

The Avoided Emissions and Generation Tool (AVERT)

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Panelists

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Webinar Logistics

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Who we are

Synapse Energy Economics

- Founded in 1996 by CEO Bruce Biewald
- Research and consulting firm specializing in energy, economic, and environmental topics
- Services include economic and technical analyses, regulatory support, research and report writing, policy analysis and development, representation in stakeholder committees, facilitation, trainings, and expert witness services for public interest and government clients
- All non-confidential publications and open-source tools available for free at www.synapse-energy.com

What's new in AVERT?

Organizations that have used AVERT

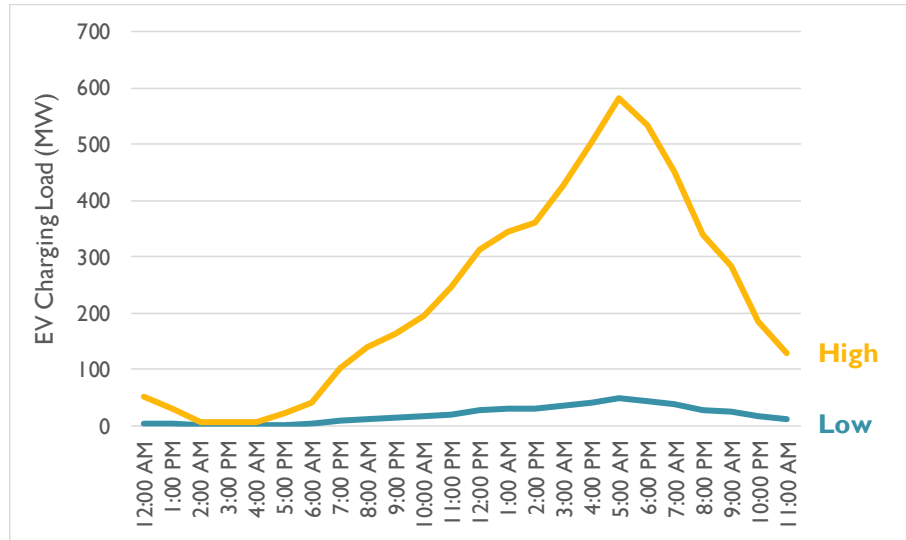
- Solar Energy Industries Association
- Climate and Energy Project
- Pacific Northwest National Laboratory
- Lawrence Berkeley National Laboratory
- Vox
- Maine Public Utilities Commission
- American Wind Energy Association
- Northeast Texas Air Care
- American Council for an Energy-Efficient Economy
- Connecticut Green Bank
- Chesapeake Climate Action Network
- Public Service Commission of Wisconsin
- Sierra Club

Modeling incremental generation costs from electric vehicles

Synapse Energy Economics (2018):

- Synapse used AVERT to get a screening-level estimate of incremental generation from electric vehicle (EV) loads
- We used the manual input feature in AVERT to model two EV charging profiles in Colorado: one representing a low EV scenario and the other representing a high EV scenario
- The percentage of each resource type's level of incremental generation was multiplied by a per-MWh generation cost to arrive at resource-specific incremental generation costs

Electric Vehicle Charging Profiles



Incremental Generation by Fuel/Unit Type

Scenario	Units	Fuel and Unit Type			
		Coal ST	Gas CC	Gas CT	Total
Low	MWh	102,194	51,223	18,137	171,554
Low	%	60%	30%	11%	100%
High	MWh	1,208,388	620,292	247,788	2,076,468
High	%	58%	30%	12%	100%

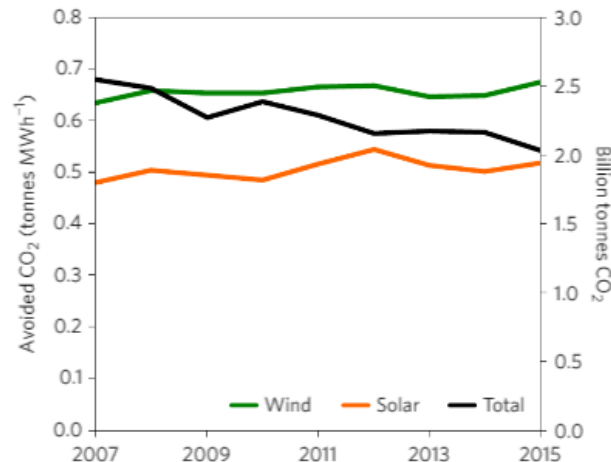
Estimating climate and air-quality benefits of wind and solar power

