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Smart grid management and optimization systems

Version 1 (Updated May 31, 2017)

Context: A century of development has led to a large interconnected system that brings power from central-station generators through transmission and distribution to end-use customers. In order to meet growing demand at minimum operating cost requires energy management and optimization systems

Problem: The energy management products that exist in the market which can monitor energy consumption and attempt to regulate it can be grouped into two main types: 1) EMS designed to operate the whole system, 2.) EMS designed to operate a single unit like home, commercial building etc.

Solution: A non-iterative power flow algorithm, named Holomorphic Embedding Load flow Method (HELM), for smart grid applications and to develop the energy management and optimization system with battery energy storage (ES). This system controls, optimizes and manages the energy between sources and loads of a particular zone.

Impact: The findings from this project allow Hydro One to perform the power flow analysis in unbalanced AC and DC interconnected distribution networks. This project also allow Hydro One to model the energy storage batteries and plan for optimal asset expansion with ES at the least cost.

CUE's role: CUE researchers have formulated the HELM algorithm to solve general power flow problems in electrical networks and applied this on modified IEEE 6 bus system and modified IEEE 13 bus system where both AC and DC sections are interconnected.

 Completed**Sponsors:**

Hydro One, OCE

Timeline:

August 2013–March 2016

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Nastaran Hajja, Gouri Barai**Key stats**

1.4M	Hydro One Customers
97%	Ontario transmission capacity
121,000km	low-voltage distribution system
29,000km	high-voltage network