Sweden's Simris Microgrid

Project Overview

Europe's distribution and transmission systems are the most reliable in the world, largely limiting microgrid opportunities to islands, the majority of which are not interconnected to the continental mainland grid. In order to explore new business models and technologies to diversify the region's resource mix and reliance upon large-scale hydro resources, the large European utility E.ON deployed a microgrid in 2017 to serve the small rural town of Simris in the southwestern Sweden. The project, which relies upon Encorp's Egility controls platform, is capable of sustaining electricity supply by leveraging a microgrid that can run on 100% renewable distributed energy resources (DER), one of the few in the world to achieve this feat. Not only that, but despite the lack of inertia from rotating fossil fuel generators that the majority of microgrids rely upon to balance generation with loads, this microgrid has offered power quality in island mode that even surpassed the power quality offered by the local utility distribution system.

The Problem

Remote areas of Scandinavia to experience more power outages than much of central Europe. Finland is particularly vulnerable to outages due to vast forested areas and heavy snow impacting fragile distribution systems. Over a half million people lost power in Finland during outage events in 2011 and 2012, for example. Sweden experienced approximately 50 wildfires during the summer of 2018 due to record heat and drought conditions. As climate change accelerates, microgrids such as Simris offer a model of how to maintain reliable electricity without increasing reliance upon on-site fossil fuel generation. Record-setting wildfires in the Arctic Circle in 2019 and 2020 have utilities and grid operators in northern climates stepping up efforts to be prepared for future threats to the electricity grid.

The Solution

Resiliency was not the primary driver for the Simris microgrid. Exploring new offerings for customers was the primary aim of E.ON. In the process of designing and implementing the project, E.ON wanted to build up its technical and commercial capabilities in the DER space, understand the costs and barriers in shifting to localized energy systems and then develop business models that align with use cases in order to identify and then meet the needs of potential customers.

The Simris project also responded to a European Union "winter package" that dictates the creation of "local energy communities" which could establish, own or lease networks and autonomously manage these new community-based structures. The other option, which was deployed for this microgrid, is that a community could enter into an agreement with the local distribution system operator – in this case E.ON – to operate such networks. The expressed purpose of these new community networks would be to maximize self-consumption of on-site DER assets while minimizing the costs to end-users.

The six key value propositions and use cases E.ON wanted to test out in this pilot project were the following:

- Seamless islanding
- Demand response
- Energy storage capabilities as a buffer for variable renewables
- Cross energy carrier synergies (i.e. electricity and thermal exchanges)
- Electric vehicle charging systems as a grid resource
- Grid automation optimization

(cont.)

The Solution (cont.)

The microgrid has achieved 100% renewable energy generation at times when both wind and solar are abundant, which is typically in spring and summer. At times, the microgrid has operated as long as three days in a row solely on renewable energy, supported by advanced batteries. The key challenge during these trials is that in a system with low inertia, the frequency can drop suddenly, and energy storage devices need to react in real-time, so power is maintained. What this microgrid proved to E.ON. is that it is possible to have a 100% renewable energy system, even if no rotating machinery is available to provide inertia. The microgrid also provided demand response services under the EU's Interflex program designed to test out three important applications for grid support including peer-to-peer energy trading to create a local energy trading market supported by centralized and decentralized balancing systems. The project also utilized artificial intelligence to create smart algorithms to improve the efficiency and flexibility features available over time.

Key Project DER Features:

- 500 kW of wind capacity
- 442 kW of solar PV
- 800 kW lithium ion battery
- 480 kW biofuel back-up generator