Howard University Department of Electrical and Computer Engineering

Title: The Intelligent Customer Distribution system control

Team Members

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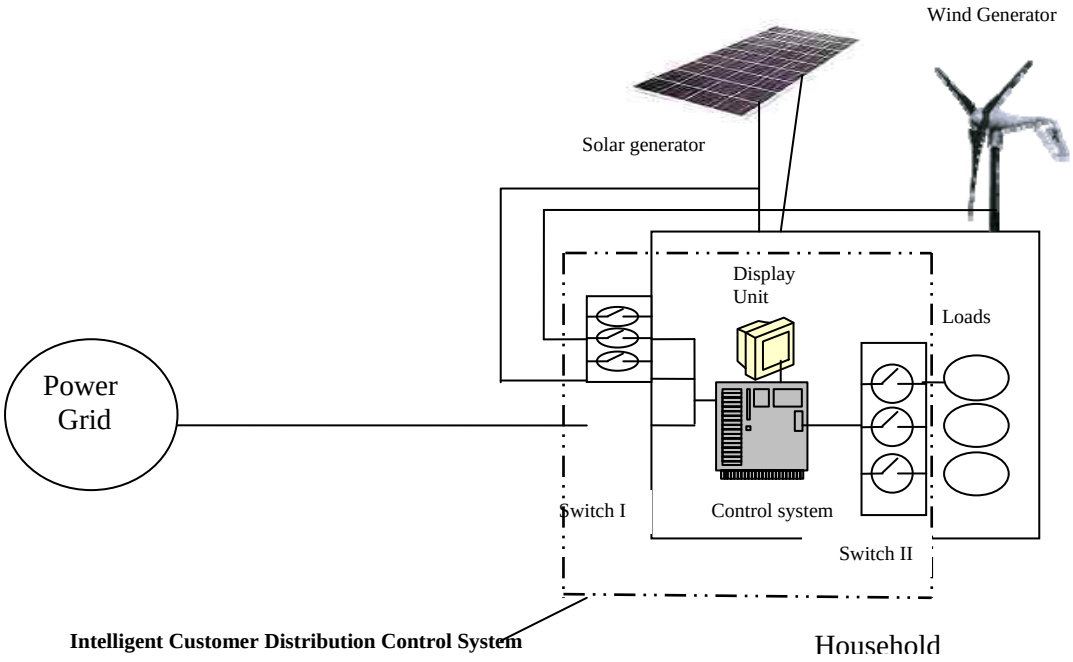

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INTRODUCTION

This Design project focuses on the quality and affiliation of power between the customer and the utility provider. Our system design will monitor and help manage power from the customer's side and also compiles an index for system implementation.

Our design comprises of three sections and they are the control unit, the display unit and the switching unit. It has to do with the control system that provides the customer with the efficient and the effective use of the energy provided by the wind and the sun in combination with that of the energy form the power grid. This design gives the customer the choice of which energy source they prefer to use at any point in time while giving them the opportunity to see the effectiveness and the efficiency of each energy source. The essence of this project is that it gives the customer the privilege of choosing the quality of energy they choose to use, the cost of that energy and due to our design, our customers can be a better citizen since they now have the choice of reducing the negative environmental impact of the energy they choose too use.

The control unit of the system gets the information on the quality, the effectiveness and the efficiency of the energy source and also balances the load based on the customer choice then sends this information to the display unit, which displays this information to the customer, thus giving our customer the opportunity to make an informed decision. After viewing the information send to the display unit by the control unit the customer can then switch to whichever energy source the customer prefers to use.

In trying to do this project, our combine knowledge in Power System Analysis, Power Communication and Control, Linear Control, Energy Conversion and Network Analysis help us with the background needed in the in the successful completion of this project.

PROBLEM DEFINITION

The main objective of our system is to provide the customer with the ability to make an informed decision on the energy they prefer to use. It must calculate the Power quality such as power factor, voltage sag, and harmonics provided by each energy sources and with limited percentage of error. System should allow switching from the control unit. The probable constraints in this design are cost, available technology and the standards set by the FERC (Federal Energy Regulatory Commission) and EPRI (Energy power Research Institute. In addition to this constraints, are the regulations and the rules set by the FCC and the IEEE.

ENGINEERING APPROACH

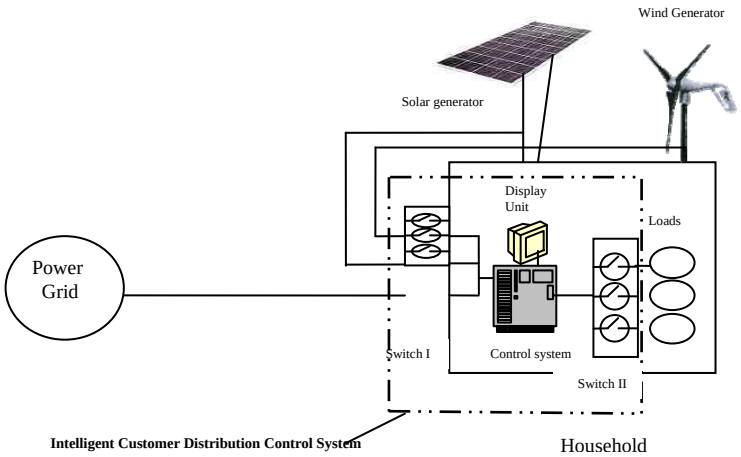


Fig1: Implementation of an Intelligent Customer Distribution Control System (ICDCS) in a Renewable Energy system connected to a power Grid.

Our system will be integrated in a Renewable Energy System connected to a power grid and has for aim to provide the customer with key info about the power supplied to their house. The system will also allow the customer to perform cost incentive decisions.

