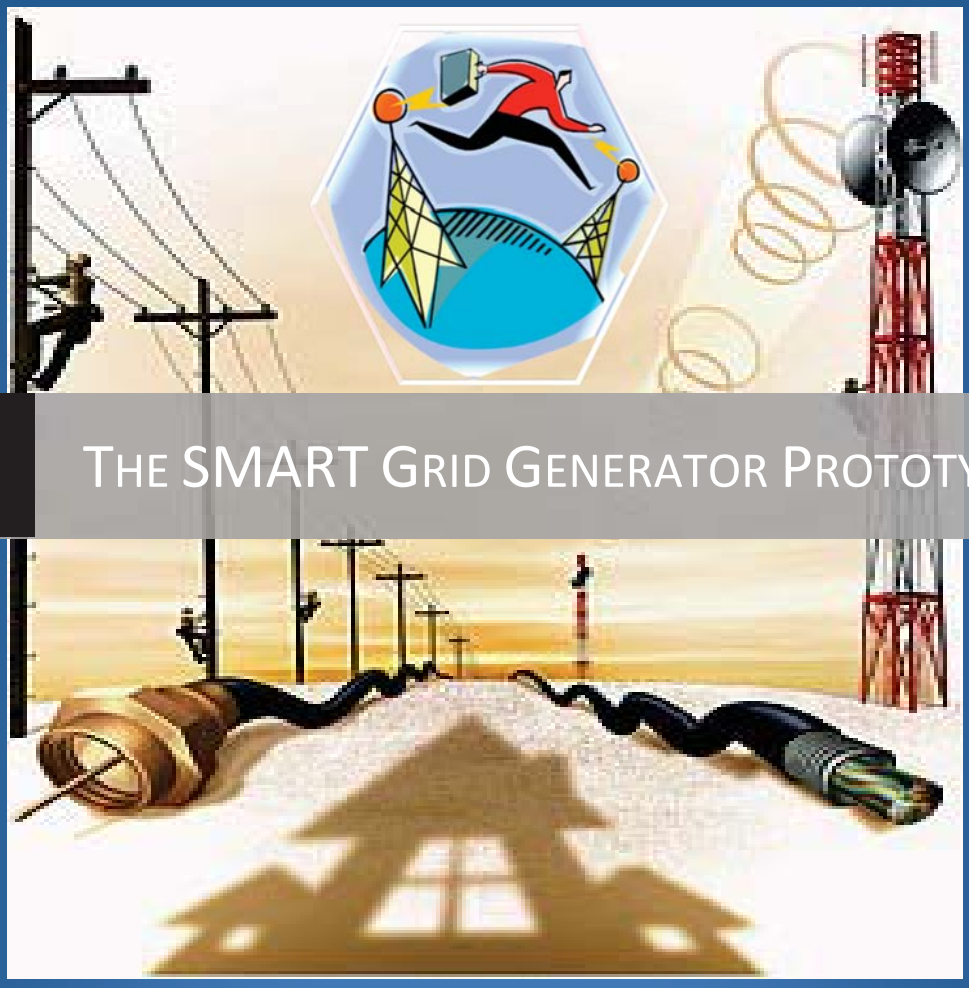

TEAM NO.:
ECE - 05

THE SMART GRID GENERATOR PROTOTYPE

SUBMITTED TO DR. CHIKA NWANKPA & THE SENIOR DESIGN PROJECT COMMITTEE

OF THE ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

DREXEL UNIVERSITY

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE SENIOR DESIGN PROJECT

MAY 13TH, 2009

Abstract:

As part of our Senior Design Project we have developed and executed a working prototype of a smart grid generator. This prototype will be used to enhance the Drexel ECE Curriculum .The final product has three deliverables.1) A MATLAB Simulink model used for validation of test results 2) a modified hardware design and 3)a hardware/software interface that includes a bidding strategy used to participate in the energy market. We have also created a user manual to run and debug the system.

Our senior design will aim to utilize distributed generation and enable automatic participation of the generator in the energy market with the help of a hardware/software interface. This has been done based on the study of distributed generators and the ability to respond automatically to price signals in the competitive electricity market. The price signals are based on the locational marginal pricing (LMP) which the Independent System Operator (ISO) who serve as a market arbiter uses to determine the price of energy. A bidding strategy ensures the most effective method of participation of the generator in the energy market. Therefore, we have successsfully completed our major goal of designing an automated controlled distributed generator that contributes to the "Smart Grid" initiative by actively participating in the competitive electric market system

"Smart Grid is an electricity transmission and distribution network that uses two-way communications and distributed generation to improve the efficiency, reliability and safety of power delivery and use". Our product will enable electrical engineering students to understand the concepts and foundation of a smart grid. We have performed extensive testing and debugging of our system. Our results and test procedures are included in the final report.

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Problem Description:

In the last few decades, electric power generation industry in many countries and regions has undergone a significant transformation from being a centrally coordinated monopoly to a deregulated liberalized market. This has led to a trend toward centralizing the control of electric power systems and the emergence of regional transmission organizations (RTOs) as agents of wide-area control. Electric power companies are continually innovating the different ways to provide cheaper and cleaner power . For the most part, the power grid will implement the recent advances in computer processing power to facilitate a more efficient and economic delivery of power with the aptitude to include the small-scale distributed generators in the power grid. This new grid concept is known as the “Smart Power Grid”[4]. The “smart grid generator” will play a major role by actively participating in the smart grid.

Our senior design project has approached this initiative by contributing to the “smart grid” idea. Presently in the power industry, everything is generator biased with the consumers not actively participating in the electric market. The smart grid initiative is to be able to involve all participants actively including consumers in the delivery of energy in other to improve the quality and reliability of the grid. [5]We have based our study in this project on distributed generators and their ability to be able to respond automatically to price signals in the competitive electricity market. The success of this project will give consumers greater flexibility, and involvement in the production of electricity and also improve consumer choices. This project will largely contribute to energy independence and security.