Bloomenergy®

THE VALUE OF MICROGRIDS

Challenges and Opportunities

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The Value of Microgrids: Challenges and Opportunities

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Today's energy landscape is riddled with challenges. This is unfortunately fitting with the many difficulties 2020 has delivered.

The rising frequency and severity of extreme weather events in recent years has underscored the need for greater energy resiliency – for our power grid, for our businesses, and for our communities.

In 2020 alone, tornadoes ripped across the US from Texas to Maine, knocking out power to an estimated 9.3 million Americans. A short while later, Hurricane Isaias ravaged the east coast, keeping 13.8 million people in the dark, some for multiple days.

Over on the west coast, California faced an unprecedented week-long heat wave that plunged the state into its first rolling blackouts in nearly 20 years, with 1.2 million people forced to face the heat without electricity. Separately, the state's planned Public Safety Power Shutoffs (PSPS) to stymie fire risk are expected to continue for the next decade and have already caused multi-day outages for over 3 million Californians since 2019.

Meanwhile, the COVID-19 outbreak is reminding us how globally interdependent society is, revealing just how vulnerable we are to disruptions that impact the production and distribution of goods and services. Communities and businesses are learning that they must be locally resilient to survive. Localizing critical services such as food and hardware supplies, as well as medical and manufacturing services is necessary to serve communities when global supply chains are disrupted.

Much like these critical services must be localized, so must one of the most important products we constantly rely on – electricity.

For businesses and communities alike, implementing localized microgrids to supply reliable and resilient electricity is now a strategic imperative.

Microgrids: Investing in Your Energy Supply

From planned outages in the west to storm-induced outages in the east, these high-impact, high-cost ramifications of power disruptions have elevated the discussion around energy independence and the essential role microgrids play in combating this new normal.

Businesses are becoming increasingly aware of how power reliability issues are impacting their bottom lines, and are both seeking and willing to pay for solutions that guarantee reliable power.

According to S&C's 2020 State of Commercial & Industrial Power Reliability Report, almost a quarter of the [surveyed C&I] companies experienced outages once a month or more, but, astonishingly, almost one-third (29%) of the companies estimated losses of $2 million or more per outage event.

This shows that power outages have a huge impact on businesses, leading to tangible expenses and ongoing business disruption.

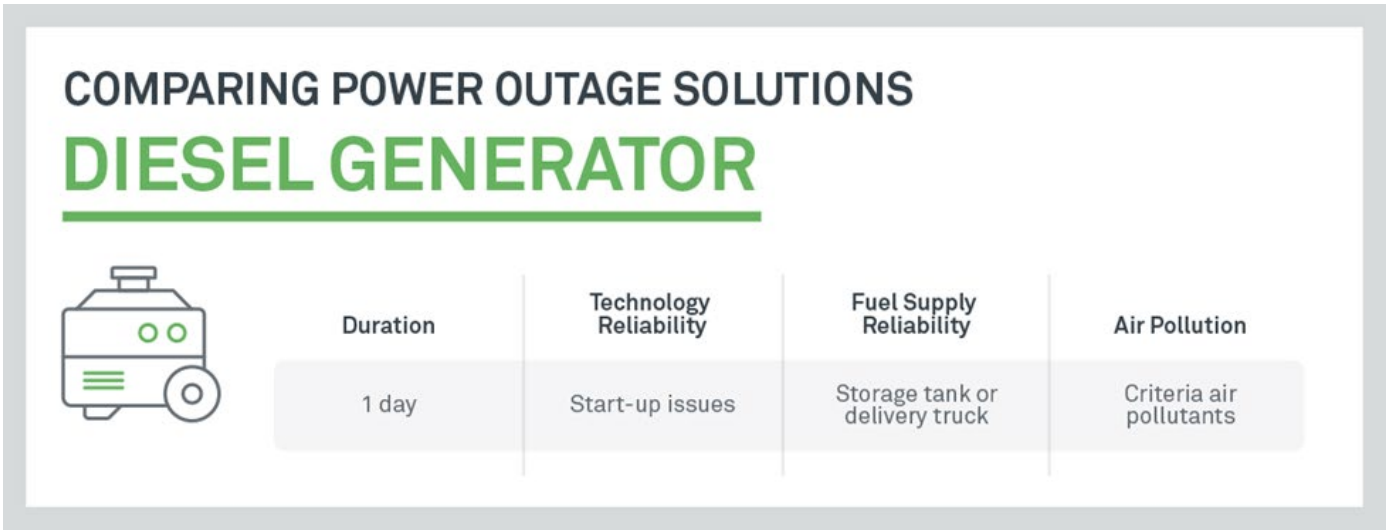
The same report shows companies recognizing that reliability pays back. One-third of companies (36%) plan to invest in energy supply. Ensuring reliability is one of the top objectives mentioned by 72% of these companies.

