

New tool calculates emissions impacts, energy benefits from smart grid investments

July 15 2016



Use of "Smart Grid" technologies can impact carbon emissions -- but by how much? A new Emissions Quantification Tool can estimate the answer to that question. Credit: PNNL

"Smart grid" technologies significantly reduce greenhouse gases and other emissions resulting from power production and usage. Taken together, smart grid and intelligent buildings mechanisms could reduce national carbon emissions by 12 percent by 2030, according to one estimate. But, surprisingly, sometimes the opposite is true for an individual project. It all depends on a dizzying variety of factors, but a new tool developed at the U.S. Department of Energy's Pacific Northwest National Laboratory makes estimating those emissions impacts easy.

The free, web-based tool enables utilities and industry to evaluate not only the environmental impacts of adopting smart grid technologies, but can give organizations the operational data to sift through factors to justify the investment.

A paper outlining the science behind the tool is featured as a best conference paper at the IEEE Power & Engineering Society meeting in Boston on July 18.

The Emissions Quantification Tool calculates the resulting changes to carbon dioxide, sulfur dioxide and nitrogen oxides, and the energy and financial savings that may be achieved by integrating smart grid technologies. The evaluated technologies include coordinated electric vehicle charging schedules, battery-stored energy, and devices that enable integration of solar generation into the power grid.

"Users can quickly and easily screen different scenarios by varying the type of smart grid technology and other variables to best characterize their specific set of circumstances and location," said Karen Studarus, a power systems engineer at PNNL and project lead. "The modules we've assembled are being used right now to explore the impacts of proposed

projects and understand the sometimes counterintuitive tradeoffs."

A business case for a smart grid

PNNL developed the tool with the guidance of a dozen utility and energy industry representatives who helped ensure the tool would deliver the high-level insights needed for a smart grid business case.

"As someone who's always trying to articulate the value of investments in smart grid, it's so useful to have a tool to illuminate the specifics driving that value," says Laney Brown of Modern Grid Partners, a utility consulting firm. Brown serves on the steering committee guiding the development of the emissions quantification tool.

Once a calculation is complete, the tool produces a detailed report with pre- and post-technology adoption comparisons. The report also informs the user on a number of variables. For example, how much energy storage would be needed to provide a certain operational benefit and what the resulting increase or decrease in emissions would be.

"With insights from the tool, utilities, policy makers, and companies can see the impacts, for example, of shifting energy use to a different time of day or of adopting additional renewable energy resources," said Studarus.

Emissions impacts can vary

Sometimes the results are counterintuitive. The tool can also uncover unintended or unanticipated results. For example, incorporation of coordinated electric vehicle charging in the Northeast would reduce sulfur dioxide—an indirect greenhouse gas—emissions by about 2.5 percent. But in California, the exact same level of coordinated charging

actually found an estimated increase of 1.5 percent due to differences between the two regions.

Calculations are based on well-established data sources, including EPA's AVERT, or Avoided Emissions and Generation Tool, which maps hourly emissions benefits of energy efficiency and renewable energy policies and programs; solar [energy](#) data from the National Renewable Energy Laboratory; and demand response models from the Brattle Group.

The tool is designed to be as transparent as possible in terms of the underlying data and algorithms so users can clearly understand how outcomes from scenarios were calculated.

"This is really uncharted territory," added Studarus. "Nobody's done this before, and the diverse utility community needs detailed information when it comes to understanding the impacts of [smart grid](#) technologies on the environment and the bottom line. A transparent and broadly applicable methodology not only estimates the benefit, it lets folks see more clearly how much faith they should be putting into the numbers."

Get the tool

A prototype of the [tool](#) was demonstrated at the National Summit on Smart Grid and Climate Change in October. Users can try the Emissions Quantification Tool free of charge at SmartGrid.gov.

Provided by Pacific Northwest National Laboratory

Citation: New tool calculates emissions impacts, energy benefits from smart grid investments (2016, July 15) retrieved 23 April 2024 from <https://phys.org/news/2016-07-tool-emissions-impacts-energy-benefits.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.