



Perfect Power Prototype at Illinois Institute of Technology

Recipient: Illinois Institute of Technology

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Progress Report

November 2, 2010



Project Overview

- Funded by the U.S. Department of Energy
- \$12M (\$7M from DOE, \$5M Cost Share)
- 5 year project
- Located at Illinois Institute of Technology (IIT)
- Involves the entire campus
- Partners: IIT, Exelon, S&C, Schweitzer, IPS



Project Objectives

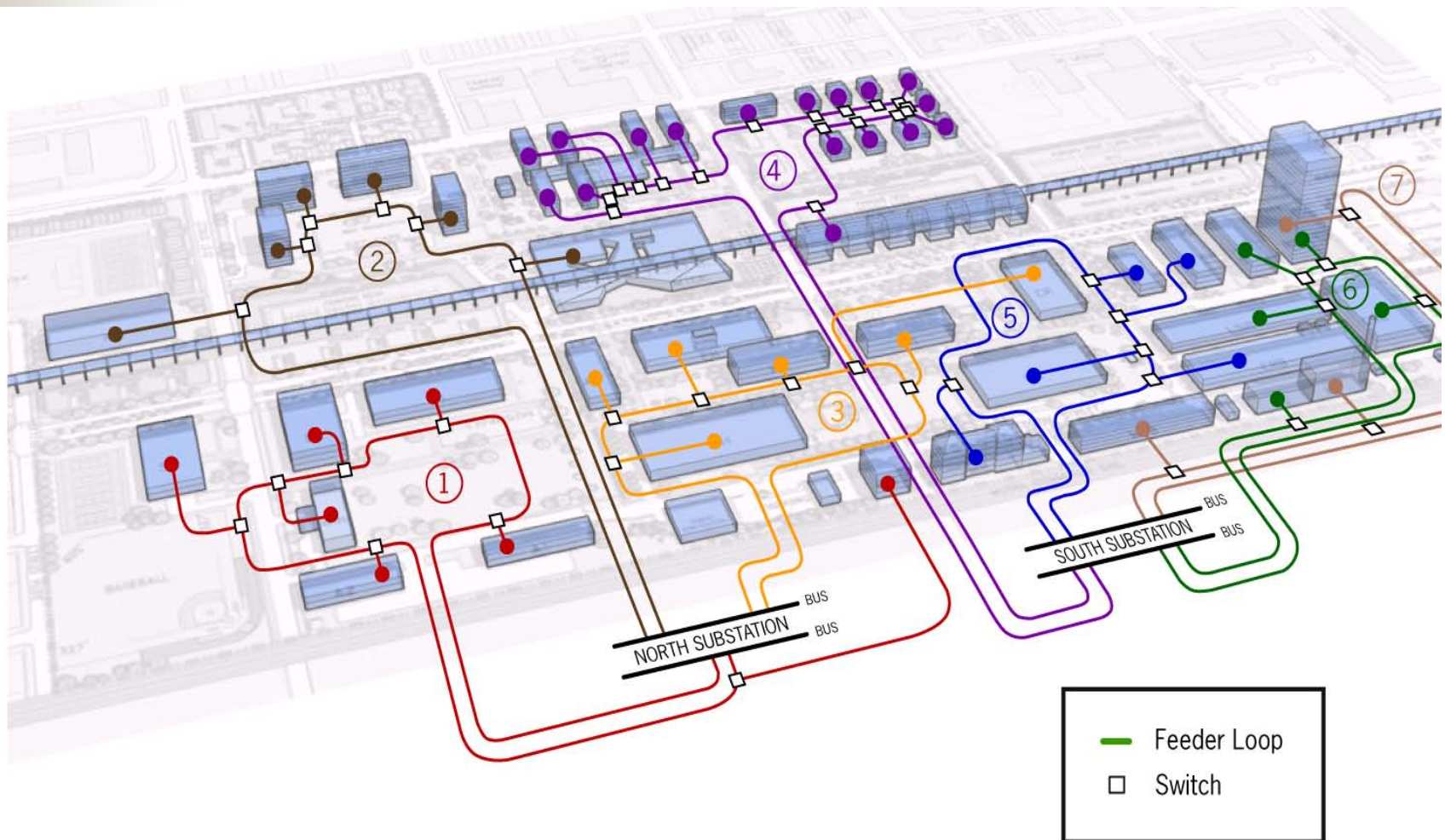
- 50% peak demand reduction
- 20% permanent demand reduction
- Demonstrate the value of Perfect Power
 - Cost avoidance and savings in outage costs
 - Deferral of planned substations
- New products and commercialization
- Replicable to larger cities
- Promotion of energy efficiency and cleaner cities



Project Tasks

- Phase I: establish the basis for Perfect Power
- Phase II: address key technology gaps
- Phase III: prepare IIT for real time pricing and ancillary markets
- Phase IV: deploy the advanced campus distribution system
- Phase V: deploy campus distribution level peak load reduction

Phase I – Perfect Power Foundation





Phase II: Task 1.0 – Advanced Distribution Automation and Recovery System

- Accomplishments
 - Year 1: Creation of a Communication Model
 - Year 2: Development of a Visualization Platform

