

Introducing AVERT v4.0

New functionality to analyze the energy, emissions, and equity impacts of electric vehicles

January 31, 2023

Speakers



Ale Nunez, Deputy Assistant Administrator for Mobile Sources
US EPA Office of Air and Radiation



Colby Tucker, Senior Policy Analyst
US EPA State and Local Climate and Energy Program



Pat Knight, Senior Principal
Synapse Energy Economics, Inc.

Webinar Goals

- Review how AVERT works
 - Learn what's new
 - Demonstration: See how you can use AVERT v4.0
 - Q&A
-
- Poll question



Our Tools and Resources Support State, Local and Tribal Stakeholders on Climate and Energy



Develop Inventories and Set Goals

GHG INVENTORY TOOLS

State Inventory and Projection Tool

Develop and update inventories for 11 sectors. Forecast emissions through 2050

Local Inventory Tool

Develop community-wide inventories or inventories of local government operations only

Tribal Inventory Tool

Develop community-wide inventories or inventories of tribal government operations only



Design, Compare, or Evaluate Policy



AVoided Emissions and geneRation Tool
Evaluate changes in power plant emissions from energy policy



Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool
Quantify and monetize health impacts of reducing emissions



Health Benefits per kWh
Estimate the health benefits per kWh of clean energy



Energy Savings and Impacts Scenario Tool
Analyze energy savings, costs, and multiple benefits from energy efficiency programs



Communicate and Support Policy Implementation



Greenhouse Gas Equivalencies Calculator
Convert a unit of energy to the equivalent amount of CO₂ emissions from using that amount



Heat Island Reduction Program
Resources to implement heat island mitigation policies and projects



Technical Support
Provide 1-1 technical support for state, local and tribal stakeholders



Convene Stakeholders
Engage state, local and tribal decision-makers



Local Action Framework:
A Guide to Help Communities Achieve Energy and Environmental Goals



Energy and Environment Guide to Action: State Policies and Best Practices for Advancing Energy Efficiency, Renewable Energy, and Combined Heat and Power



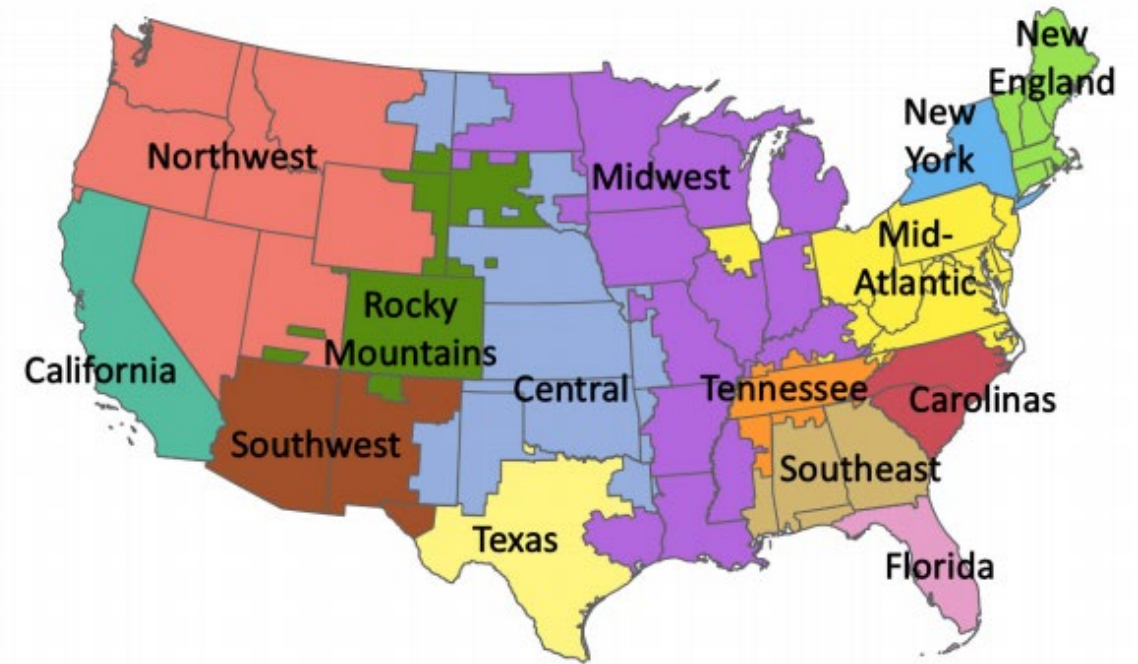
Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy:
A Guide for State and Local Governments