Study by Lawrence Berkeley National Laboratory (2017)

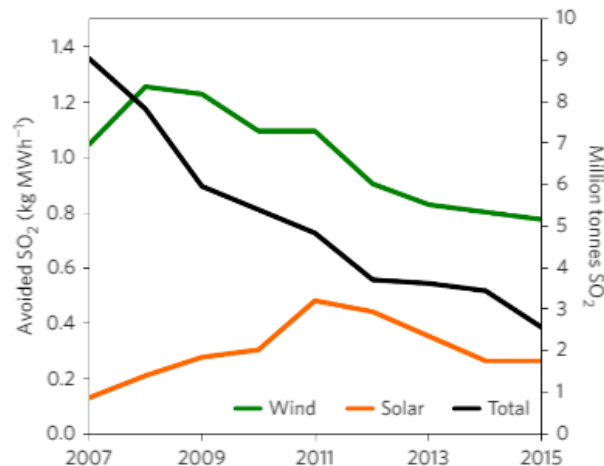
- The team used AVERT to examine the climate and air-quality benefits of continental U.S. wind and solar generation from 2007 to 2015
- They used AVERT to find the SO_2 , NO_x , $\text{PM}_{2.5}$, and CO_2 emissions that were avoided from this generation
- The output was used to generate economic and health benefits:
 - *Cumulative air-quality benefits of 2015:*
US\$ 29.7 – 112.8 billion
 - 3,000 to 12,700 avoided premature mortalities
 - *Cumulative climate benefits of 2015:*
US\$ 5.3 – 106.8 billion

Source: <https://goo.gl/NADhiU>

Marginal CO_2 Emissions Benefits



Marginal SO_2 Emissions Benefits



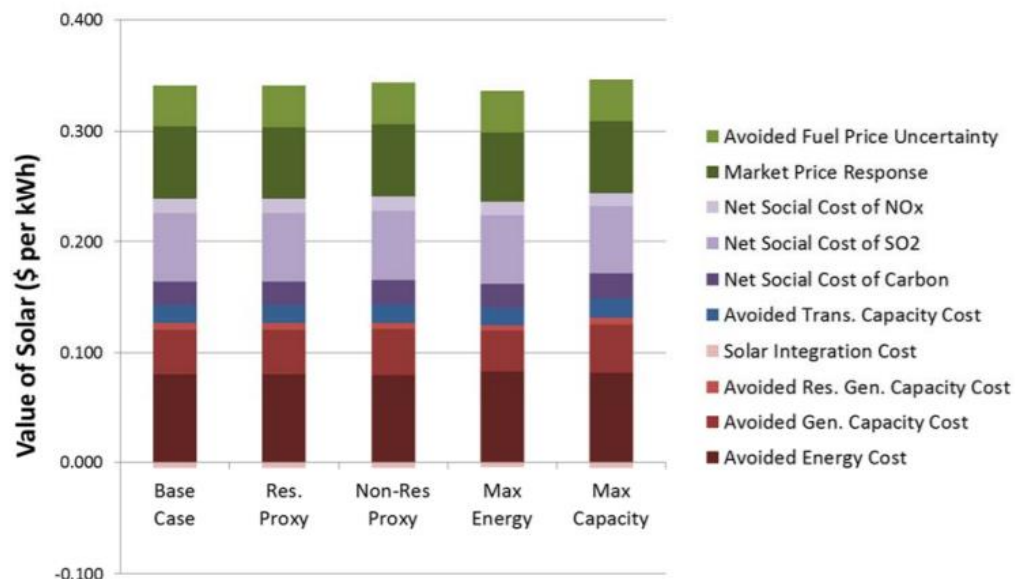
Valuating distributed solar in Maine

Maine Public Utilities Commission (2015):

- The Commission used AVERT to generate avoided environmental costs as a part of its distributed solar valuation
- Hourly avoided emissions from distributed solar were calculated using PV fleet production profiles. They were used to calculate the annual avoided emissions per kWh.
- Displaced emissions were then multiplied by social costs of CO₂, SO₂, and NO_x to arrive at benefits (\$ per kWh)

