Seminario del Centro ITAM de Energía y Recursos Naturales

Martes 20 de marzo, 12:01 pm, salón 112

"An Engineering, Economic, and Environmental Electricity Simulation Tool for Mexico"

Daniel Shawhan

We have developed new power system simulation software known as the Engineering, Economic, and Environmental Electricity Simulation Tool (the "E4 Simulation Tool" or "E4ST"—pronounced "east"—for short). It is designed to do unusually realistic, detailed simulations of how power systems operate and evolve, and how their operation and costs would respond to different transmission investments, generation investments, natural gas supply investments, policies, input prices, demand patterns, and so on.

The Mexico E4ST model will be usable on a standalone basis. It will also be usable in combination with the Texas and WECC models, so that cross-border power and natural gas flows can be endogenously determined. We will seek guidance from Mexican government officials about how to usefully employ the model. Here are ideas that we have in mind so far:

- Estimate the consumer, health, and producer benefits of switching generation from oil-fueled to natural gas-fueled.
- Estimate the benefits of new transmission lines that are under consideration.
- Estimate the benefits of new gas-fueled power plants enabled by potential new natural gas pipelines that are under consideration.
- Estimate the benefits of the US allowing energy from Mexico, e.g. power generally through tighter integration of the electricity markets and renewables-based power specifically by allowing it to qualify fully for US clean energy policies.
- Help decide about optimal transmission system expansion, natural gas pipeline network expansion, and generator investments.

To predict the effects of a change, such as a policy change or investment, we simulate the operation and evolution of the system both with and without that change. The predicted costs and emissions that we can calculate include fuel costs, annual fixed costs, construction costs, carbon dioxide emissions, premature deaths from generator sulfur dioxide and nitrogen oxide emissions, and estimated dollar value of those premature deaths. Some other effects that we can calculate include electricity prices, consumer surplus, producer profits, and government revenues. We can disaggregate any of the effects, for example geographically or by generator type. We calculated the estimated mortality impact of each generator, per GWh, by using a detailed air pollution fate and transport model, taking into account each generator's location, effective smokestack height, and emission rates.

Daniel Shawhan; Resources for the Future

Education:

PhD in applied economics and management, Cornell University, 2008
BA in economics, with honors, Grinnell College, 1995

Much of Daniel Shawhan's research focuses on predicting and estimating the effects of electricity policies, including environmental ones. He has played a leading role in developing a new set of capabilities for simulating how power grids, power plants, and pollution levels will respond to potential changes in policy. The same simulation capabilities can be used to evaluate the effects of potential new power plants and transmission lines. In related statistical work, Shawhan has examined whether power plant startups and ramping greatly increase emissions, whether windfarms really reduce emissions from fuel-burning power plants, and whether the Regional Greenhouse Gas Initiative cap-and-trade program has increased emissions in the neighboring coal-rich state of Pennsylvania. He also works on electricity market design and environmental policy design. Shawhan has helped state governments craft electricity market reforms and first-in-the-nation policies for hybrid vehicles, energy efficiency, green buildings, and renewable energy.