Award Details

OPAL-RT Real-Time Simulator for Renewable Energy and Smart Grid Research

Research Details

Competition Year:	2018	**Fiscal Year:**	2017-2018
Project Lead Name:	Liang, Xiaodong	**Institution:**	Memorial University of Newfoundland
Department:	Engineering and Applied Science, Faculty of - Engineering and Applied Science, F	**Province:**	Newfoundland and Labrador
Award Amount:	146,665	**Installment:**	1 - 1
Program:	Research Tools and Instruments	**Selection Committee:**	Electrical and Computer Engineering (RTI)
Research Subject:	Power systems	**Area of Application:**	Electrical energy
Co-Researchers:	No Co-Researcher	**Partners:**	No Partners

Award Summary

Emerging technologies enables the transition to a blended energy landscape where renewable energy becomes a significant contributor to our modern society. The advancement of renewable energy is exciting but also creates significant technical challenges to the power industry. The current power system infrastructure is based on an architecture designed a century ago, which relies on large, centrally controlled power plants with predictable outputs. Renewable energy, on the other hand, is distributed, independently controlled, and intermittent. Due to such an incompatibility, adapting the power grid to operate reliably with renewable energy sources is a complicated global challenge. Microgrids are becoming increasingly popular as grid-connected or isolated small-scale power systems, typically managing a group of renewable and/or conventional distributed generators, energy storage systems, and loads within a defined electrical boundary. Microgrids are considered to be a technically feasible option to improve sustainability, resilience, and energy efficiency.

To address these technical challenges related to renewable energy and smart grids, the proposed research program in this proposal includes the following three interrelated themes: 1) Dynamic load modeling in modern smart grids; 2) Synchrophasor technology applications in smart grid environment; and 3) Advanced control techniques for microgrids. It aims to develop advanced control technology, optimization-based planning and operation approach, and adequate dynamic load modeling for planning, operation, and control of tomorrow’s greener and smarter power grids. The research results can significantly advance the field and greatly benefit Canadian power industry.

In order to succeed in the proposed research, an OPAL-RT real-time simulator is urgently needed. OPAL-RT's state-of-the-art, real-time simulation platform provides a simulation environment based on MathWorks’ Simscape Power Systems, hardware-in-the-loop feature, and synchrophasor technology based wide area monitoring, protection, and control, which are critical to obtain the required synchrophasor data for dynamic load modeling, validate the created dynamic load model with integrated renewable energy sources, develop phasor measurement unit (PMU) based application algorithms, and evaluate and fast prototyping the designed microgrid controllers. Without the simulator, the proposed research program will become very difficult and restricted.

The proposed OPAL-RT real-time simulator will be utilized by the applicant, her team, and other faculty members at Memorial University whose research areas are in renewable energy and smart grids. It will offer excellent training opportunity for undergraduate and graduate students, postdoc fellows and other highly

qualified personnel by using this cutting-edge equipment.