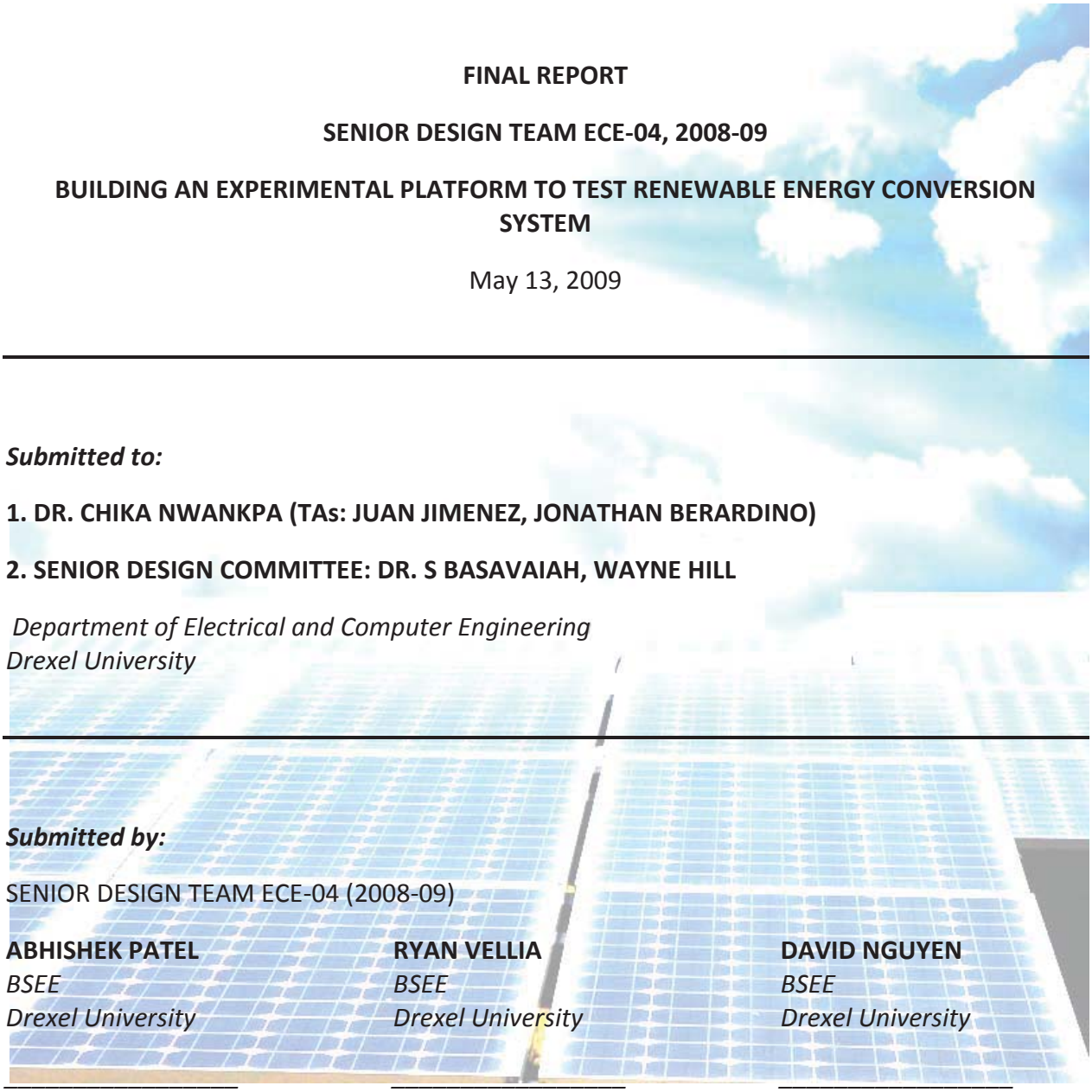

FINAL REPORT

SENIOR DESIGN TEAM ECE-04, 2008-09

BUILDING AN EXPERIMENTAL PLATFORM TO TEST RENEWABLE ENERGY CONVERSION SYSTEM

May 13, 2009

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EXECUTIVE SUMMARY

Building an Experimental Platform to Test Renewable Energy Conversion System

Abhishek Patel, Ryan Vellia, David Nguyen

Drexel University

May 13, 2009

Introduction:

Global warming and the Energy Crisis have created strong environmental, economic as well as political incentives for developing efficient and reliable network integration technologies in order to harness the full potential of renewable energy sources (RES) [12]. However, deregulated growth and unpredictable energy supply of such distributed sources poses reliability concerns for the existing power system. As a result their participation in real-time energy markets is limited compared to more reliable and economic scheduled generation. Therefore, as a start, it is essential to study the performance of a power system subjected to renewable generation. An experimental platform can be designed for investigating the impact of such nonconventional energy sources on stability, reliability as well as efficiency of power system under dynamic load and generation. Such a platform can provide a unique lab environment to identify potential problems as well as test possible solutions for seamless integration of RES with existing utility grid.

Experimental Platform:

The objective of this project is to design, build, and test an experimental platform in the Interconnected Power System Laboratory (IPSL) in order to test the performance of a 3-bus power system with remotely controlled renewable generation and load**.** The major accomplishments of this project include:

1. Adding a 3rd bus to the existing 2-bus IPSL setup
2. Introducing 1φ, utility interactive renewable generation with battery back-up to IPSL
3. Integrating and testing the experimental platform for variable load and generation

The three existing components of the project are “RLC” load banks, PECO utility supply serving the existing IPSL stations, and transmission line modeling units. They will be integrated into the experimental platform. The platform shall serve as a small-scale model of a practical 3-bus power system with variable load, generation as well as line characteristics. Computer aided power flow measurements shall provide data to assess the system performance under variable load and generation profile

ABSTRACT

Building an Experimental Platform to Test Renewable Energy Conversion System

Abhishek Patel, Ryan Vellia, David Nguyen

Drexel University

May 13, 2009

The objective of this project is to design, build, and test an experimental platform for Drexel University's Interconnected Power System Laboratory (IPSL). The platform is a model of a practical 3-bus power system with dynamic load control and utility-interactive renewable generation with battery backup. Existing IPSL setup allows for unidirectional power flow analysis of single source circuits. The experimental platform is an enhancement of this setup. It incorporates a 3-node meshed network with bidirectional flow of power and two independent sources: one – utility grid, two – renewable energy source (RES). The platform serves as a small-scale model of a practical 3-bus power system with variable load and generation. Computer aided real-time and synchronous power flow measurements provide accurate data to assess the system performance under variable load and generation profiles.

The significant achievements of this project include expansion of IPSL's capability of measuring and analyzing 3-bus power system in real-time as well as providing network integration of 1.6kW photovoltaic (PV) generation as an alternative RES for dynamic power system studies and experimentation in a lab environment.