



First Grid Connected Energy Storage Facility in Ontario

Project Summary:

Location:
Minto, ON

Partner:
NRStor Inc.

Challenge/Requirement:
Ontario's electricity system operator is seeking to improve the way the frequency of its grid is regulated

Temporal Power's Solution:
A 4 MW flywheel energy storage facility with +/- 2 MW of range will provide regulation services with up to 5 times the effectiveness of conventional technologies

4 MW Temporal Power flywheel facility located in Minto

In 2012, the Independent Electricity System Operator (IESO) issued a Request For Proposal (RFP) for alternative sources of regulation service. Temporal Power worked with Ontario-based energy storage developer NRStor Inc. to submit a proposal for a flywheel facility to provide 4 MW (+/- 2 MW) of frequency regulation as an ancillary service contracted by the IESO. In early 2013, the IESO awarded NRStor the project, initiating the development of Canada's first grid-connected flywheel energy storage facility. Temporal Power not only provided the innovative flywheel technology which is the core of the facility, but was also responsible for the engineering, construction and commissioning of the balance of plant.



Application Overview

The IESO procures a range of ancillary services to enhance the stability and reliability of Ontario's electricity grid. Frequency regulation consists of matching electricity supply and demand on the grid every few seconds. To do this, the IESO monitors the total demand, total supply, and net electricity exchanged with other operating regions, and computes a correction signal (called Automatic Generation Control (AGC)), which is used to dispatch generation assets which have reserved capacity for regulation services.

Currently, the Ontario electricity grid requires an average of 150 MW of regulation service, which is contracted by the IESO. However, conventional frequency regulation has several limitations:

1. Conventional generation assets have optimal efficiency within a certain operating range. Reserving capacity for regulation service requires operating at reduced capacity, which can reduce efficiency.
2. The effectiveness of regulation service is determined by how quickly a generator can respond to the AGC signal. Conventional generators are limited in how quickly they can change their power level (ramp rate), hence a larger overall quantity of regulation service must be procured than would otherwise be needed.
3. By reserving generation capacity for regulation service, the total amount of generation capacity available to supply electricity is reduced. This can constrain supply at periods of peak demand and drive electricity prices up, especially when the operator is required to import expensive power from other operating regions.

Technical Solution

Temporal Power specified a 10-flywheel system utilizing its 250 kW flywheels, providing a +/- 2.5 MW nameplate capacity. The flywheels are powered by 5 banks of back-to-back inverters, and are installed below grade. The flywheels, and bulk of the electrical equipment, are housed in a fabricated steel building. Automatically-controlled cooling and ventilation systems ensure the flywheels and associated power electronics remain within their operating temperature range. The control system monitors hundreds of parameters and logs data in real time, allowing operators to monitor the flywheel and facility operation, and diagnose any issues.

The site, located in a small industrial park in the Town of Minto, approximately 2 hours north of Toronto, was chosen based on the availability of suitable land, and connection capacity at the nearest substation. The design phase of the project began in May 2013, with a focus on developing the electrical grid interconnection to allow the flywheel system to connect to the 44 kV distribution line.

Construction & Commissioning

Construction began in November 2013, and involved excavation and concrete formwork to construct the protective vaults which house the flywheels. The building and associated services were finished in March 2014, at which point the flywheels were shipped to site and installed. An overhead gantry crane was included as part of the building design which greatly facilitated the installation of major equipment at the site. Commissioning of the flywheel facility took place during May-June 2013.

