The Electricity Journal 30 (2017) 12–15

Contents lists available at ScienceDirect

The Electricity Journal

journal homepage: www.elsevier.com/locate/tej

Special Issue: Contemporary Strategies for Microgrid Operation & Control

Controlling and optimizing resilient distributed energy resources and microgrids with a demand-side operation platform

Mark Johnson

ARTICLE INFO

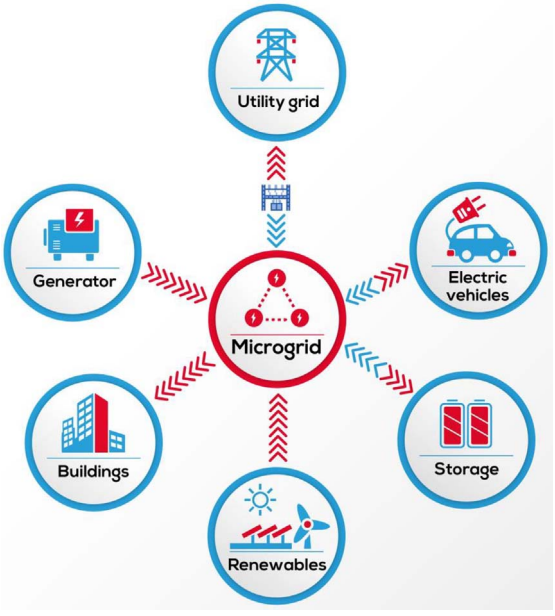
Keywords:
Distributed
Energy
Smart
Grid
DERs
Smart grid
Microgrid
Nanogrid
Solar
Storage
EV charging
CHP
Controls
Inverters

ABSTRACT

Moving to true grid resiliency requires multiple distributed energy resources, but these DERs must be properly controlled for each installation's needs. This article answers these DER and microgrid resiliency questions and suggests some best practices for optimal financial and operational control in our New Energy Landscape.

More-severe weather, an aging grid infrastructure, and the retiring of older, inefficient generation sources have threatened the stability and reliability of today's electrical grid. Additionally, a rise in distributed generation and other new grid technologies has contributed to a greater need for grid automation and intelligence, leading to many utilities and commercial and industrial facilities to seek out alternative ways to manage their energy. The use of microgrids has emerged as an efficient way to manage both the complexity of the grid and to add new levels of reliability and resiliency to combat the aging grid.

Moving to true grid resiliency requires multiple distributed energy resources (DERs), including independent power like solar power, combined heat and power (CHP), battery storage and electric vehicle charging stations to provide flexibility, but DERs must be properly controlled for each installation's needs. The ability to control power distribution becomes an even more important consideration for the rise of islandable microgrids, which demand more automation to meet the deluge of energy that is being generated in our digital age. As a result, operations managers need a safe, hands-on approach to DER and potential microgrid management, favoring a solution that offers the ability to tightly control the multitude of DERs throughout their facility.



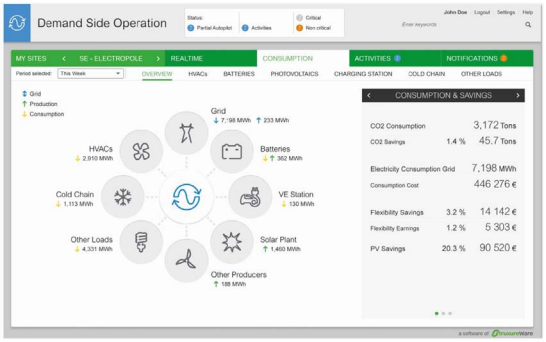
E-mail address: mrmarksjohnson@gmail.com.
URL: https://www.linkedin.com/in/markstevenjohnson/.