- Future Work
 - Year 3: Real-Time Control of Distribution Systems
 - Year 4: Centralized vs. Distributed Control Modes
 - Year 5: Pilot Demonstration



Phase II: Task 2.0 – Buried Cable Fault Detection and Mitigation

- Accomplishments
 - Simulation of the IIT's Distribution Network

- Future Work
 - Identification of the Best Fault Detection and Mitigation for IIT's Distribution Network
 - Pilot Demonstration of the Identified Fault Detection and Mitigation in IIT's Distribution Network



Phase II: Task 3.0 – Intelligent Perfect Power System Controller (IPPSC)

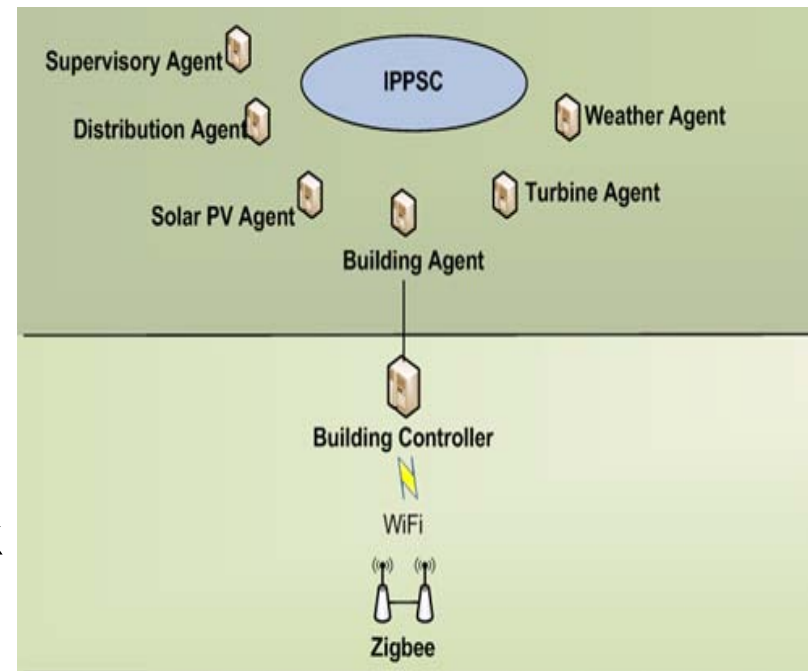
- Provide for Island Mode Capability, Manage System Demand, Minimize Costs, Automate and Optimize Ancillary Services, Minimize Carbon
- Accomplishments
 - Built interfaces for electric pricing and weather data
 - Finished database retrieval and storage code
 - Finished software utilities required for running the program
 - Finished remote control of substation breakers on the loops
- Future Work
 - Agent to agent communications
 - Communications with turbine controllers and distributed generation
 - Optimization and analytics
 - User Interface



Phase II: Task 4.0 – Advanced ZigBee Wireless

- Accomplishments
 - Frequency-agility based Interference Avoidance Technique
 - Demonstration prototype

- Future Work
 - Installation of ZigBee devices in Siegel Hall
 - Energy-efficient routing protocol
 - Cyber security & self-healing algorithm for the Campus Network





Phase III – Ancillary Services Demonstration

- Task 1.0 – IPPSC, Version 1 Demonstration
 - To be completed by February 2011.
- Task 2.0 – Turbine Fast Start and ComEd/PJM Portal
 - Enable the two existing 4MW-Allison-Turbines to participate in the Perfect Power System: completed in August 2009.

Phase IV – Distribution System Automation Demonstration

- Task 1.0 – High Reliability Distribution System Installation
 - Loops 1, 2, 3
- Task 2.0 – Substation Automation
 - North substation automation completed
 - South substation automation being planned
- Task 3.0 – IPPSC Version 2 Demonstration
 - On schedule





Phase V – Distribution Level Peak Load Reduction Demonstration

- Task 1.0 – Peak Load Reduction Capability
 - Provide load reduction capabilities for both blackstart during Island Mode and demand response during Grid Parallel mode. The agents for the building controller and HRDS will coordinate the optimal load shedding scheme depending on local conditions.
- Task 2.0 – IPPSC, Version 3 Demonstration
 - On schedule.
- Task 3.0 – Solar PV
 - Purchase, install and integrate a Solar Photovoltaic System (PV) into the overall Perfect Power System: on schedule
- Task 4.0 – Install Uninterruptible Power Supplies (UPS) at Critical Buildings
 - On schedule.



Demonstration Status

- HRDS Smart Loops (Loop 3)
 - Loop 3: Design, install and commission completed by 09/30/2009. February 12, 2010: “Celebration of a Milestone at Illinois Institute of Technology: Completion of the First Phase of the Perfect Power Project.”
 - Loops 1 and 2: Complete in December 2010.
- 50% peak demand reduction when called upon by PJM/ComEd
 - Turbine fast start completed for providing this capability
- 20% permanent demand reduction
 - Collected baseline data and normalized, HDD/CDD
- Demonstrate value of Perfect Power
 - 2010 ComEd/PJM DR valued at \$450,000

