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Electric vehicle fleets: Reliability in the face of adversity

White Paper

I. Disaster response for electrified fleets

The expanding role of public transportation - Evacuation
The most critical role for public transportation during a natural disaster is evacuation, and with transportation's electrified future, it is critical to keep the power flowing as long as possible to enable the most effective response.

When Three Mile Island occurred, people from 40 miles away evacuated[1], when Irma hit the Florida coast a half-million people evacuated from Miami-Dade County to Georgia, South Carolina and North Carolina. In 2019 200,000 Californians were evacuated ahead of wildfires.[2] FEMA worked with both public and private (charter) bus transportation to evacuate people to safety and afterwards return them home.

The role of transit during a natural disaster
The Post-Katrina Emergency Management Reform Act of 2007 authorized the use of federal funds to develop catastrophic mass evacuation plans. Both public transit authorities and charter companies can be used by FEMA during a mass evacuation. Mitigation, preparedness, response, and recovery are the basic steps to action but, if you have an electric fleet, nothing happens without planning to keep the power on as long as possible to enable the longest possible response period and to turn the power back on for a quick recovery.

The ability to respond to natural disasters for electrified transit authority fleets, or emergencies of any kind for an electrified fleet, is completely reliant on the integrity of the electrical infrastructure, reliability of (power distribution or electric vehicle charging) hardware, and the safety of the employees. Any issues in these areas will curtail services and responsiveness; therefore, being prepared is critical and maintaining power for the operation is imperative.

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Preparedness

No matter where your transit depot operation is located in the world, at some time you will have to prepare for, respond to, suffer through, and recover from a natural disaster. In 2019 the California wildfires caused PG&E to cut power from October 9 through November 1, imposing 10 intentional blackouts to prevent infrastructure from sparking a wildfire.[3] Approximately 36 counties and two million residents and businesses were affected. Santa Clara County, home of Silicon Valley, declared a state of emergency highlighting the need for reliable power. This is just one example of how a combination of climate conditions can wreak havoc on the grid. Weather can be completely unpredictable, so how do you respond when it causes power outages?

The US has more electrical grid blackouts than any other developed nation, and outages lasting more than an hour have been increasing over the last decade.[4] If the blackout is not caused from excess demand, a transmission line may be the problem like in the blackout of 1965 when 30 million people were left in the dark for 13 hours because of a 230 kV transmission wire which caused a power surge and shutting off power to a grid distribution territory that encompassed 80,000 sq. miles. Or, it may just be a software glitch like the power outage of 2003 that left 55 million people without power for two days[5]. Or, a major hurricane like Sandy or Maria that left millions of customers without power for 10 days. With distributed energy resources (DERs) such as renewable energy, batteries, and EV chargers evolving to deliver power to businesses and vehicles, public transit and charter bus companies are able to operate longer and recover more quickly.

Microgrids/DERs can be customized to specific size and needs. Whether you call it a microgrid, nanogrid, or just an aggregation of DERs, these can add reliability and resilience to everyday operations or operations under difficult circumstances.

II. Microgrids/DERs

Advantages of microgrids and DERs. Through technical innovation, regulatory evolution, and cost declines, customers have more options available to take control of their electricity supply to help reduce their electricity costs, improve their electricity supply reliability, and impact their carbon footprint through the use of renewables.

Microgrids can incorporate various hardware and software to provide reliability, flexibility and resilience—in short, they provide options. A microgrid can provide a depot fleet with reliable power, lower energy bills, aid utilities in managing peak load and controlling where the energy is sourced by incorporating renewable energy into the power mix. Both microgrids and DERs provide a way to balance the need to meet carbon emission reduction targets while ensuring reliable power during times when renewable energy is not available. Also, they ensure increased protection from losing power during natural disasters since they don't have to rely on power supply being fed through miles of above-ground wires and assets that need maintenance and repair after the effects of climate or other natural disaster event. In addition, modern technology enables microgrid/DER energy-management optimization, improved efficiency, economics, and resilience in the face of disaster recovery.

Can your operation benefit from a microgrid/DER?

Questions to ask:

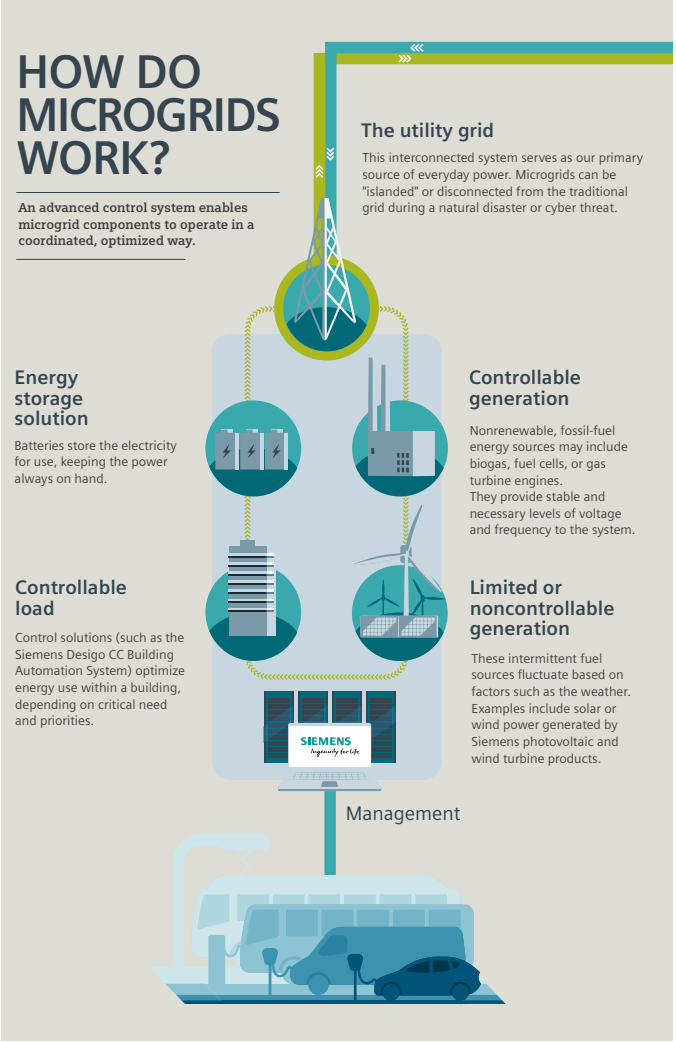
- **Does the operation need a continuous power source, the ability to balance loads against changing power needs?**
  Microgrids/DERs offer both reliability and flexibility.
- **Does the operation need stability in bad weather?**
  Microgrids aren't dependent on the central grid, offering resiliency. An operation can use the central grid as the primary source of energy but, during a disaster or cyberthreat, can operate in islanded mode--as a stand-alone power source ensuring continued operation. Or, the right combination of DERs can serve to keep an operation running during a power outage.
- **Does the operation need energy security?**
  In today's world of cyber threats like malware and computer viruses microgrids/DERs are easier to keep safe. When power is generated locally rather than transmitted from one central utility source, it is easier to manage and protect that distributed energy from cyber invasion, as well as physically, with the right control system.
- **Does the operation need to reduce costs or reduce carbon emissions?**
  If the operation has an electrified fleet, Total Cost of Ownership (TCO) is already reduced because EV maintenance costs and energy costs are saving money, but there are more savings that can be captured. Simple load and energy management software allows optimization of power usage based on demand, utility prices, and other factors. Microgrids can also store and incorporate renewable energy, thus, reducing carbon emissions.
- **If "no" is the answer to any of these questions, then ask "Does the operation provide critical services that would be needed during a natural disaster?"**
  If a fleet would be needed to move people out and away from a disaster area, resiliency is critical to the fleet, especially if it is an electric-based fleet. Microgrids/DERs can ensure operations continue in the face of adversity and get people to safety.

How do Microgrids/DERs work?

A microgrid connects to the central grid and maintains voltage at the same level as the central grid unless there is some sort of problem on the grid, or there is a reason to disconnect. A switch can separate the microgrid from the main grid automatically or manually, and it then functions as an island. DERs can provide energy while disconnected from the central grid as well. A building or system of buildings can be linked to optimize different energy sources based on customer needs and grid demands. An additional benefit from local generation is reduced transmission loss which can be as much as 2%-13% of power released from a plant.[6]

Microgrids and DERs require expertise.

When disaster strikes, and the operation is under stress, the confidence that the fleet can meet the community's needs and recover efficiently is priceless. Choosing a partner with the experience and expertise ensures consistent reliability of the fleet to respond when needed.



Siemens can tailor an on-site energy solution specifically around an organization's goals and infrastructure. Companies like Siemens who have over 170 years of experience in world-wide electrification, breadth of hardware, and the ability to build and service microgrids can make a complex infrastructure seem as simple as playing with Lego® toys. Their expertise in eMobility makes Siemens an ideal partner for fleet improvements with their complete portfolio of offerings to enable PlugtoGrid™ solutions which include EV chargers, electrical distribution make-ready hardware, and managed services devoted to eMobility and customer service.

Siemens' extensive experience in electrification offers one-stop shopping for the customer who needs peace of mind when venturing into uncharted technology.

Siemens can customize, build, and maintain any microgrid, DER or eMobility solution.

Footnotes

[1] Erin Blakemore, "How the Three Mile Island Accident Was Made Even Worse By a Chaotic Response," history.com (March 27, 2019).

[2] Alex Johnson and Ben Kesslen, "Northern California wildfires force nearly 200,000 people to evacuate," NBC News (October 27, 2019).

[3] Andrew Hay, "Explainer: California faces decade of 'unique' wildfire blackouts," Reuters, (November 22, 2019).

[4] Megan Clark, "Aging US Power Grid Blacks Out More Than Any Other Developed Nation," International Business Times, https://www.ibtimes.com/aging-us-power-grid-blacks-out-more-any-other-developed-nation-1631086 Accessed February 3, 2020.

[5] "9 of the Worst Power Outages in United States History," Electric Choice, https://www.electricchoice.com/blog/worst-power-outages-in-united-states-history/ Accessed on February 3, 2020.

[6] Nick Stumo-Langer, "How Microgrids are Reducing Energy Costs and Increasing Reliability," Aquicore, https://ilsr.org/how-microgrids-are-reducing-energy-costs-and-increasing-reliability/ Accessed on February 4,2020.

Published by
Siemens 2020

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Order No. SIDS-M40032-00-4AUS

Printed in USA

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