Local Government Climate and Energy Strategy Series:
A Guide to Developing and Implementing Greenhouse Gas Reduction Programs

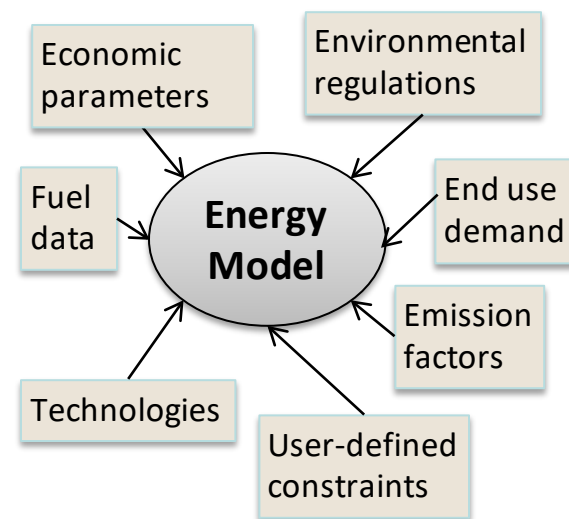
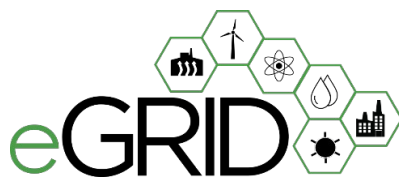
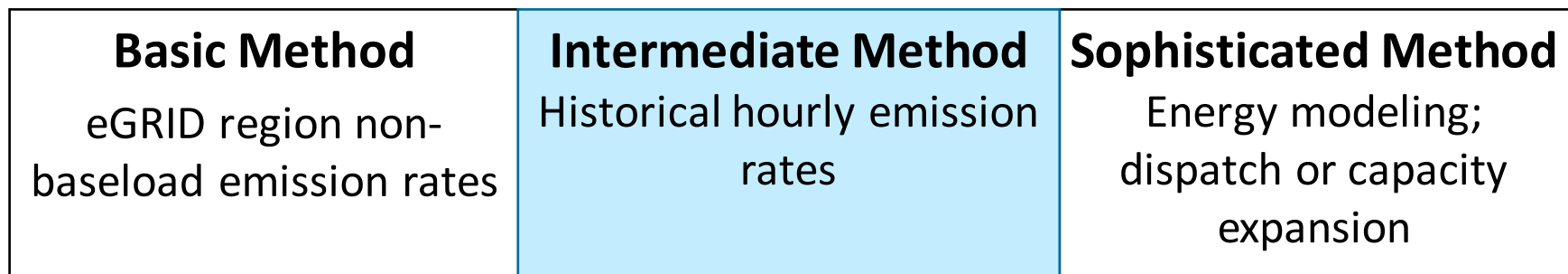
AVERT Review

- Free, easy to use:
 - Policy, program, and project analysis
- Excel & Web Editions
- Default load profiles for EE/RE
- Produces hourly marginal emissions (CO₂, NO_x, SO₂, PM_{2.5}, VOCs, NH₃)
- Data updated annually
- Target audience: State, local, tribal govt.