The system has 3 key components:

- Control Unit: will compute network data, measure system performances, help balance generation to load upon customer's choices.
- Display unit: will provide graphs, and data (Performance indices) of the network computed by the Control unit.
- Switch system: will allow the switching between generations, and between loads.

We will in our design study:

- Develop PV and wind models using MATLAB SIMULINK to evaluate performance of the system.
- Design and implement a reliable PV-wind based power model for different weather conditions and periods of the day.
- Design and implement control schemes that aim at eliminating violations of the power supply quality based on selected indices.
- Designed a scheme to implement energy management options by a customer for best selection of optimum control options resulting in cost incentive choices.

An alternative solution will be to:

- Develop a prototype of ICDCS that will be simulated using a solar power and wind generation's equivalent circuits connected on a board .That board will be connected to some interface software to be determined (e.g. Labview). Algorithms with control commands will be loaded to a chip that will be connected via the interface software to a computer.

TASKS AND DELIVERABLE

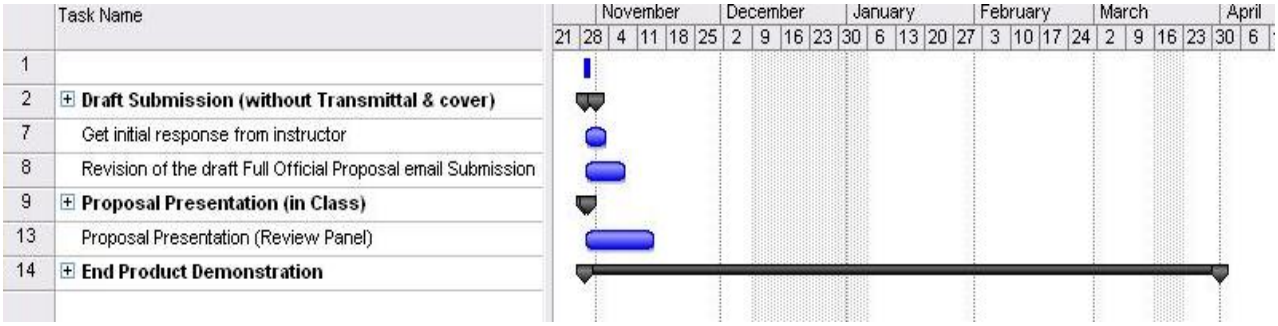
The scope of our work involves evolving the power industry, from a centralized system to a decentralized system. This will be materialized in the form of the ***Intelligent Customer Distribution system control design***. To accomplish this we have a variety of tasks to complete. These include:

- Problem Definition
- Methodology
- Technology considerations and selection
- End product design
- End product prototype implementation
- End product testing
- End product documentation and demonstration

The expected deliverable will be a fixture that will be affixed in the compound of the consumer. This fixture can be programmed to the precise specifications of the consumer. These specifications will need to be known by the manufacturer as it is programmed before reaching the consumer. Included with the program will be a manual detailing simple instruction on how to reset the system to its default program if problems may arise in the future. Included with the document for the device will be manufacturer's lifetime warranty certificate which entitles the customer to repairs and maintenance. Since the input and output of this device is electricity we would not recommend any self troubleshooting other than resetting the system

PROJECT MANAGEMENT

Schedule milestones are:



Team Member	Assigned Tasks
1. Abdoulaye Sy 2. Kalifa Llewellyn 3. Emmanuel Ekatah 4. Opeyemi Liadi	o To determine the energy storage systems on site o Formulate the most effective means of interconnection with utility companies. o Write the program code to calculate required indices for display. o Simulations for the various power sources will be simulated by a circuited connected to the computer using an IO board. o Make contingency provisions for unforeseen problems o Get parts and assemble the prototype o Troubleshoot any problems or issues that may arise

- **Resources and Budget**:
  We intend to take advantage of one of the objectives of the Center for Energy Systems and Control (CESaC) which aims to promote and encourage interdisciplinary teamwork and produce skilled graduates in electrical engineering in addressing the new challenges of today's energy sector and complex networks. At CESaC we will have access to expertise and resources needed for the successful completion of this project. We have the guarantee from the professors working in CESaC that we will have their full cooperation towards the successful completion of this design project in a timely fashion.
- **Safety Issues:** Considering that the system will operate on electrical current, it is important that proper electrical safety considerations be taken. These include ensuring that every member in the group is properly informed about the dangers that can arise.
- **Engineering ethics issues**: following ABET guidelines; we will exhibit the ability to: apply knowledge of mathematics, science, and engineering; to design and conduct experiments, as well as to analyze and interpret data; to design a system, component, or process to meet desired needs; to identify, formulate, and solve engineering problems.

CONCLUSION

Customers of the power industry need a safe, reliable and affordable power supply. Our project will permit the empowerment of customers with the tools to make comparisons and give them the choice to choose the optimal energy source. The result of this project will benefit customers who are faced with the problem of being limited to one type of energy source. In addition to this, these customers are not given the privilege to choose the quality of their power source. In today's market the needs of the consumer comes first and these two problems prevent this criteria from being accomplished.

In essence, this system consists of a control unit that will perform quality analysis and load balancing. There will be a display unit that will show the customer the result of the analysis done by the control unit. It will also display the available energy sources and the load in real time. The final component of the design will incorporate a number of switches that will enable the customer to choose their preferred power source based on the information provided to them through the display unit.

The fundamental subject matter underlying this project is power analysis. This encompass studies in harmonic analysis, load flow calculation, short circuit analysis and load profiling to name a few. So together with the prior academic training that each group member possesses, we need guidance and expertise from the EE faculty at Howard University.

Although the cost of putting the system in place is more expensive than just settling with just one source of power, within 4 years that cost will be recovered in money saved. The group is open to any suggestions that will help us in the improvement of our design.