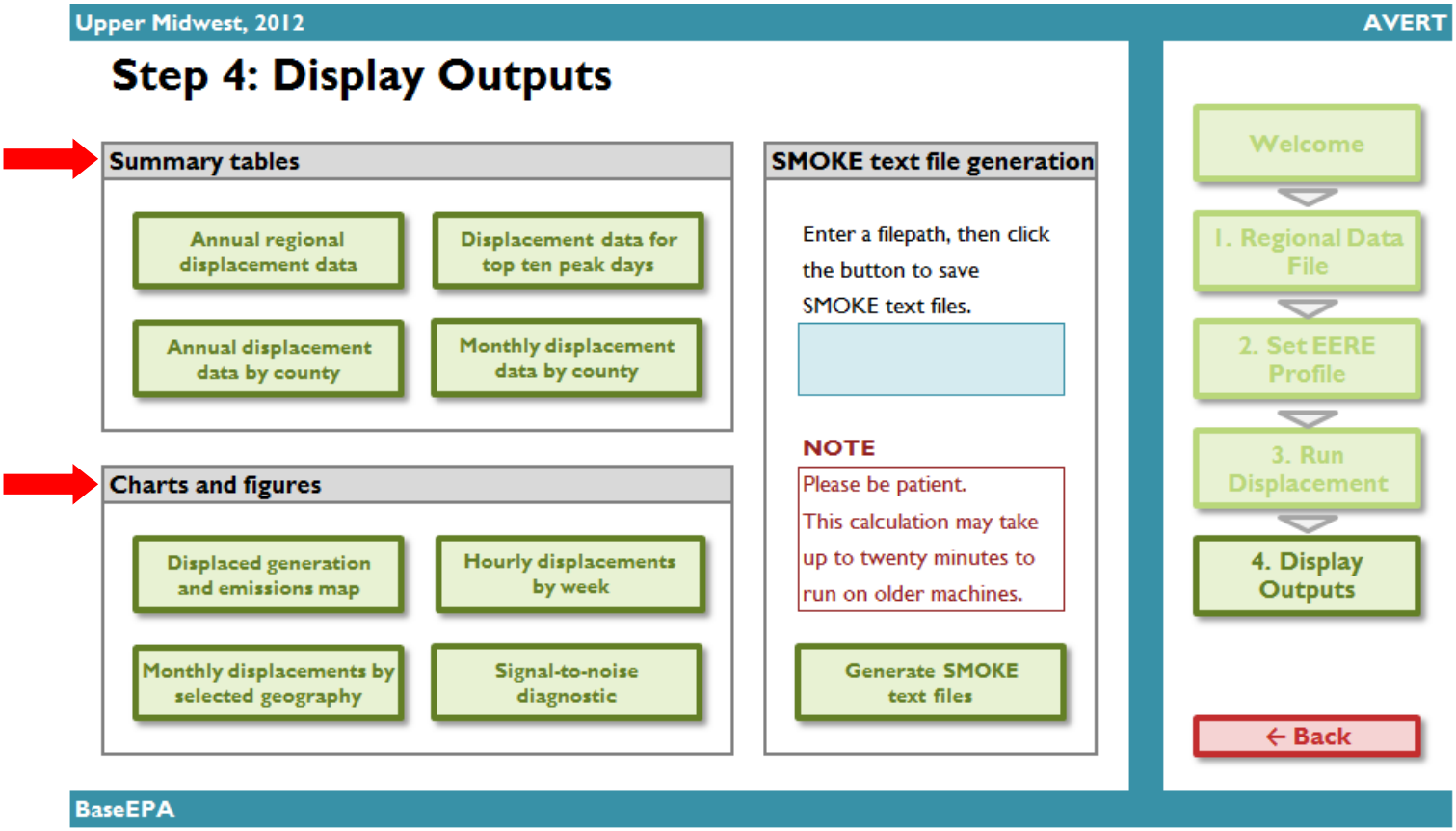
Run displacement by selecting the button entitled "Click here to calculate displaced generation and emissions." Note that this is a processor-intensive step. When using an older computer, or when analyzing regions with many fossil units, this step may take up to ten minutes.