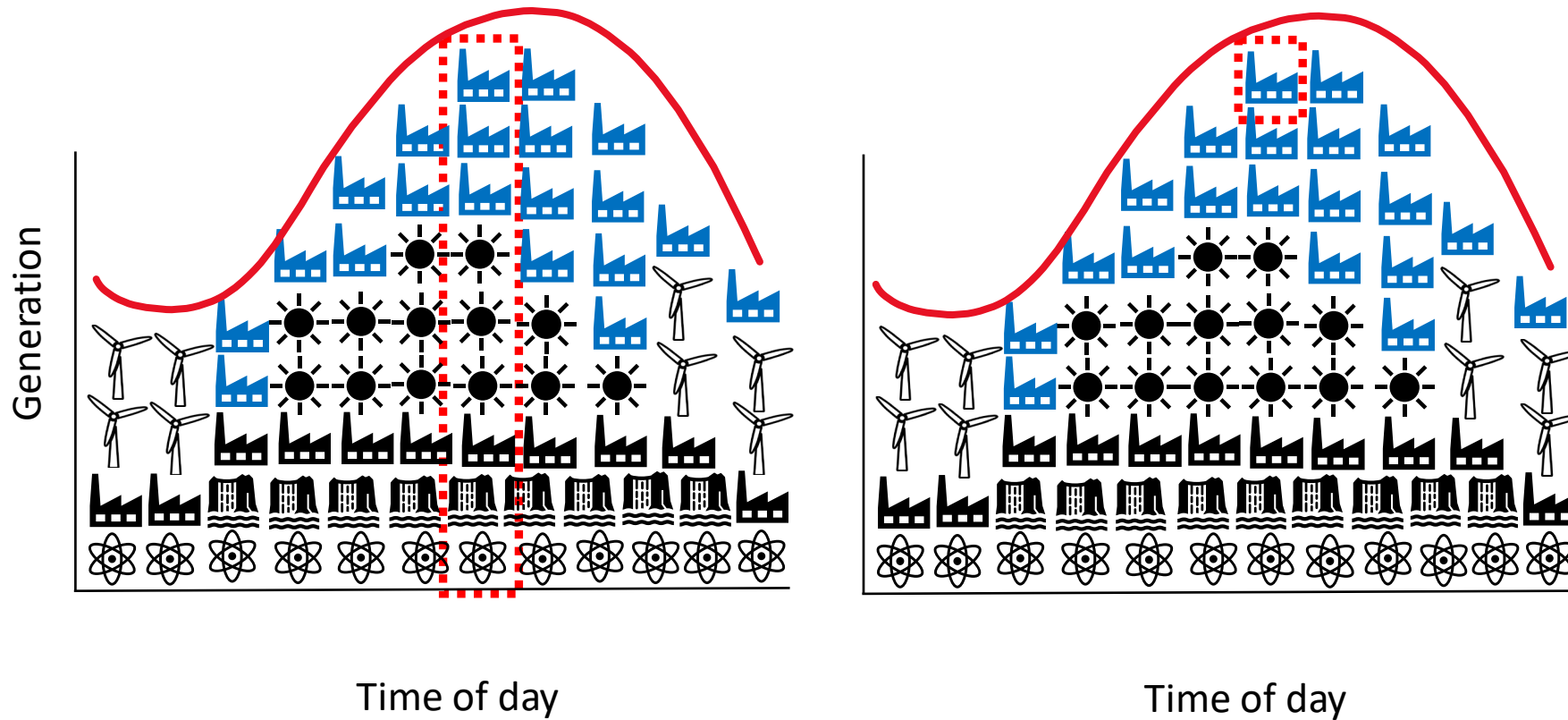


For more info: <https://www.epa.gov/avert>

Power Sector Emission Quantification Methods: Basic to Sophisticated



Average vs. Marginal Emissions



Why add EV functionality to AVERT?

- Demand from our stakeholders
- Supports equity analysis
 - Disproportionate geographic impacts can be identified and estimated
- Supports decarbonization analysis
 - Allows multiple resource deployment (i.e. EE/RE + EV)
- Researchers and analysts are already using AVERT for EV analysis

Why should you use AVERT v4.0?

- Model impacts of EVs deployed in a given, near-term year
 - GHG emissions analysis
 - Criteria pollutant emissions analysis
 - County-level geographic analysis (with lat/long EGU)
 - Temporal (hourly, seasonal) analysis
 - Health impacts and economic valuation with COBRA
 - Policy analysis
 - Supports the importance of EE/RE + EV
 - Charging profiles (time of use rates, related incentives)
- Robust: conducted external peer review
- Easy, fast to use and modify

How does AVERT v4.0 work?