Source: <https://goo.gl/GVyhyD>

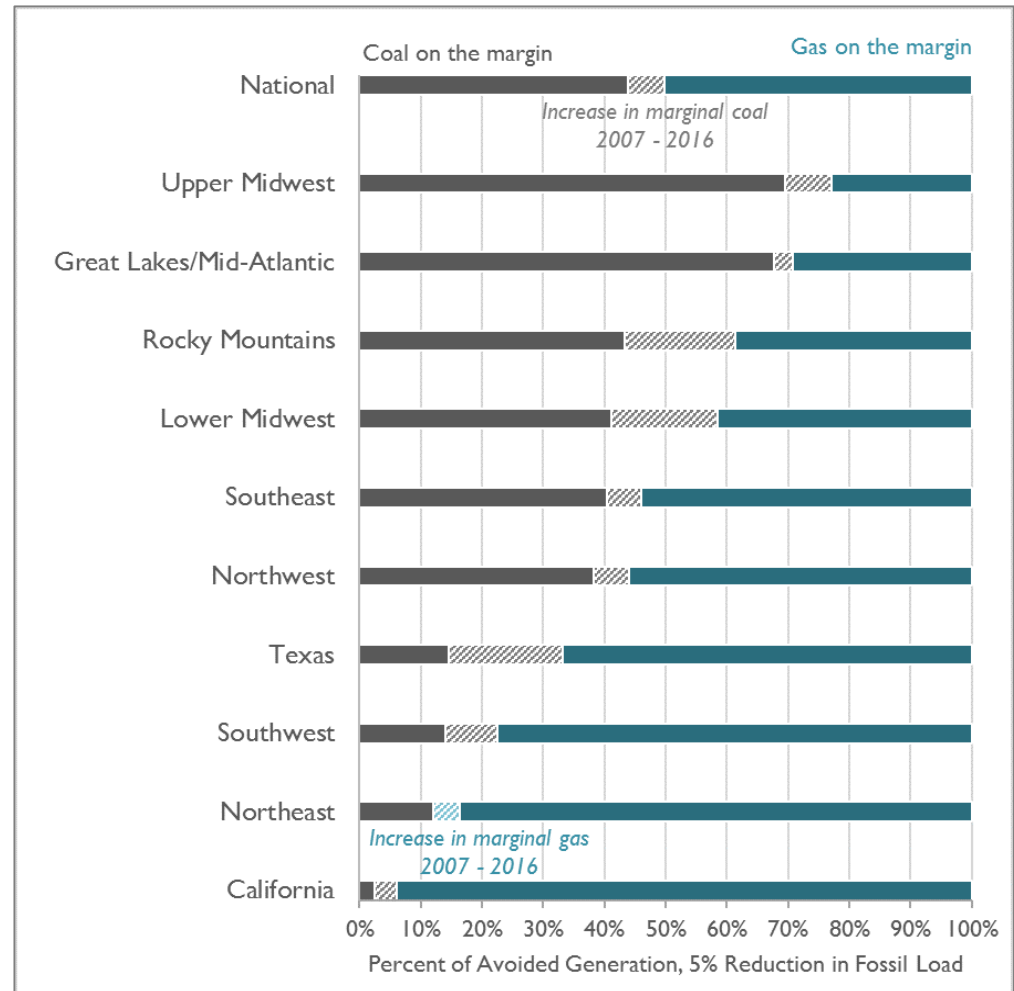
Value of Solar by Profile Sensitivity



Marginal Fuel-Type Analysis

- Marginal units are the most expensive generators online in any hour. They are chosen last to meet peak demand and are the first generators impacted by energy efficiency programs.
- From 2007 to 2016, the proportion of avoided marginal coal shifted substantially, from 44% to 50%.
 - Avoided coal generation increased in all regions except New England, where few coal plants remain.
 - In each region, total coal generation remained stable or decreased
- This indicates that coal is shifting from “baseload” to “peaking” behavior, increasingly operating only during the hours with highest load.