A pop-up box that reads "Calculation complete" will appear once the calculations are complete.



Step 4: Display Outputs

The data generated in Step 3 are aggregated in two major groups of charts and tables in this step: "Summary tables" and "Charts and figures". There are eight total display output options. Each output is described in more detail in the AVERT User Manual.



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, 2012 **AVERT**

Output: Annual Regional Displacements

Click here to return to Step 4: Display Outputs

	Original	Post-EERE	Impacts
Generation (MWh)	245,694,500	235,514,500	- 10,180,000
Total Emissions			
SO_2 (lbs)	956,871,300	921,132,200	- 35,739,100
NO_x (lbs)	416,259,200	400,349,300	- 15,909,900
CO_2 (tons)	246,098,700	236,856,400	- 9,242,300
Emission Rates			
SO_2 (lbs/MWh)	3.895	3.911	
NO_x (lbs/MWh)	1.694	1.700	
CO_2 (tons/MWh)	1.002	1.006	

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 electric generating unit (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, 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

Monthly displacement data by county

This table shows a summary of the displaced generation and emissions for each of the counties from each of the states contained within the region, broken out by month and with an annual total.

Upper Midwest, 2012 — AVERT

Output: Monthly Displacement Data by County

Click here to return to Step 4: Display Outputs

Negative numbers indicate displaced generation and emissions. All results are rounded to the nearest hundred.
A dash ("—") indicates a result greater than zero, but lower than the level of reportable significance.

State	County	Month	Displaced Generation (MWh)	Displaced NO_x (lbs)	Displaced SO_2 (lbs)	Displaced CO_2 (Tons)
IA	Allamakee	1	-9,800	-67,900	-500	-10,100
IA	Allamakee	2	-8,200	-56,500	200	-8,400
IA	Allamakee	3	-7,700	-53,500	-3,100	-8,000
IA	Allamakee	4	-7,000	-48,800	-5,500	-7,400
IA	Allamakee	5	-7,600	-53,300	-7,800	-8,200
IA	Allamakee	6	-5,900	-42,000	-4,700	-6,300
IA	Allamakee	7	-4,400	-32,200	-2,500	-4,700
IA	Allamakee	8	-5,700	-40,500	-4,000	-6,000
IA	Allamakee	9	-7,300	-51,000	-6,600	-7,800
IA	Allamakee	10	-8,900	-61,800	-2,300	-9,200
IA	Allamakee	11	-8,800	-60,300	-800	-9,000
IA	Allamakee	12	-10,400	-72,000	200	-10,700
IA	Allamakee	Annual	-91,800	-639,700	-37,300	-95,900
IA	Appanoose	1	–	–	-400	–