- Power Sector

 - Induced generation*

 - Marginal power generation and emissions
 - 14 grid regions assigned at the county-level
 - County-level VMT is converted into electricity demand
 - EV charging profile (NREL's EVI-Pro Lite)
 - EE/RE Context

- Vehicles

 - Emissions of avoided fossil-burning vehicles*

 - **Emission factors:** State-specific
 - Exhaust, Evaporative, Refueling (MOVES3)
 - **Vehicle types:** Light-duty vehicles, transit bus, school bus
 - **Fuel types:** gasoline, diesel, CNG
 - **Vehicle vintage:** 2020-2025
 - **Vehicle age:** New or fleet average
 - **VMT** monthly, by county, by vehicle type

VMT: Vehicle miles traveled

Old AVERT v3.2

Carolinas, 2021
AVERT

Step 2: Set Energy Scenario

DIRECTIONS: Enter the energy efficiency and/or renewable energy changes for one or more policies, programs, and/or scenarios. To modify each hour manually, click the button on the right. Each entry is additive, creating a single energy change profile. For further instructions consult Section 4 of the AVERT user manual.

Enter EE based on the % reduction of regional fossil generation

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

And/or enter EE distributed evenly throughout the year

Reduce generation by annual GWh:	0	GWh
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OR

Reduce each hour by constant MW:	0.0	MW
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And/or enter annual capacity of RE resources

Onshore wind capacity:	0	MW
Offshore wind capacity:	0	MW
Utility solar PV capacity:	0	MW
Rooftop solar PV capacity:	0	MW

Edit capacity factors

Enter detailed data by hour

Changes in Hourly Energy:

Welcome

1. Regional Data File

2. Set Energy

3. Run Scenario

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EPA_NetGen_PMVOCNH3

New AVERT v4.0

Carolinas, 2021
AVERT

Step 2: Set Energy Scenario

DIRECTIONS: Enter the energy efficiency and/or renewable energy changes for one or more policies, programs, and/or scenarios. To modify each hour manually, click the button on the right. Each entry is additive, creating a single energy change profile. For further instructions consult Section 4 of the AVERT user manual.

Enter EE based on the % reduction of regional fossil generation

Reduce generation by a percent in some or all hours

Apply reduction to top X% of hours: % of top hours

Reduction % in top X% of hours: % reduction

And/or enter EE distributed evenly throughout the year

Reduce generation by annual GWh: GWh

OR

Reduce each hour by constant MW: MW

And/or enter annual capacity of RE resources

Onshore wind capacity: MW

Offshore wind capacity: MW

Utility solar PV capacity: MW

Roof-top solar PV capacity: MW

And/or enter electric vehicle (EV) data

Battery EVs:

Plug-in hybrid EVs:

Electric transit buses:

Electric school buses:

Select charging profiles:

Select location of EV deployment:

Enter detailed load change data by hour

Changes in Hourly Energy:

The currently entered reduction profile equals 0 GWh, or 0.0% of regional fossil generation

Table 1. Sales and stock comparison

	% of annual vehicle sales in entire region	% of registered vehicles in entire region
Light-duty vehicles	0.0%	0.0%
Transit buses	0.0%	0.0%
School buses	0.0%	0.0%

Table 2. EERE EV comparison

	Historical additions (Annual Avg. 2018-2020)		EERE required to offset EV demand		EERE required divided by historical additions	
	MW	GWh	MW	GWh	MW	GWh
EE (retail)	187	1,640	0	0	0%	0%
Onshore Wind	0	0	-	-	-	-
Utility Solar	558	1,084	0	0	0%	0%
Total	760	2,857	0	0	-	-

Edit capacity factors

View detailed EV data

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EPA_NetGen_PMVOCNH3

AVERT v4.0: Entering a scenario

And/or enter electric vehicle (EV) data

Battery EVs:	0
Enter number of vehicles Plug-in hybrid EVs:	0
Electric transit buses:	0
Electric school buses:	0
Select charging profiles	Default
Select location of EV deployment	Entire Region

View detailed EV data

	% of annual vehicle sales in entire region	% of registered vehicles in entire region
Light-duty vehicles	0.0%	0.0%
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And/or enter EE distributed evenly throughout the year

Reduce generation by annual GWh: GWh

OR

Reduce each hour by constant MW: MW

And/or enter annual capacity of RE resources

Onshore wind capacity: MW

Offshore wind capacity: MW

Utility solar PV capacity: MW

Rooftop solar PV capacity: MW

Edit capacity factors

And/or enter electric vehicle (EV) data

Battery EVs:

Enter number of vehicles Plug-in hybrid EVs:

Electric transit buses:

Electric school buses:

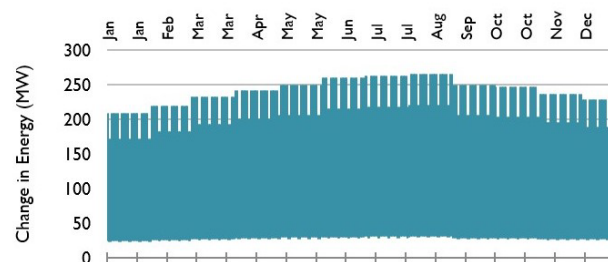
Select charging profiles:

Select location of EV deployment:

View detailed EV data

Enter detailed load change data by hour

Changes in Hourly Energy:



The currently entered profile equals an increase of 963 GWh, or 1.0% of regional fossil generation.