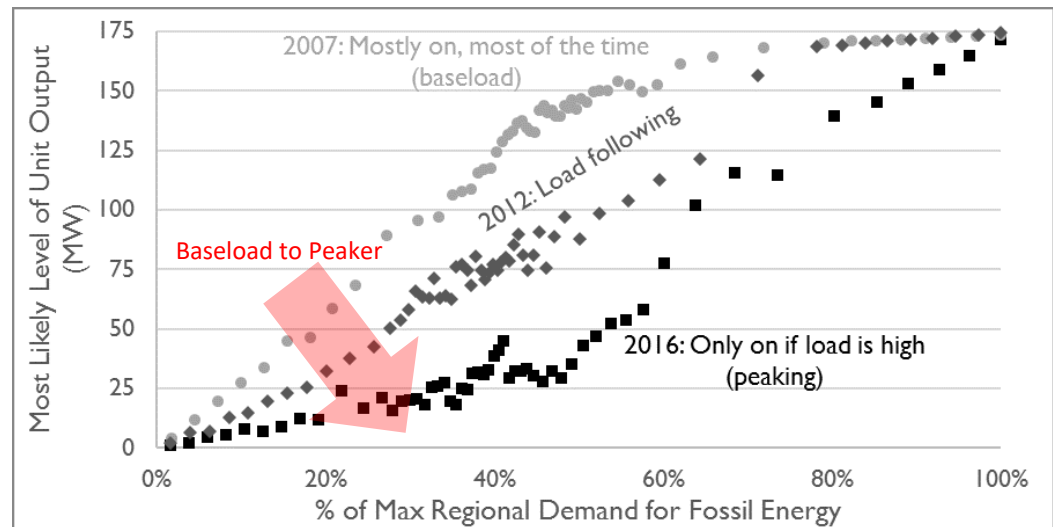
% of Avoided Generation, Gas & Coal – 5% Reduction, National, 2007 – 2016



Marginal Fuel-Type Analysis: Case Study

- In 2007, AVERT data shows that W.H. Sammis Unit 4 ran most of the time. In 2016, AVERT shows a far lower level of generation.
- W.H. Sammis 4 effectively transitioned from “baseload” to “peaker” status. It is slated to retire in 2020.

W.H. Sammis 4 Predicted Generation vs % of Regional Fossil Load, 2007 - 2016



COBRA: Health Benefits

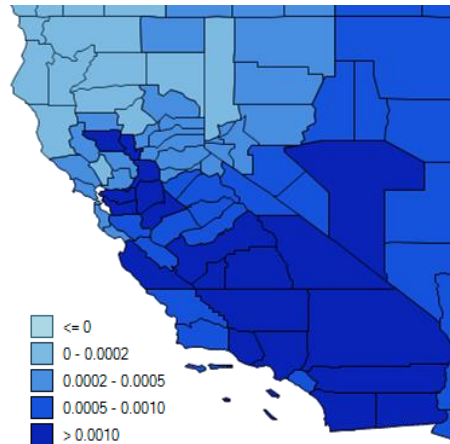
COBRA:

- Converts emissions reductions into changes in air quality
- Estimates the number of cases of illness and death avoided
- Estimates the economic value of those benefits

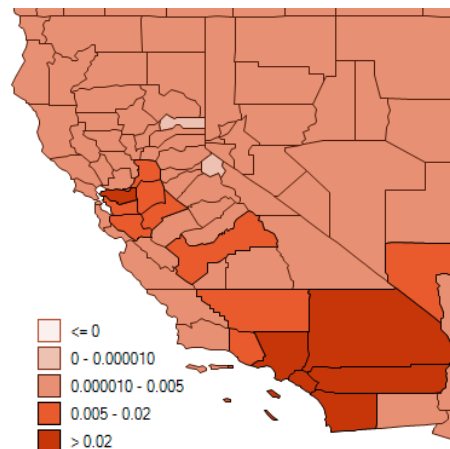
Example: A 10% generation reduction in all hours in California

- Emissions reduction modeled using AVERT Web Edition and passed into COBRA
- A 10% generation reduction leads to broad PM 2.5 reductions, particularly concentrated in the southern half of the state
- Most health benefits are realized in Los Angeles, its surrounding areas, and the counties outside of San Francisco

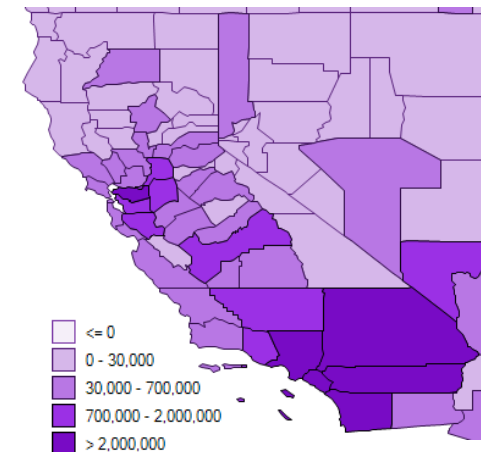
PM 2.5 ($\mu\text{g}/\text{m}^3$) Delta – 10% reduction in CA, 2017



Avoided Hospital Admissions, 2017



\$ Total Health Benefits (high estimate), 2017



Questions?
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