Companies have recognized the problem and are willing to invest into reliable energy and reduce their exposure to energy-related risk.

Diesel Generators are Not the Answer to Today's Energy Challenges

The solution that most often comes to mind is a diesel backup generator. However, over-reliance on diesel generators is a hasty reaction that worsens air quality, public health, and quality of life.

Worse still, this traditional, outdated solution threatens climate change goals and is ill-suited to the power reliability challenges we now face.



Typical diesel generator exhaust contains more than 40 toxic air contaminants, including a variety of carcinogenic compounds. The California Air Resources Board estimates that an uncontrolled one-megawatt diesel engine operating for only 250 hours per year would increase the cancer risk to residents within one city block by as much as 50 percent.

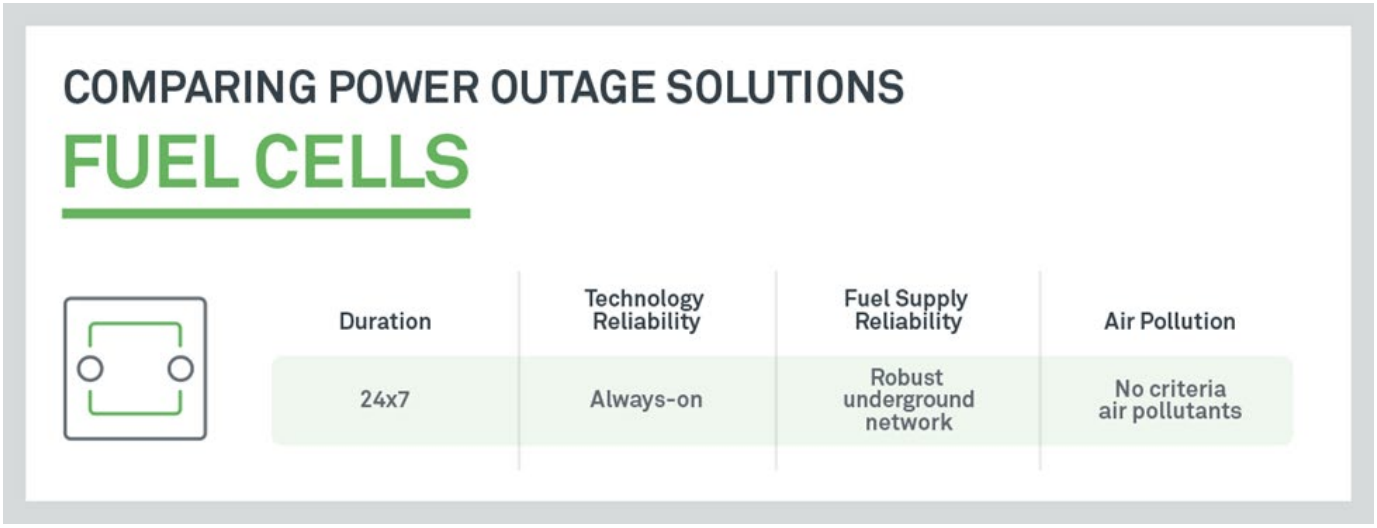
But what happens as power outage emergencies become more frequent and longer-lasting (often multiple days)?

Diesel generators rely strictly on stored or delivered fuel to run, which creates significant vulnerability during major disasters. According to the National Renewable Energy Laboratory, long outages "often coincide with abnormal conditions such as extreme weather events, which can close roads and impede normal transportation."

The same wildfire, storm, or flood that prevents cars from driving on the roads – a situation which occurred during the Camp Fire – prevents fuel trucks from resupplying dwindling diesel tanks.

Because diesel generators are idle assets that sit unused 99% of the time, they also face a high risk for start-up failures without diligent, continuous maintenance. During Hurricane Sandy, 16 percent of emergency medical services organizations reported diesel generators not performing as expected, according to the American College of Emergency Physicians.

Unlike diesel generators, Bloom Microgrids powered by fuel cells are not idle assets – they are always on, providing 24/7 power and value.