Table 1. Sales and stock comparison	% of annual vehicle sales in entire region	% of registered vehicles in entire region
Light-duty vehicles	33.5%	1.7%
Transit buses	0.0%	0.0%
School buses	0.0%	0.0%

Table 2. EERE EV comparison	Historical additions (Annual Avg. 2018-2020)		EERE required to offset EV demand		EERE required divided by historical additions	
	MW	GWh	MW	GWh	MW	GWh
EE (retail)	187	1,640	68	598	36%	36%
Onshore Wind	0	0	-	-	-	-
Utility Solar	558	1,084	188	365	34%	34%
Total	760	2,857	256	963	-	-

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Step 2: Set Energy Scenario

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Reduction % in top X% of hours: % reduction

And/or enter EE distributed evenly throughout the year

Reduce generation by annual GWh: GWh

OR

Reduce each hour by constant MW: MW

And/or enter annual capacity of RE resources

Onshore wind capacity: MW

Offshore wind capacity: MW

Utility solar PV capacity: MW

Rooftop solar PV capacity: MW

Edit capacity factors

And/or enter electric vehicle (EV) data

Battery EVs:

Enter number of vehicles Plug-in hybrid EVs:

Electric transit buses:

Electric school buses:

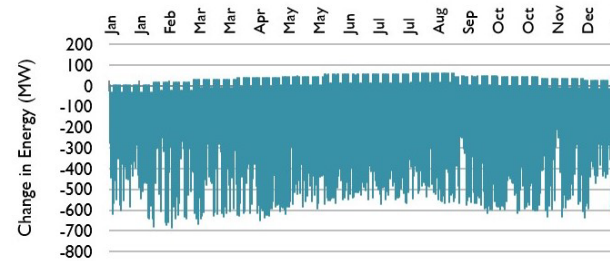
Select charging profiles:

Select location of EV deployment:

View detailed EV data

Enter detailed load change data by hour

Changes in Hourly Energy:



The currently entered reduction profile equals 1,894 GWh, or 2.0% of regional fossil generation.

Table 1. Sales and stock comparison	% of annual vehicle sales in entire region	% of registered vehicles in entire region
Light-duty vehicles	33.5%	1.7%
Transit buses	0.0%	0.0%
School buses	0.0%	0.0%

Table 2. EERE EV comparison	Historical additions (Annual Avg. 2018-2020)		EERE required to offset EV demand		EERE required divided by historical additions	
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Limitations of AVERT v4.0 (not exhaustive)

- Same as previous versions of AVERT:
 - Near-term time horizon
 - Not for analyzing very large load changes
 - Others listed in user manual
- Not suitable for mobile source regulatory analyses, including state implementation plans (SIP) and transportation conformity analyses
- AVERT Web Edition still running AVERT v3.2
- EV research is quickly advancing



Demonstration

In Review

- AVERT v4.0 can help you answer:
 - What is the emissions impact of adding a certain number of EVs in a given year?
 - How much EE/RE do we need to deploy to offset emissions of X number of EVs?
 - What are the ozone season NOx implications of an energy scenario?
 - Where, in which counties and at which fossil fueled EGUs, are pollutants expected to change because of an energy scenario?
 - How do vehicle charging profiles impact emissions?
 - What are the health impacts of an energy scenario? (with COBRA)
 - and more...

Upcoming AVERT Events

- Office Hours (via Zoom, registration required)
 - February 15, 2-3pm ET
 - February 28, 1-2pm ET
- Annual power sector data release (~April 2023)
- Web Edition Update (Spring-Summer 2023)

Q&A

- Learn more about AVERT v4.0 at www.epa.gov/avert
- Email EPA: avert@epa.gov