http://dx.doi.org/10.1016/j.tej.2017.03.010

Available online 19 May 2017

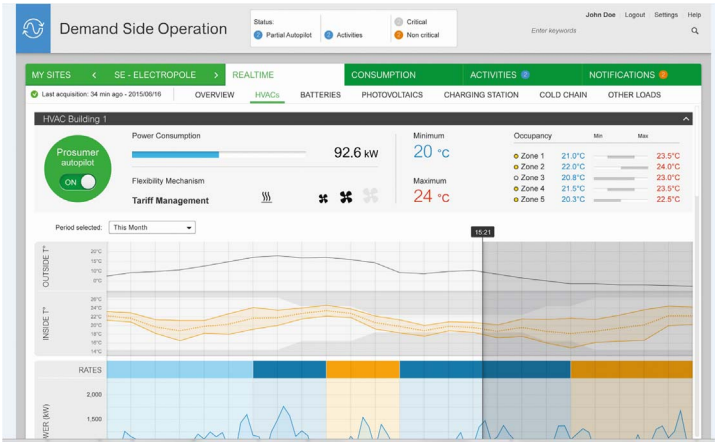
This shift in our new energy landscape with more distributed energy has increased the number of power sources that generate energy in order to avoid outages. While this proves to be immensely valuable to ensure power resiliency, it has demanded more complex and advanced systems that draw upon the wide variety of DERs. This places a premium on the ability to control which DERs their system is drawing upon with responsible, cost-effective energy consumption that does not sacrifice resiliency or safety. Many facility managers look upon integrated software solutions that provide the option to monitor and control every aspect of their DERs and microgrid in order to avoid outages, optimize energy spend, and increase self-consumption of clean energy. Lastly—and perhaps most importantly—universal control of DERs and a microgrid system ensures peace of mind, laying the groundwork for the cornerstone of any power system: reliability.

To empower grid managers with optimal control, perhaps no offering enables more autonomy and trust of a smart grid than a demand-side operation (DSO) platform with utility-grade dependability for economic optimization. With software systems that enable management of critical energy and resource data assets through an end-user-friendly interface, DSO offers the best opportunity for managers to capture the benefits of clean energy and the smart grid, optimizing efficiency, cost, and reliability. One of the key features users see with DSO is the ability to access real-time data that considers critical factors such as weather conditions and price data feeds, then uses advanced algorithms to automatically predict energy flexibility and make proposals to the system for evaluation. This data is then converted into actionable instruction for DERs and microgrid control that optimizes power usage, reduces cost, and enables self-consumption of clean, sustainable energy. As the pervasiveness of DERs and microgrids grow, DSO is a crucial tool for remote management of assets to optimize efficiency and cost-effectiveness. It's also the key consideration for making energy storage systems "greener"; DSO services include supplying "negawatts" (that is, curtailing load) or "posiwatts" (providing energy) to the grid.



The DSO platform offers a more sophisticated form of economic optimization for power delivery, ensuring efficiency and reliability by creating and monitoring a larger—and expanding—network of DERs. This enables advanced autonomy of energy storage; with more control, managers can determine which DER to draw from in order to optimize performance and cost. The DSO strategy for delivering electricity enables a more advanced and variable power supply than the traditional network distribution network operation (DNO) model by varying DERs. This allows for optimized participation in demand response programs and the operation of distributed energy assets, in addition to enabling fast communication and decision-making between smart grids.

The DSO platform is most effective at managing a multitude of DERs and microgrid applications, including campuses, communities, and large industrial bases for economic optimization. It's obvious that most facilities cannot afford a power outage; universities estimate that a single power outage lasting only a nanosecond can cost multiple years of lost research. For that reason, facility managers put a premium on the reliability afforded by DERs and microgrids that can stand up to environmental challenges to avoid an outage.



Many solar installations are now looking at storage as an ideal way to store excess or unused solar power for on-peak use. This not only reduces cost but it also cuts carbon and helps an organization achieve carbon reduction commitments and goals. This double-bottom-line includes both clean power to improve their green footprint with a new solar installation, but also an energy system that could manage and preserve assets within the building, including lighting, life support systems, and HVAC. The energy storage battery adds a resilient DER to the facility to prevent against outages that could put occupants at risk, keeping everyone safe and comfortable.

One megawatt equals 1 million watts of battery energy storage of either lithium-ion or flow battery technology that will integrate seamlessly with legacy power systems, creating an additional DER for the facility to draw upon to maintain power efficiency and reliability. Integrated with DSO software, the campus or facility is able to monitor and control power usage remotely to ensure they are meeting their green energy goals – chiefly to cut energy consumption and lower the cost of energy. DSO is able to monitor and forecast the PV system, in addition to monitoring the energy storage system as a whole. Include electric vehicle charging stations in this clean energy ecosystem and you have further ways to use clean energy to power vehicles for carbon-free transportation. Trusted technology systems and software along with engineering services ensure safe utility-grade performance.

The value of DSO comes from managing DERs of grid-connected assets. The DSO platform remains versatile in monitoring and controlling DERs, not only in non-islandable microgrids, but also when controlling islandable grids or just multiple DERs. Some microgrid