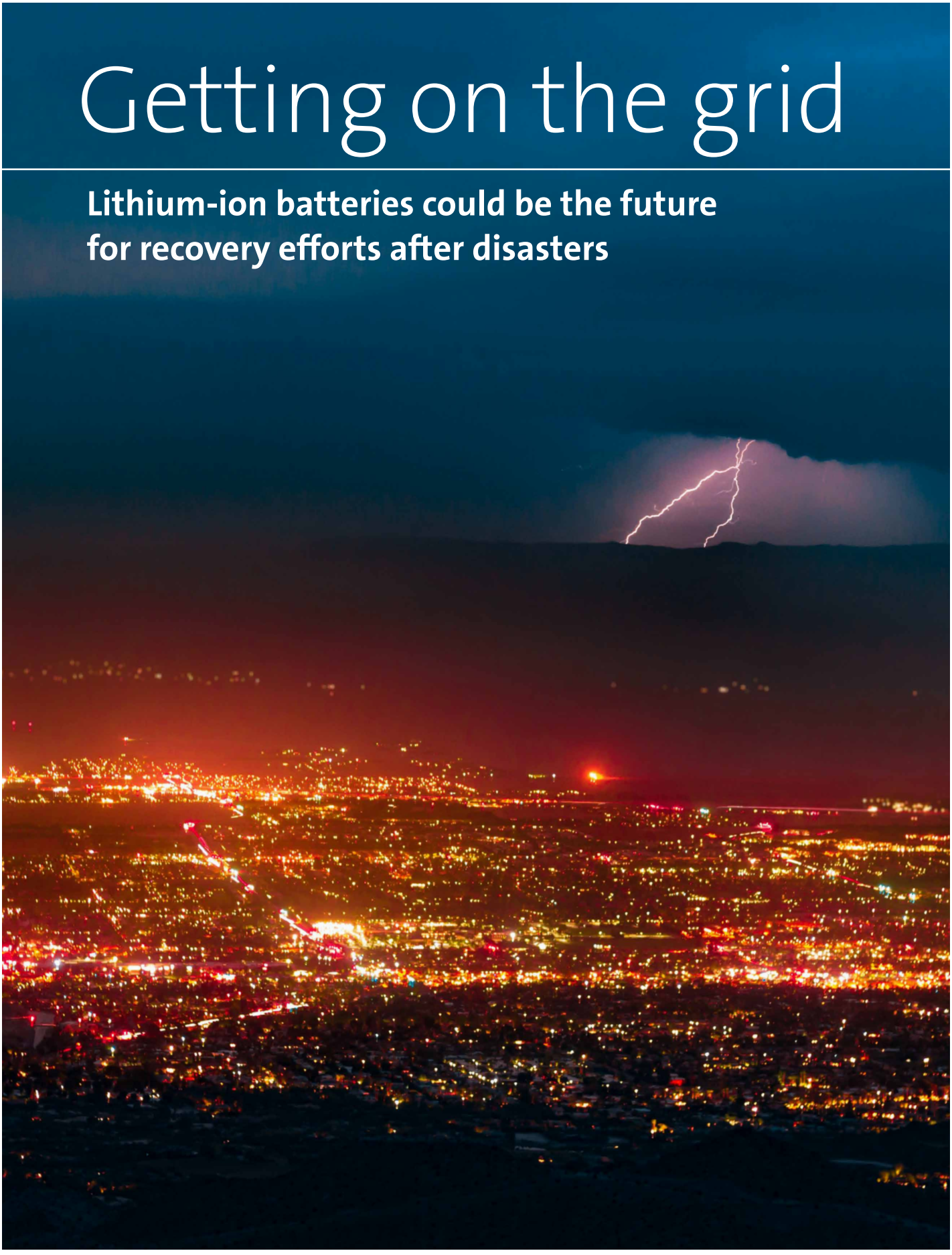
Getting on the grid

Lithium-ion batteries could be the future for recovery efforts after disasters



By Kathleen Furore

Several months after hurricanes dealt a one-two punch to Puerto Rico, recovery still floundered in many areas.

