Capstone Project- Design and Implementation of a Customer Driven Microgrid

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Objective:

Over a three- to five-year period, student teams will develop system and subsystem designs that ultimately result in the construction and operation of a microgrid.

Background:

A microgrid customer-driven microgrid consists of small generation sources and storage installed by customers and connected to the distribution feeders that supply electricity to the customer's premises. Under normal conditions this generation, particularly renewable generation, can provide economic benefit to the customer as well as the utility. During disturbances or periods of price spikes there can be a reliability benefit. Finally, during severe disturbances, these generators can use the utility feeders to form a small local island that continues to supply some power to customers.

The Klipsch School anticipates a grant that will support research and development of such microgrids. The capstone projects will represent the "design and implementation" part of the overall research theme.

The projects are contingent on the availability of funds.

Registration:

The proposed capstone sequence is intended to be a a continuous offering from Fall 2006 through Spring 2010.

Registration for AY2006 will be the normal Klipsch School sequence of EE498/499

Depending on the specific scope for the academic year, special course requirements may be imposed.

Off-Campus Activities:

As the project matures towards implementation by an electric utility, it will acceptable for students to do this work during an internship or co-op phase at the utility.

Scope of Work (AY 2006):

Specific tasks are as follows:

1. Propose *Scenarios* for the evolution of Customer Driven Microgrids
    a. How will markets develop?
    b. What will public policy and ratemaking look like?
    c. What would the business model for the utility be?
    d. What benefits will accrue.

2. Develop *Requirements* for customer driven microgrids
    a. Technologies
    b. Interconnection standards
    c. Protection/Communication
    d. System planning and Design
    e. Autonomous agent-based control

3. Define scope for a proof of concept system
4. Design the system
5. Demonstrate system[1]
    a. Simulation
    b. Laboratory Prototype
    c. Implementation
6. Speculate on whether the paradigm can succeed based on economics/public policy considerations.

Budget:

A budget is not relevant in the first academic year. Rather, the project will result in an estimate of cost and benefit which will set budgets for future designs.

[1] In the first year a paper study with simulation will be accepted as a deliverable. Subsequent years will need to move through laboratory-scale hardware demonstration through full scale implementation by a utility

Interdisciplinary Content

1. Economics
2. Electric Construction/Codes
3. Application Software
4. Power Systems
5. Renewable energy and Electric Energy Storage
6. Computer Science
7. Digital Control
8. Telemetry

Schedule/Milestones:

Specific milestones will be developed by the Team. However, the team must follow the guidelines set by the Klisch common capstone approach and include at a minimum:

Semester 1
- PDR
- CDR
- Final Presentation

Semester 2
- PDR
- CDR
- Final Presentation

Evaluators:

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