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, 2012 — AVERT

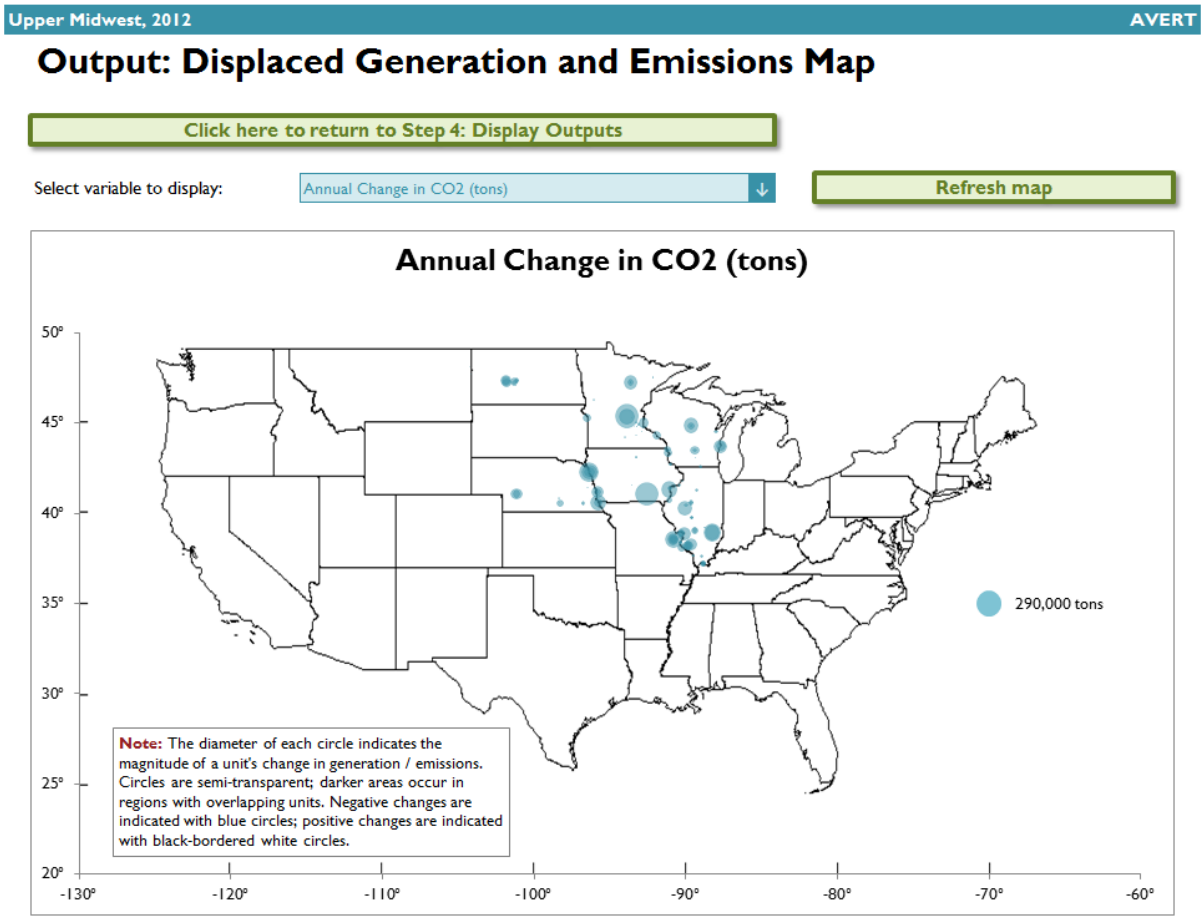
Output: Displacement Data for Top Ten Peak Days

Click here to return to Step 4: Display

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)
1	Jul 26	990,200	-32,800	-32,000	-56,500	-58,900	-23,300
2	Jul 27	966,700	-26,300	-26,300	-57,000	-42,500	-19,800
3	Jul 25	963,900	-35,800	-35,900	-69,600	-62,700	-27,100
4	Jul 14	963,400	-21,800	-21,800	-42,400	-36,800	-16,500
5	Aug 01	954,200	-16,500	-16,400	-35,900	-27,700	-12,800
6	Jul 06	953,600	-16,000	-16,000	-37,400	-26,700	-12,600
7	Jul 13	950,100	-17,000	-16,400	-37,800	-29,900	-13,100
8	Jul 07	928,900	-19,000	-19,100	-41,100	-29,600	-14,600
9	Jul 10	927,500	-18,400	-18,500	-42,700	-31,400	-14,400
10	Aug 12	923,200	-15,500	-15,500	-34,200	-21,500	-12,000

Displaced generation and emissions map

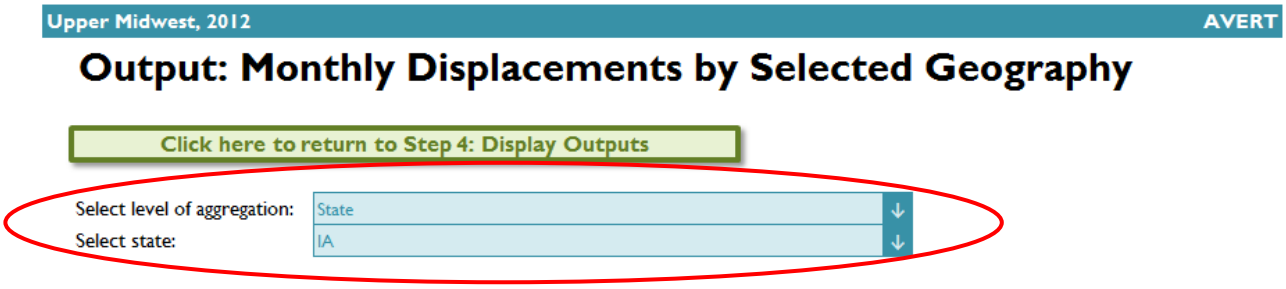
This dynamic map allows the user to view where emissions have been displaced within the selected region. Users can view changes in generation, heat input, SO_2, NO_X, and CO_2.