"In Puerto Rico, roughly 150,000 homes and businesses are still waiting for electricity. That's 11 percent of the island's customers," NPR reported in March. "Many have been waiting since before Hurricane Maria when Hurricane Irma grazed the island."

Houston was struck by nearly $200 billion worth of damage caused by Hurricane Harvey in August 2017. More than 100,000 homes were damaged in historic flooding and hundreds of thousands were left without power in the wake of the storm.

The onslaught of last year's hurricanes and wildfires was unprecedented. But severe weather events will continue, as will more common events such as thunderstorms and ice storms, which also can wreak havoc on an area's electrical supply.

Can cities avoid long-lasting outages that can have a debilitating impact on the families, schools, hospitals and businesses in a storm's path?

A microgrid — "localized grids that can disconnect from the traditional grid to operate autonomously and help mitigate grid disturbances to strengthen grid resilience," according to the U.S. Department of Energy — is one solution that holds promise, whether on the mainland or in more remote locales.

"Microgrids, including energy storage systems with lithium-ion batteries, can be important and resilient energy sources," says Kenneth Boyce, principal engineer director for Energy and Power Technologies at UL. "They are especially impactful when used to help hard-hit locations withstand and recover from events causing severe or long-term power outages."

Why lithium-ion?

Lithium-ion technology, the same technology used to power laptops and cellphones, is the most popular chemistry used in batteries today, because of the advantages it offers — the amount of energy in its footprint chief among them, Boyce says.

Lithium has unique properties that make it especially useful for batteries. According to PowerScout, a California company that designs smart-home products that help conserve energy: "Lithium is the lightest of the six alkali metals, has the greatest electrochemical potential and provides the largest energy density for its weight."

In other words, "it is a very powerful and effective way to have energy stored," Boyce says.

Grid benefits

Because they can operate while the main grid is down, microgrids can help mitigate grid disturbances; they also can function as a grid resource for faster system response and recovery.

Another plus, microgrids "support a flexible and efficient electric grid by enabling the integration of growing deployments of distributed energy resources such as renewables like solar," the U.S. Department of Energy notes.

"The idea of coupling an energy source like solar and an energy source like lithium-ion creates a synergy so you can locally generate and store power," Boyce says. "It can be a stationary product — solar panels on a roof for example — or it can be a mobile storage system, so you have more flexibility in case of a catastrophic event."

Clearly, microgrids of lithium-ion

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batteries can be powerful energy sources that facilitate recovery in the event of severe, long-term power outages due to their high energy density, as well as their charging and discharging efficiency.

But recent reports of smartphone fires, exploding laptops and smoldering hoverboards, all of which involved lithium-ion batteries, have raised safety concerns about the batteries' potential for unwanted ignition.

Just how big is the risk of fire in lithium-ion battery-powered microgrids? And what steps can be taken to ensure the safety of the batteries when used in a microgrid application?

"Lithium-ion batteries are very effective and generally have a low failure rate. However, they can be susceptible to faults that can cause ignition or explosion, as we have seen in the news many times," Boyce says. "UL has been diligently working for many years in many ways to expand battery safety science, so we understand what causes those faults and how we can proactively assess battery systems to demonstrate that hazards have been addressed."

Safety testing

UL has engaged in extensive scientific research, testing to rigorously assess battery systems, and development of many standards, which "include the world's first safety standard for energy storage systems" — all in an effort "to promote the safe and sustainable use of batteries and energy storage technologies," Boyce says. "Products that bear the familiar UL Mark have been assessed to show compliance with those important safety requirements."

Fire departments across the country are proactively preparing for any fires caused by lithium-ion batteries, although the size of an emergency recovery system can present a new set of problems.

Ronald Spadafora, the New York Fire Department's chief of fire prevention, says that today's large-scale power supplies should be approached cautiously, even during a recovery effort.

