

In the Field

Integrating Megawatt-Scale Solar in Indiana and Michigan

EPRI, Indiana Michigan Power Company Examine Generation, Variability, Costs, Benefits, and More

By Chris Warren

It was an historic moment for the Indiana Michigan Power company (I&M) and its parent company American Electric Power (AEP). In December 2015, their first company owned-and-operated solar plant—a 2.5-megawatt facility near Marion, Indiana—began generating electricity. The milestone reflects the companies' recognition that solar power is becoming affordable and practical.

I&M is building three more solar plants, and its most recent integrated resource plan (while subject to change) proposes to increase solar generation by 4,000% over the next 20 years.

"We recently retired a large coal unit and the cost of solar has dropped, so our integrated resource plan indicated a solar power plant was becoming a more reasonable option," said Marc Lewis, I&M's vice president of regulatory and external affairs.

Given I&M's limited experience with solar—there are only about 100 net-metered residential installations connected to its distribution grid—the utility has many questions about the impacts and benefits of owning and operating megawatt-scale solar power plants. For instance, I&M wants to understand more clearly the performance of different panel technologies in Midwestern weather, best maintenance practices, and distribution grid impacts.

Gathering Data at Four New Plants

In 2015, EPRI and I&M launched an [Integrated Grid pilot](#) project to evaluate the performance and grid impacts of the Marion plant, along with three other utility-scale solar plants that will be connected to I&M's distribution grid by the end of 2016: a 4.6-megawatt facility in Michigan and 2.6-megawatt and 5-megawatt plants in Indiana. I&M will collect performance data for a year, and EPRI will analyze it.

"Solar output varies with temperature and irradiance," said EPRI Senior Project Engineer Steven Coley. "Based on each plant's particular location, design, and panel technology, we are modeling its expected generation and comparing that to actual generation." EPRI also will assess generation variability throughout the day and in different seasons and compare actual and predicted returns.

Distribution Grid Impacts

EPRI will examine the costs and benefits of connecting the plants to different parts of the distribution grid, including whether voltage regulation devices, capacitor banks, adjustments to protection equipment, and other upgrades are needed to maintain grid reliability and power quality at acceptable standards.

With respect to benefits, siting solar near large loads can reduce power line losses and avoid the need for expensive new equipment. "In some areas, you might not need to upgrade transformers if the solar output aligns with peak load and can be relied upon to reduce peak demand," said Coley.

The pilot project will help I&M build its solar expertise in several areas, such as:

- Impacts of weather conditions on solar generation in different parts of its service territory
- Generation from different solar panel technologies
- Solar energy delivery and its impact to the distribution grid

I&M can use this knowledge to reach the solar generation target in its integrated resource plan and assist large commercial and industrial customers that want to purchase solar electricity. “If there was a customer interested in having us build and operate solar to serve their needs, the lessons learned with this pilot will help us do that,” said Lewis.

Based on this benefit-cost analysis, along with the results of other Integrated Grid pilot projects, EPRI plans to publish findings and lessons to help utilities optimally integrate solar into power systems. These may include factors that utilities can consider in siting solar plants.

Key EPRI Technical Experts

Steven Coley