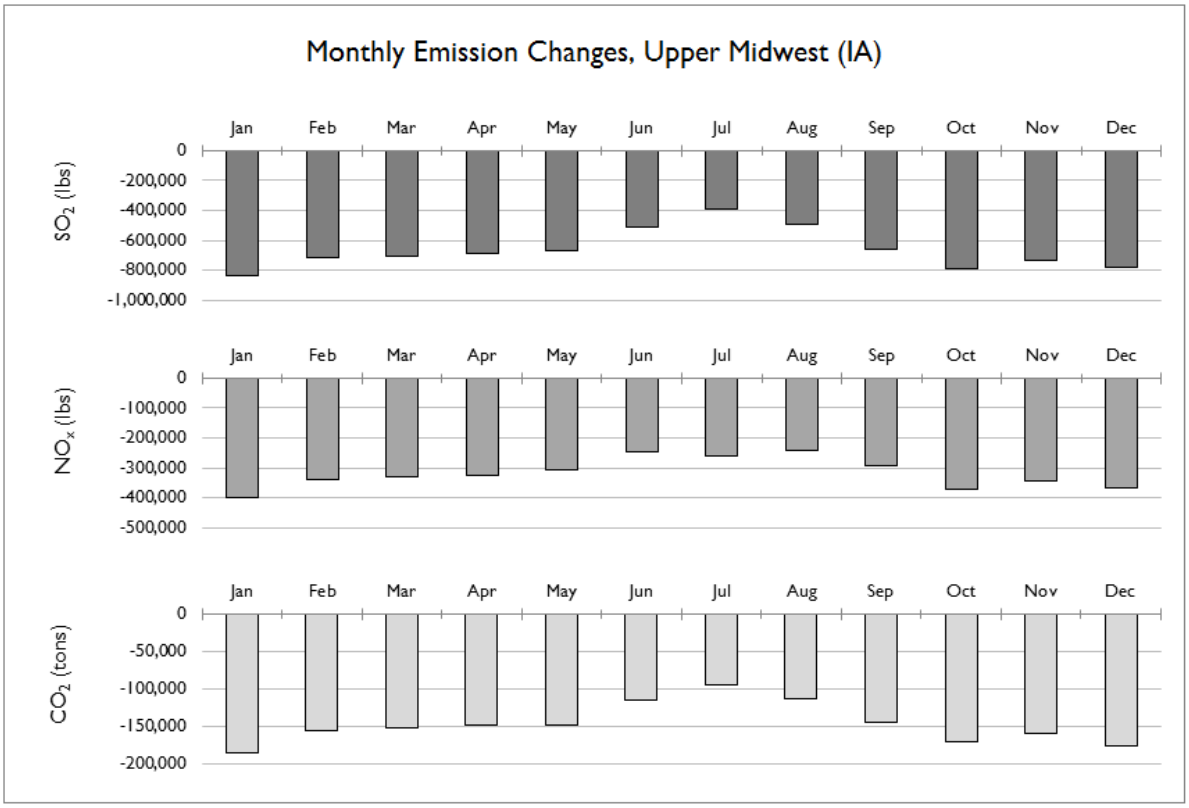


Displacement data by month

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.