"We have to prepare for these new systems because we know that they're going to be the future for large buildings, but we have to make sure we're considering how we can keep these systems safe," Spadafora says. "Even a temporary system needs to be properly installed and operated. We can cut down on incidents by making sure that we're following proper procedure."

Spadafora says the issue with lithium-ion batteries is that an overheated cell can cause nearby cells to overheat at various rates. A large system of batteries can be destroyed in a small amount of time or can take hours, meaning it's important to put the fire out as quickly as possible.

Peace of **mind**

AN EMERGENCY POWER supply isn't just for large-scale emergency efforts. It can also be a key component of individual recoveries.

After losing power last year, Joseph Marion bought a solar-powered power pack, an eco-friendly alternative to portable generators, for his home in Fort Myers, Fla. These power packs can cost anywhere from $150 to $3,000.

For Marion, who purchased a $1,500 model, the cost is a small price to pay for a little extra peace of mind.

"I'm not someone who holds out during storms, but I'm not going to head out of town if there's a bunch of thunder and lightning," says Marion, 72, a retired pipefitter from Franklin Park, Ill. "Having a power pack gives me a little extra time to get my things together and to make sure everything is secure if I have to head up to Georgia or something."

Private power

In the aftermath of the 2017 hurricanes in Puerto Rico, private firms stepped in to help by creating microgrids to restore power to remote areas. Boyce says these microgrids are good examples of the incredible potential at play here.

"There was a lot of damage to the infrastructure there, so energy storage systems and solar panels were used in a Lego-style approach to find solutions where power was most needed," Boyce says. "Puerto Rico shows how you can customize these systems to meet a particular need."

Last year, Tesla used its batteries and solar panels to restore power to a children's hospital in San Juan. Tesla tweeted that it was "the first of many" solar plus battery projects going live in Puerto Rico.

In February, sonnen, a Los Angeles-based company that manufactures renewable-energy products, announced the commissioning of a solar and battery storage microgrid in collaboration with Pura Energía, its local energy partner in Puerto Rico. Together, the two companies worked to power a school in the remote town of Orocovis. Sonnen and Pura Energía also installed microgrids on the island in community and relief centers, food distribution centers and other locations.

