CVR and Grid Edge Technology as a Non-Wires Alternative for Capacity Reduction

Authors:

Hydro Ottawa Kevin Ainsworth, Steve Hawthorne

Varentec Inc. Umang Deora, Rohit Moghe, Damien Tholomier

Short Abstract:

By combining CVR (Conservation Voltage Reduction) with grid-edge power-electronic technology, Hydro Ottawa is targeting a demand reduction of 1.2 MW or 2.4% of substation peak load at Kanata MTS substation. The project currently includes 43 pole mount ENGO® devices, manufactured by Varentec, to support up to 6% voltage reduction at the station LTC. The ENGO™ devices boost low-voltage outliers above CSA minimums, enabling demand reduction, energy savings and improved power quality without customer impact or participation. Project cost and complexity make CVR attractive compared to other non-wires alternatives to offset demand and reduce or defer capital investments on lines and stations.

Learning Objectives:

1. **Understand CVR and how it can be leveraged by LDCs as a tool energy savings and demand reduction.**
2. **Learn how grid edge devices (in this project, Varentec's ENGO™ + GEMS™ solution) can boost the technical and economic performance of CVR by supporting low-voltage outliers.**
3. **Hydro Ottawa will share project experience and lessons learned.**

Long Abstract:

The objective of Non-Wires Alternatives is to offset distribution investment by deferring or replacing the need for specific equipment upgrades such as T&D lines or power transformers by reducing load / demand at a substation or circuit level. CVR (Conservation Voltage Reduction) empowers electric distribution utilities to achieve a significant reduction in energy and peak demand, without impacting customers through load shedding or major equipment investments.

New power electronics-based grid-edge technology combined with CVR offers promise to manage and mitigate load/demand and can be classified as a Non-Wires Alternative (NWA) to conventional upgrades. Deployment of utility owned assets called Dynamic VAr Controllers (DVCs) provide visibility to low voltage nodes and enable real-time Volt-VAr Optimization (VVO)/CVR at the grid edge; hence achieving a fast and dynamic response to varying load and enabling increased demand reduction and energy saving through CVR. This grid edge technology can be used by the utilities as a cost-effective NWA to achieve deterministic flexible control over their system without the need for consumer participation.

Hydro Ottawa deployed the Varentec's solution comprised of hardware components called Edge of Network Grid Optimization (ENGO®) and a cloud-based software component called Grid-Edge Management Solution (GEMS®). ENGOs are fast-acting power-electronics devices that are installed on the secondary side of a distribution grid, to autonomously sense and regulate voltage with a ± 0.5% within control range by injecting sub-cycle VArs between 0 to 10 kVArs. GEMS acts as a supervisory control and provides a data analytics and visualization engine.

Hydro Ottawa's Kanata substation has 43 pole mount ENGO units deployed at the low voltage outliers to ensure the tight regulation of voltage at a local and feeder wide level and prevent a dip below the minimum CSA standard (110V at customer location) during periods of CVR or peak loading conditions. These DVCs allow Hydro Ottawa to reap multiple benefits of peak demand reduction, voltage stability, grid visibility and dynamic VAr management, all with deterministic control within the hands of the distribution operators.

This paper highlights the use of this grid edge technology as a new resource in every utility's toolkit. Prior to implementing CVR, the lowest recorded voltage (at the AMI location) without the ENGO devices deployed was below the CSA limit and did not permit any reduction in voltage at the substation. Comparing the voltages on a similar loading day with one transformer upgrade and the ENGO devices turned ON showed a healthy improvement of 12.3% (14.8V) resolving all CSA violations and creating an additional voltage margin for planned reductions.

Kanata being a heavily commercial and industrial circuit, the CVR factor for power used was calculated to be 0.47. CVR tests were conducted through the peak load month of July/August 2020 with a 3% and 5% reduction in voltage at the LTC. Stepping down the voltage (during the peak load hours) provided a load reduction of 1,2MW or ~2.4% of the substation load (50 MW) by reducing the voltage by 5% at the LTC. The ENGO devices were primarily responsible for facilitating this risk-free reduction in voltage as well as identifying the worst voltage outliers that did require service transformer upgrade to maximize the voltage reduction at the Kanata substation.