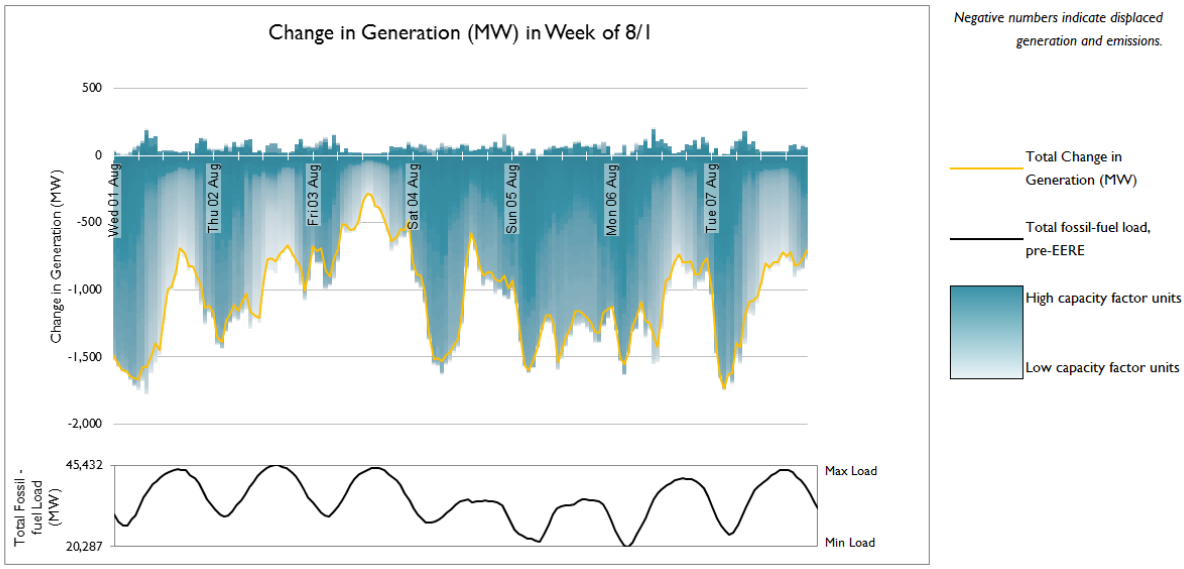
- If selecting a state, choose the state in the next dropdown menu.
- If selecting a county, choose both the state and the county in the next two dropdown menus.



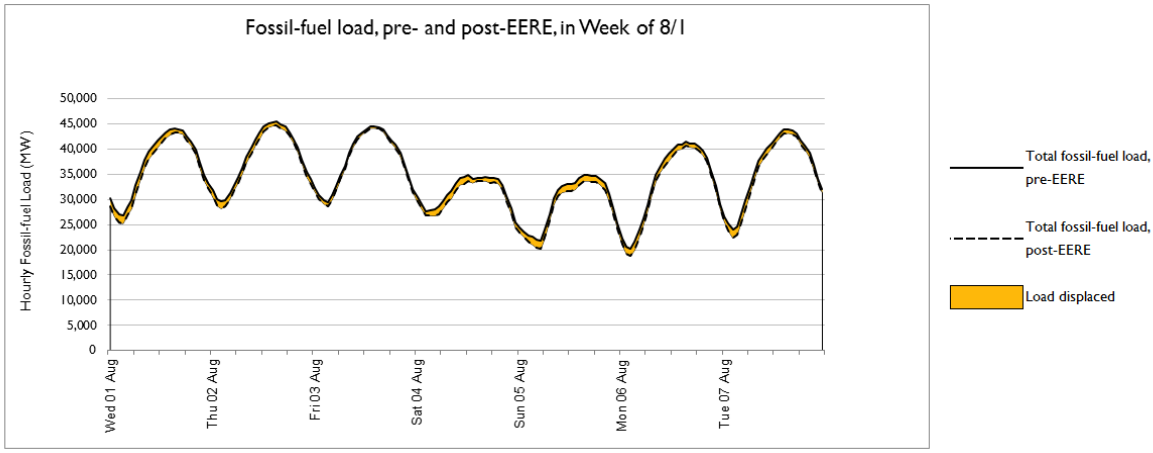


Hourly displacements by week

This option includes two figures. The first displays a dynamic representation of hourly displacement from each EGU in a region. Individual plants are stacked as gradated bar plots.



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.



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. The signal-to-noise diagnostic chart shows where that assumption holds, where it does not hold, and to what extent.