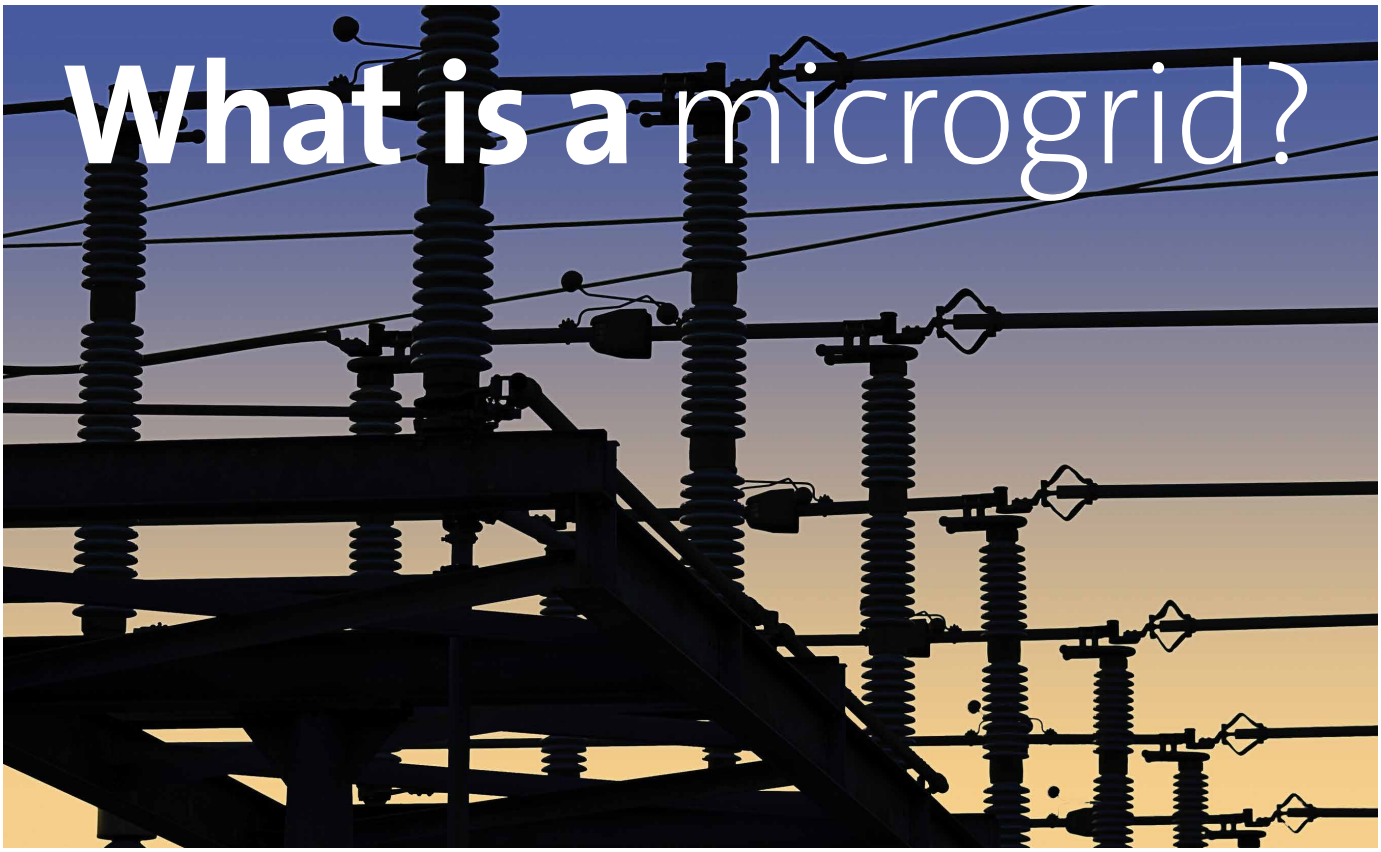
The examples showcase the potential integrated renewable energy systems have when catastrophes strike and beyond.

"These microgrids effectively form the blueprint for more than just recovery, but for preparation for islands and regions around the world that are susceptible to natural disasters and power outages," Adam Gentner, sonnen's director of business development, Latin American expansion, said in a statement.

—Kathleen Furore is a freelance contributor

Tesla battery bank in Ontario. The bank was installed in three months.

What is a microgrid?



A MICROGRID IS A LOCAL ENERGY GRID with control capability, which means it can disconnect from the traditional grid and operate autonomously.

How does a microgrid work?

The grid connects homes, businesses and other buildings to central power sources, which allow people to use appliances, heating/cooling systems and electronics. But this interconnectedness means that when part of the grid needs to be repaired, everyone is affected.

This is where a microgrid can help. A microgrid generally operates while connected to the grid, but importantly, it can break off and operate on its own using local energy generation in times of crisis like storms or power outages.

A microgrid can be powered by generators, batteries and/or renewable resources like solar panels. Depending on how it's fueled and how its requirements are managed, a microgrid might run indefinitely.

How does a microgrid connect to the grid?

A microgrid connects to the grid at a point of common coupling that maintains voltage at the same level as the main grid unless there is some sort of problem on the grid or other reason to disconnect.

A switch can separate the microgrid from the main grid automatically or manually, and it then functions as an island.

Why would a community choose a microgrid?

A microgrid not only provides backup for the grid in case of emergencies but can also be used to cut costs or connect to a local resource that is too small or unreliable for traditional grid use. Microgrids empower energy consumers to use energy in the best way to suit their needs and priorities.

A microgrid allows communities to be more energy-independent and, in some cases, more environmentally friendly.

—U.S. Department of Energy

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