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Controls for urban microgrid

Version 1 (updated May 31, 2017)

Context: In the past decade, there has been increasing penetration of renewable energy and rapid development of the microgrid concept where several Distributed Generators (DGs) and loads can operate together with more flexibility and greater reliability.

Problem: One well reported issue in interconnection of DGs is fluctuation of the distribution system voltage from the rated nominal voltage. Urban microgrid systems are also liable to power quality events, with unbalanced voltage being a typical problem.

Solution: Two control strategies for three-phase power electronics interfaced DG systems are proposed: (1) Active power oscillation minimization and (2) the DG's negative sequence current is set to be in-phase with the grid negative sequence current.

Impact: This project allows Hydro One to assess the corrective measures needed to ensure that power quality does not deteriorate to unacceptable values due to connection of DGs. The model created also allow for prediction of out-of-bounds voltage fluctuations.

CUE's role: Researchers have developed a four-wire interfacing power converter with a DSP controller for microgrids. They also completed computer simulations for investigating and optimizing switching and control schemes and modelled impacts of DG on power quality of distribution system in addition to building a prototype microgrid.

✓ Completed

Sponsors:

Hydro One, NSERC, Ontario Research Fund

Timeline:

January 2011–July 2015

Research Team:

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Key stats

2 Lab prototypes constructed
2 Control strategies developed