Illinois campus switches to microgrid

Sep 23 2011 Brian Bienkowski One Comment

As technology rapidly evolves, and old power systems remain, an Illinois campus is confronting modern electricity needs by getting on their own grid and offering an innovative solution to the nation's emerging energy problems.

The Illinois Institute of Technology's (IIT) project, dubbed Perfect Power at IIT, is a five-year plan to completely overhaul the institute's electricity use, flow and distribution by partnering with the U.S. Department of Energy (DOE), Galvin Electricity Initiative and local utility companies. Th e centerpiece of the project is a "smart microgrid"—a miniature version of bulk electric grids. Grids refer to the way electricity gets from supplier to consumers, including everything from power generation to the lines that carry it places.

IIT's South Side campus will get its energy from an institution-wide microgrid. Photo: Joe Ravi, license (CC-BY-SA 3.0)

Like large power grids, microgrids generate, distribute and regulate electricity, but on a local level—in this case the institute's campus on Chicago's South Side.

"The three main goals are to promote reliability, efficiency and sustainability," said Andrew Barbeau, director of the IIT Galvin Center for Electricity Innovation.

The Perfect Power System, developed by Galvin Electricity Initiative, consists of two substations, which transform voltage for use, and seven electrical loops that bring the electricity to buildings. Power will come from a mix of on-site sources and Large distributors.

Loops prevent outages

"Instead of a line, we have a circle," Barbeau said. "If there's a problem in the loop, buildings receive power from the other direction."

Electrical loops will prevent outages at campus buildings. Photo: IIT

Governing the system will be a master controller—a computer—that will analyze real time information and send electricity out as demanded. To cut waste, it's programmed to send more power to high priority areas, less to low demand areas and check prices from utility companies. It will also identify any problems in the electrical loops and report them instantly.

"The master controller is the brains of the microgrid," Barbeau said. "It will tell us what happened, why it happened and what we need to do."

Electrical loops and building meters are in place, but work remains on the master controller and one of the two substations. The project is expected to be completed ahead of the 2013 estimate.

While the microgrid system will allow IIT to rely less on large power suppliers, they can still use them when necessary. Renewables can play a larger role because onsite storage removes the problem of wind and solar variability. Having local control over local power needs saves energy and money.

Working with feds, utilities

IIT's project began in 2008 when the DOE gave them $7 million as one of eight projects aimed to reduce the nation's electricity demands by 15 percent. Private and university funds were added to that, making it an $18.5 million investment.

However, IIT will have its investment returned in five years, according to Barbeau. Planners estimate an annual savings of $1.3 million by reducing demand and usage.

The DOE has been a strong supporter of microgrid projects in recent years—both as a path to cleaner energy and as economic engines.

"Modernizing our electrical grid to make it stronger, smarter, more efficient and more secure is a crucial step in expanding renewable energy and creating jobs," said Steven Chu, U. S. energy secretary, in a statement on energy project funding. "These investments will help lay the foundation for American leadership in the clean energy economy."

And campuses seem to be ideal for microgrids. A report by Pike Research predicts that campuses will lead the way in microgrid technology. The report predicts an increase of 164 percent for total installed generation capacity for campus microgrids between now and 2017.

The idea of electrical self-sufficiency isn't new. Hospitals, refineries and other places that cannot ever be without power have generators that support multiple buildings—a very crude example of microgrids. But projects like IIT's bring "together industry and public sector stakeholders," according to Tom Welch, spokesman for the DOE. Utilities, while ostensibly standing to lose business, have something to gain as well. Microgrids could bolster the stability of large power providers by stepping in when their power goes down. This symbiotic relationship also gives microgrids the ability to sell excess power back to providers.

Utilities, like ComEd (who serves Chicago and Northern Illinois), who no longer own power plants are much more receptive to microgrids than before, according to John Kelly, deputy director with the Galvin Electricity Initiative.

"Once you shed the power generation from the utility company, they behave better," Kelly said. "ComEd collects money from people and chooses a supplier now, they no longer fear that they'll be competing against microgrids."

Getting buy-in from power providers was a potential hurdle. Without support from ComEd, the project may have stalled, according to Barbeau.

"We're lucky to have a relationship with them," Barbeau said. "They're looking at us as a model for them to use some of these new technologies."

Getting off coal

As a technological institute, IIT's electricity use keeps going up while power outages cost the school approximately $500,000 annually.

Photo: IIT

“On top of money, we’ve lost (university) experiments,” Barbeau said. “We’ve also had a lot of on-going maintenance.” The current energy system is old and in need of repairs. Necessary improvements, which will now be avoided, were estimated to cost $7 million.

Illinois allows consumers to choose where they get their energy. IIT currently gets approximately 65 percent of its energy from nuclear, 35 percent from hydroelectric and 5 percent from wind, according to Kelly. The Perfect Power System is complementary to other energy projects at the institute, and renewables are expected to account for even more power as the project progresses. Self-contained energy systems lend well to renewables.

In microgrid research, the Environmental Law and Policy Center, an environmental advocacy organization, has found that most microgrid projects propose energy efficiency increases through local, cleaner energy, according to Barry Matchett, legislative director.

“If you were going to have microgrids set up in a campus or neighborhood and it introduced a new source of pollution, it would raise flags for us,” Matchett said. “But we just haven’t seen that.”

IIT unveiled two wind turbines in July, one on the main campus and one southwest of the city for research. The institute is also working on solar panels for campus roofs, and researching geothermal power, which is electricity generated from heat within the earth. Renewables are more cost effective in a microgrid setting since energy is stored or used right away, which removes transmission costs.

Kelly believes an open market is key in getting places off “dirty” energy.

While the renewables versus traditional energy argument often gets muddied with ideology and politics, the Perfect Power System may offer a way out of that impasse. Even if the cleaner power and efficiency of the system fail to excite, the ability to save money has piqued the interest of people, according to Barbeau.

“It’s (Perfect Power System) attracting attention around the world,” Barbeau said. “Our energy is cleaner, but this is really an economic success story.”

Editors note: This story first appeared in Mindful Metropolis and is reprinted with permission.

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