Microgrids: Possibilities and Challenges

By Cindy Miller and Ernest Leaf

Microgrids are being considered as a possible solution for many reliability and resiliency problems. A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

There are thought-provoking possible uses: military bases, which are exempt from state regulation and have their own generator to use; public purpose microgrids; use for disaster-prone areas. This last area is one that seems especially worth considering in states like hurricane-prone Florida and wildfire-prone California.

In areas where natural disasters are common, microgrids make a lot of sense. When the generation of electricity is moved out to the end user, the risk to the end users losing power is less. A centralized system with large power plants, main transmission lines and then the distribution feeders means the risk to the overall system is centralized. One large event will take out all the users downstream of the event. Without microgrids and distributed energy, all the system eggs are in a few baskets, so to speak. More end users will stay online with more microgrids distributed throughout the system.

Regulatory issues are surfacing, primarily focused on the principle of the cost causer paying for a benefit, rather than the entire body of ratepayers paying for it. In our opinion, the advantages of the microgrid should be considered. Where there are benefits to the grid, these benefits should be recognized and compensated accordingly. We recognize that this is not a simple matter. Legislatures in disaster-prone areas may want to consider special treatment where utilities provide microgrids. Also regulatory clarity generally is needed.

Utilities are in a position to thrive in the microgrid trend. A host of advantages comes with this involvement, including corporate responsibility for fostering low-carbon renewable energy generation and improved system reliability. Distributed energy and associated microgrids are at a competitive price point, leading a powerful trend driven by utility stakeholders, electric vehicle development, environmental pressures, smart cities initiatives and smart devices (the internet of things). Utility partial or complete ownership of microgrids rose 400 percent between 2014 and 2018.[1]

A microgrid is a distributed energy resource – powered by a local generation source, be it a renewable source such as solar or wind or by a diesel generator, natural gas microturbines, or a biomass turbine and generators – that can be islanded or operated without the energy grid.

Microgrids are of special interest in Florida for power recovery of critical facilities after major storm events. There are a few – solar plus storage systems, such as the SunSmart E-Shelters program at the University of Central Florida. Resiliency is a driving force behind microgrid development. Some primary benefits are: solutions for system bottlenecks; resiliency/reliability of power to customers; grid voltage and frequency support; and reduced system losses by providing generation closer to loads.

However, the addition of distributed energy to the grid may lead to uncontrollable step loads, harmonics, power imbalances and other issues. Thus, a loss of stability to the grid as the percentage of inverter-based sources increases is an issue. Also, the financial picture of microgrids is cloudy. Who pays for them? Who owns them? How can utilities negotiate the complex regulatory environment to include them into the rate base? What's the benefit to ratepayers if a utility builds a microgrid for a small number of customers?

There are a few regulatory hurdles. Regulations are a key determining factor on how quickly the opportunities can be realized. Microgrids can be defined as generation. But the regulations regarding how distribution utilities can interact with them may need to be revised. They need to define how energy storage, which can be classified as both energy load and generation, should be treated.

[1] "Utilities Should Consider the Emerging Microgrid Market," Relay Magazine. Florida Municipal Electric Association, Volume 52, Issue 3, Spring 2020.

How can distributed energy assets be included in the rate base? If there is a system balancing aspect to them, does it alter their classification?

It does appear that it is worthwhile to explore microgrids and utilities could use their access to customers to creatively employ microgrid solutions. For example, they could combine multiple customers to supply resiliency on a larger scale that customers could not build for themselves and gain the benefits of economy of scale.[2]

Tallahassee municipal utility example

Municipal electric utilities are not subject to the same regulations as investor-owned utilities, and therefore may have more flexibility on using microgrids. In a May 2020 interview with David Byrne, Assistant General Manager of the City of Tallahassee electric utility, Byrne described how the power station near Tallahassee Memorial Hospital was designed to be back-up supply for the services there. There is a substation and distribution line. Station #12 only has one transmission line along the adjacent road. The area was subject to interruptions. Yet building another transmission line in the area was daunting – there was no room, lots of trees, and a high cost.

The solution was to produce power at the substation. The generator provides power directly to the substation and can serve. The decision goes back about five years. The City worked with Tallahassee Memorial Hospital as the primary beneficiary. It was put in service in 2018. It has been very efficient with fast start-up in less than five minutes. It is by Wartsila, a Finnish company. It is operated remotely from one of the other power plants.

