OVERVIEW OF PERFECT POWER MICROGRID

Illinois Institute of Technology (IIT) in collaboration with Exelon, the Galvin Electricity Initiative (GEI), and other key partners launched a U.S. Department of Energy-funded project in 2008 to develop, demonstrate, promote, and commercialize a system and supporting technologies that will achieve "Perfect Power" at the main campus of IIT. A "Perfect Power" system, as defined by GEI, is a system that will not fail to meet the electric needs of the individual end-user. IIT's Perfect Power system is an implementation of a smart microgrid that is scalable and replicable for a range of implementations.

The overall objectives of the microgrid project include: (1) the achievement of system-wide Perfect Power for IIT's electric power conditions and demonstration of its technological viability through the implementation of distributed energy and advanced sensing, switching, feeder configuration, and controls; (2) 50% peak demand reduction capability when called upon by Exelon/PJM Interconnection; (3) 20% permanent peak demand reduction from the 2007 annual peak demand ; (4) deferral of Commonwealth Edison (ComEd) planned substation upgrades due to the demand reduction achieved; (5) demonstration of the economic value of Perfect Power, specifically the avoidance of outage costs, investment avoidance, and the introduction of significant savings and revenue from providing ancillary services; (6) a design that can be replicated to any microgrid; and (7) promote the Perfect Power prototype.

Key elements of the Perfect Power smart microgrid installed at IIT include:

- A High-Reliability Distribution System design and installed on IIT's campus that replaces the old radial distribution system with a new redundant looped system, with automated distribution system breakers and switches, to ensure power to all buildings included in the Perfect Power loops in the event of a failure to a cable, switch, or substation feeder breaker. This allows for intelligent rapid reconfiguration of distribution and demand response.
- A retrofit to the campus' 2 existing 4MW-Allison-Turbine cogeneration packages to achieve fast-start capability in order to provide standby peaking service and islanding.
- The Intelligent Perfect Power System Controller (IPPSC), a master controller designed to interface, coordinate, and control the actions of building controllers, controllers for the High Reliability Distribution System (HRDS), and distributed generation controllers.
- Substation automation at IIT's North and South Substations to make the substations compatible with the HRDS and the IPPSC.
- An advanced system for sensing distribution system conditions and automatically reconfiguring the system to respond to disturbances. The architecture will provide transaction capabilities that control transport, including fault detection, location and isolation; feeder reconfiguration; volt/VAR management; service restoration; emergency response; and integration of distributed resources.
- Advanced Metering Infrastructure, with smart meters installed in every campus building, to provide system information to the master controller for demand response and system optimization.
- Advanced ZigBee wireless technology for implementing energy efficiency programs validated through testing and demonstration.
- Large-scale battery storage systems for the demonstration of the Perfect Power System's capability to conduct daily peak load shaving and load-shifting. The energy storage also will be used to integrate the intermittent wind and solar energy resources on campus, and allow for peak-time EV charging using off-peak electricity or renewable energy sources.
- Electric vehicle charging stations that will be integrated with the battery systems to use off-peak stored electricity or renewable energy sources to charge vehicles during peak work hours. The electric vehicle charging stations will be connected to the IPPSC for load management and demand-response.
- A wind turbine unit that demonstrates the integration of distributed small wind generation into a microgrid.