Case Study:

Opus One deploys Microgrid Management System for community, providing emergency backup operation using renewable generation and energy storage.

Challenge:

The electricity grid in North America is being challenged like never before. Global climate change is causing extreme weather events to occur more frequently. Coastal flooding, wildfires, extreme heat, hurricanes and recently in Ontario ice storms have resulted in millions of people losing power for their homes, costing billions in damage with serious consequences to electric utilities. At the same time, the grid is going through an energy revolution. More distributed renewable generation resources have been deployed than ever before. Although sustainable, they introduce complex dynamics to the electric system in the form of distributed energy transfer, bi-directional power flow and intermittent power generation. Furthermore, a global movement towards electric vehicles is underway as environmentally-conscious commuters are making an effort to curb carbon emissions. Increased adoption of electric vehicles adds stress and operational uncertainty to aging and capacity constrained infrastructures.

The combination of aging infrastructure, climate induced catastrophes, renewable generation and electrification of transport requires technology solutions that provide reliable and resilient electricity to safe havens in local communities in case of grid outage.

The solution must incorporate an intelligent controls platform that ties in a variety of generation, demand and storage resources, directing them in concert with one another in a flexible and reliable manner. The use of energy storage technology is key to achieving this, by smoothing the generation profile and providing back-up when the sun is not shining or the wind is not blowing.

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Solution:

The GridOS™-MEMS (Microgrid Energy Management System) supported by professional implementation services is Opus One's solution to address these challenges facing the electricity grid.

GridOS™-MEMS controls energy resources, from solar, battery storage, electric vehicle charging stations to demand management systems in an optimized manner based on a variety of configurable algorithms. From Time-of-Use optimization, to peak shaving, to extreme weather preparation measures, to carbon neutral/net zero strategies, GridOS™ is configured and contextualized based on the specific needs of the project. It runs on the Siemens RUGGEDCOM APE utility-grade computing platform that leverages the switching and routing capabilities of the RX1500 series, achieving both reliability from a power and communications perspective. The solution is implemented by a team of dedicated, skilled professionals who strive to ensure that customers receive an automated and sustainable solution.

Results:

Opus One in partnership with Siemens, eCAMION, University of Toronto and Toronto Hydro has formed a consortium under Natural Resource Canada's ecoENERGY Innovation Initiative to demonstrate the feasibility of smart grid technology that can address growing grid challenges. The goal is to build an Integrated Urban Community Energy (IUCE) system that utilizes a lithium-ion battery storage system to support emerging grid applications such as electric vehicle charging and solar photovoltaic generation. The team in collaboration with the YMCA of Greater Toronto, selected the Cherry Street Y, also contained within the Pan-American games Athletes' Village, as the technology demonstration location.

The system consists of a 100kVA/125kWh grid-scale lithium ion battery system, 1 X Level 3 DC Fast Charger (a first in Toronto), quantity 6 Level 2 electric vehicle charging stations, and a 3kW translucent-cell solar photovoltaic system on the green roof, all controlled by GridOS™-MEMS running a Time-Of-Use (TOU) scheme and islanding protection strategy. If there is a grid outage, the system removes itself from the grid while sustaining the charging of up to 7 vehicles. Once the grid restores stability, the system synchronizes automatically, bringing the microgrid back into grid-connected state. In parallel, the GridOS™-MEMS TOU drives the use of power to minimize electricity cost at peak. A streamlined control algorithm is implemented to ensure that the load from vehicle charging does not exceed the capacity of the in-coming feed thereby avoiding costly infrastructure upgrades.

The system contains multiple layers of redundancy. The batteries which are designed by eCAMION of Toronto are configured in two 62.5kWh strings offering reliability should one fail. The control devices, which are critical to the microgrid are powered by the utility grid under normal conditions, but when the grid fails, the lithium-ion battery system provides backup power and if the battery runs out, a UPS offers the last line of defense. This double contingency strategy coupled with solar power allows the system to survive for days and even weeks, achieving improved grid resiliency.

An augmented layer of control is introduced to allow the microgrid system to interface with the electric utility (Toronto Hydro) offering monitoring and controls during an emergency situation such as grid-wide power outage. Furthermore, GridOS™-MEMS is provisioned for supervisory coordination with distribution feeder automation systems.

A first-of-its-kind microgrid solution using solar, energy storage and electric vehicle charging that can address current challenges while providing cost-saving opportunities and resiliency to the facility owner.

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