It appears to be a microgrid because it can be separated from the rest of the system. If transmission goes down, the substation can operate on its own. It can be switched to "island mode." It can be disconnected from the transmission if

[2] On October 27, 2020, Tampa Electric Company filed a petition for approval at the Florida Public Service Commission of a direct current microgrid pilot program and for a rule variance. The "Block Box Energy System" would provide power to approximately 37 homes. The system interconnects the Block Box at each home into a network of neighborhood Block Boxes, each built by Lennar Homes Inc. as part of a housing development. Each home is also equipped with rooftop photovoltaic solar panels. The solar panels are directly connected to the Block Box and do not serve only that home. Tampa Electric requests that the assets installed for the systems be afforded rate base treatment and that O&M expenses incurred by Tampa Electric be recoverable as base rate revenue requirements.

there is a good reason to do so. It can really help with reliability issues. They do initially cost more money and there could be regulatory issues.

Byrne concludes that "wherever you have a back-up generator, you have the potential of a micro-grid and to be able to 'island off.'" He said it is a better economic choice. The power supply would have been built elsewhere – so there are "two benefits for the price of one." There is the reliability benefit and the power supply benefit.

Regulatory considerations

In talking with people in the industry at a recent National Association of Regulatory Utility Commissioners conference, it became clear that there is the concern about whether all ratepayers of an investor-owned utility can be charged for a microgrid that some may argue only affects a segment of the ratepayers.

The Smart Electric Power Alliance (SEPA) issued a 2019 report, "Microgrids: The Role of Microgrids in the Regulatory Compact."[3] The 16-page report states, "Given the lack of both regulatory familiarity and utility experience with microgrids, understanding how to justify them as a grid asset can be challenging." They said that few business case examples exist that clearly demonstrate value to both participants and non-participants from a regulatory perspective. The key distinguishing feature of a microgrid versus other integrated distributed energy resources (DERs) is its ability to island from the grid and provide resiliency.

Microgrids are often used to provide back-up power to community resiliency hubs or critical infrastructure. These applications are often seen as for the public good contributing benefits to all ratepayers. However, valuing these benefits is difficult. The National Association of Regulatory Utility Commissioners (NARUC) in partnership with Converge Strategies LLC concluded that resilience benefits are acknowledged but quantifying the benefits is challenging.[4]

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[3] "Microgrids: The Role of Microgrids in the Regulatory Compact." Smart Electric Power Alliance. 2019. https://sepapower.org/resource/microgrids-the-role-of-microgrids-in-the-regulatory-compact/

[4] "The Value of Resilience for Distributed Energy Resources: An Overview of Current Analytical Practices." Prepared for The National Association of Regulatory Utility Commissioners by Converge Strategies LLC. April 2019. https://pubs.naruc.org/pub/531AD059-9CC0-BAF6-127B-99BCB5F02198

The SEPA report says that this inability to effectively value resilience has already impacted the success of microgrid development in several utility rate cases. In 2018, three utilities proposed multi-customer microgrid projects to their state regulators. The projects would have cost around $105 million to ratepayers, but would have added resilience benefits to the grid.

According to the SEPA Report, he Maryland Public Service Commission considered two multi-customer microgrid proposals but rejected them on the grounds of unequal distribution of benefits to ratepayers and the inability to quantify resilience benefits.

However, the Illinois Commerce Commission approved the Bronzeville Community Microgrid, a $25 million project that demonstrated a shared utility multi-customer microgrid business model in the U.S. The ICC noted community learning benefits as grounds for its approval. The remaining cost to ComEd after a $5 million grant from the U.S. Department of Energy "is being socialized across all ratepayers," according to the Smart Electric Power Alliance article.

Jurisdictions are just beginning to consider this topic. In 2018, California enacted legislation calling for the California Public Utilities Commission to develop microgrid regulations. In 2019, Hawaii state regulators, the Hawaiian Electric Company (HECO) and other stakeholders began investigating a tariff for third-party microgrids to reduce regulatory barriers while helping on reliability. The tariff includes provisions for microgrid owner compensation and requirements to streamline the interconnection process. [5]

Maryland Public Service Commission orders

As stated above, there are examples of microgrid proposals being rejected by a state commission. In 2016, the Maryland Public Service Commission rejected a proposal by Baltimore Gas and Electric for approval of its public purpose microgrid proposal. Order No. 87669 issued July 19.2016.[6] The Commission noted the potential of public purpose microgrids to improve reliability and

[5] https://microgridknowledge.com/microgrid-tariff-hawaii/

[6] In the Matter of the Baltimore Gas and Electric Company's Request for Approval of Its Public Purpose Microgrid Proposal. Public Service Commission of Maryland. Case No. 9416. Order No. 87669. July 19, 2016. http://www.psc.state.md.us/wp-content/uploads/Order-No.-87669-Case-No.-9416-BGE-Microgrid-Order-.pdf

resiliency and to facilitate the incorporation of new, sustainable technologies into the distribution network. However, the Commission found it not in the public interest in several aspects, including the site selection process, cost recovery and associated ratepayer impacts.

