NSERC SMART MICROGRID NETWORK
nsmg-net

Project 1.4

Operational Strategies and Storage Technologies to Address Barriers for Very High Penetration of DG Units in Intelligent Microgrids

Michael Ross (McGill University)
Dr. Chad Abbey (Hydro-Québec)
Dr. Steven Wong (CanmetENERGY)
Prof. Géza Joós (McGill University)

NSERC CRSNG

Problem

- There is growing amounts of renewable energy on the power system at the distribution level
  - Sources such as wind and solar are intermittent by nature, which makes balancing power difficult

- How can we facilitate the integration of a high penetration of variable generation to make the system dispatchable?

Solution

- Implement a Microgrid to create a self-contained network that manages the local resources in a controllable manner
- Energy Storage Systems are efficient means of maintaining power balance by:
  - Maintaining a reserve of energy to ensure power balance during islanded operation
  - Acting as a controllable load or a generator to smooth power fluctuations
  - Store energy when demand is low and generate when demand is high to minimize the cost of energy

Solution

- New control algorithms for Microgrid operation must be developed through the integration of DER (controllable loads, DGs, ESS) and ICT
- These strategies must take into consideration all modes of operation and objectives (Projects 1.1, 1.2, 2.2) and available resources (Project 1.3, 2.3, Theme 3) in order to appropriately develop a framework for energy management in the Canadian context

Outcomes of project

- This project will:
  - Develop next generation power management strategies using ICT for Microgrids with a high penetration of renewables
  - Formulate a methodology for evaluating control strategies of Microgrids
  - Provide a technical evaluation of various storage technologies and sizes for Canadian Microgrid applications
  - Identify additional benefits that can be achieved through the implementation of storage systems and other DER in Microgrids

Partnerships with Canadian industry

- Collaboration on this project thus far from:
  - Dr. Chad Abbey, Hydro-Québec
    - Control strategies
  - Dr. Steven Wong, Natural Resources Canada
    - Control strategies, network data
  - Bobby Sagoo, GE Energy
    - Control strategies
  - University of Waterloo
    - Weather data
  - IESO
    - Load data

Future work & potential collaboration

- Collaborations with the following projects will enrich the quality of the deliverables:
  - Project 1.1 to develop control strategies for renewables in islanded mode of operation
  - Project 1.2 to determine appropriate control approaches for Microgrids with a high penetration of renewables
  - Project 2.2 to determine operational strategies to minimize technical effects of renewables on the EPS
  - Project 2.3 to integrate demand response as a means of balancing power
  - Project 2.4 to develop Microgrid models and equipment models that accurately represent Canadian systems and technologies to evaluate energy management strategies