In 2018, "In the Matter of the Merger of Exelon Corporation and Pepco Holdings,"[7] the Commission again rejected a proposal for a microgrid. In particular, the Commission was concerned that the proposal would recover all microgrid costs solely from its Maryland customer base. The Commission noted the benefits of microgrids to connect to and disconnect from the larger distribution system, to operate as part of the larger grid or independently – in "island mode" mode – without sustained loss of service to customers when there is an interruption or other grid disturbance.

The microgrid participants included multiple grocery stores, gas stations, a pharmacy, a fire station, a police station, a hotel, a Metro station, and several local government and other community facilities which can act as secondary locations to accommodate the public during periods of prolonged outages. Pepco anticipated that the uninterrupted operations of these participants would enable the microgrids to offer essential services to approximately 280,000.

Each microgrid would feature a distributed energy resource (DER) mix of solar photovoltaic arrays, natural gas-fired generation and battery energy storage systems to individuals within a five mile radius. The Company did not identify any additional sources of funding, private or public. Instead, Pepco would seek to recover costs, net of any available grant monies, in a future base distribution rate case, subject to a prudency review. The monthly bill impact on a typical residential customer using 81 kWh per month was not expected to exceed $0.36 per month, when levelized over 20 years.

The lack of microgrid participant contribution was a main concern of the Maryland Commission. Under the cost causation principle, a principle widely used in public utility ratemaking, the concept of "beneficiary pays" requires that rates for service reflect the costs actually caused by the customer who must pay

[7] In the Matter of the Merger of Exelon Corporation and Pepco Holdings, Inc. Public Service Commission of Maryland. Case No. 9361. Order No. 88836. September 17, 2018. https://www.psc.state.md.us/wp-content/uploads/Order-No.-88836-Case-No.-9361-Pepco-Microgrid-Order.pdf

those rates. The Commission found that the proposal was not in the public interest with regard to cost recovery and ratepayer impacts and cost effectiveness. Therefore the Commission denied the proposal.

California Public Service Commission order

The California Public Utilities Commission, on the other hand, is doing all it can to expedite the use of microgrids.[8] The Commission (CPUC) ordered large investor-owned utilities to engage in multiple planning exercises in order to accelerate the deployment of microgrids within their service areas.

Southern California Edison was ordered to submit a series of reports and plans tied to their progress toward adopting new resiliency programs and supporting microgrid deployment. They must report to the CPUC their progress toward establishing pre-approved templates for microgrid interconnection, specify when a virtual inspection may suffice in place of a field inspection, and plan semi-annual public workshops to help residents better understand grid operations. [9]

This California Public Utilities Commission "Decision Adopting Short-Term Actions to Accelerate Microgrid Deployment and Related Resiliency Solutions " adopted solutions to accelerate interconnection of resiliency projects due to the wildfire season. The large investor-owned utilities must: (a) develop and implement standardized pre-approved system designs for interconnection of resiliency projects to deliver energy services during grid outages; (b) develop and implement methods to increase simplicity and transparency of the processes by which the utilities inspect and approve a project; and (c) prioritize interconnection of resiliency projects for key locations, facilities, and/or customers.

The California decision required the large investor-owned utilities to modify their net energy metering tariffs to allow storage devices to charge from the grid

[8] The California Legislature enacted legislation in 2018 relating to microgrids. See, e.g., Chapter 4.5 added by Stats. 2018, Ch. 566, Sec. 2.
https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PUC&sectionNum=8372.&highlight=true&keyword=microgrid

[9] Decision Adopting Short-term Actions to Accelerate Microgrid Deployment and Related Resiliency Solutions." Order Instituting Rulemaking Regarding Microgrids Pursuant to Senate Bill 1339 and Resiliency Strategies. Rulemaking 19-09-009. June 17, 2020.
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M340/K748/340748922.PDF

during the pre-public safety power shut off window. Also, the utilities were required to modify their net energy metering tariffs to remove storage sizing limits.

The California Commission also emphasized collaborative engagement between large investor-owned utilities and stakeholders.

A part of the Commission's staff proposal was aimed at reducing the amount of time required to interconnect distributed energy resources including microgrids. The purpose was to increase resiliency of electric service during widespread outages while maintaining the safety and reliability of the grid.

Are Microgrids an Answer to Reliability Issues in Disaster-Prone States?

A key question remains as to how to encourage microgrid deployments without shifting costs between ratepayers. If this regulatory consideration can be overcome, does it make sense for disaster-prone states to pursue microgrids as swiftly as possible? In our opinion, it does.