For customers looking to keep their business running through prolonged PSPS outages, disasters, and whatever else a changing climate may bring, diesel generators carry too high a community cost, and simply do not provide the level of reliability that a well-functioning business demands.

Policy and Embracing the Microgrid Opportunity

As stated above, businesses are ready to invest in microgrids to safeguard operations and ensure their community has access to safe and reliable power when it's needed most. S&C states 51% of companies validated their organization is becoming more dependent on reliable energy.

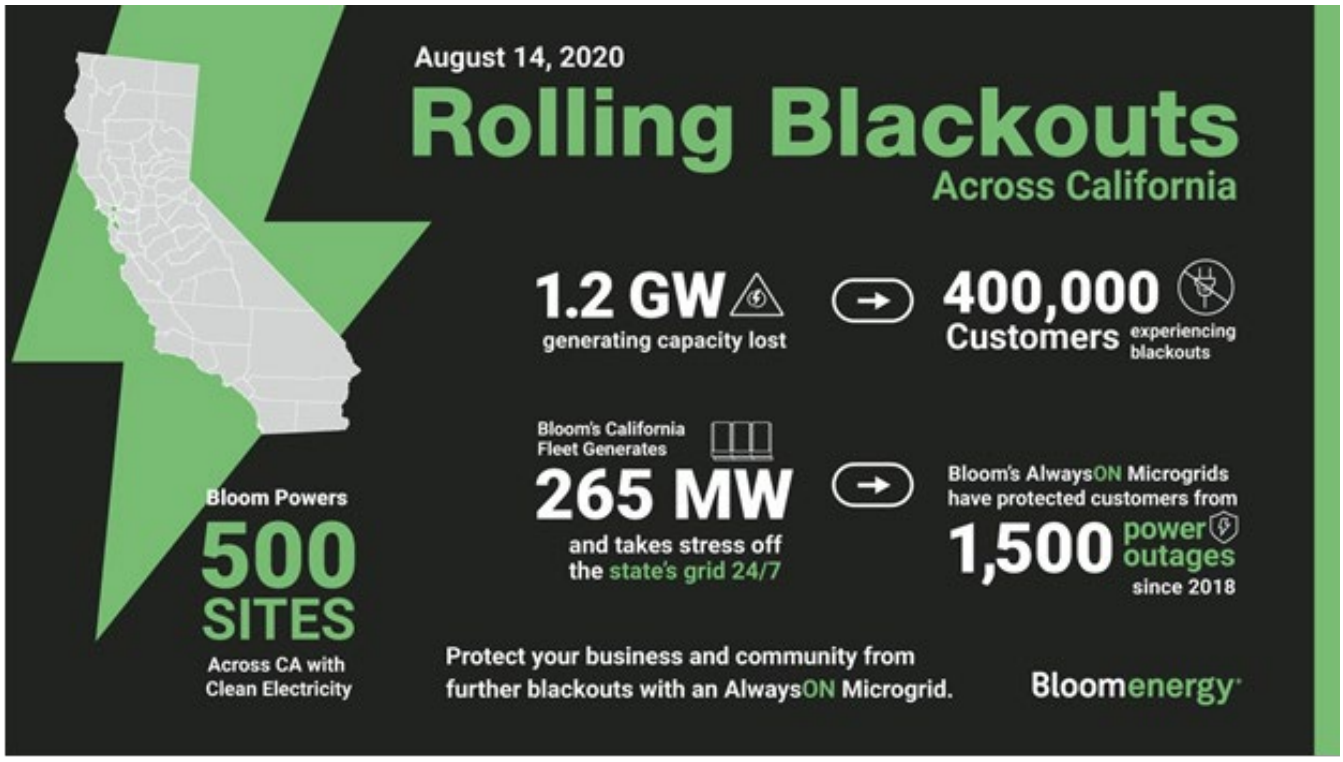
During outages, businesses with microgrids maintain power to not only keep their businesses running, but also serve as a safe-haven for employees and their local communities to charge devices, escape the elements, and otherwise utilize their facilities.

But to do that, they need a regulatory framework that supports access, choice and flexibility without penalizing them with fees and extra costs. Policymakers can play a critical role in ensuring businesses have flexibility to access power that is reliable, clean, and cost-effective.

Across the country, centralized electric grids are struggling to cope with rising severe weather events that often reap havoc on transmission and distribution infrastructure. As we all experience the increased effects of climate change, it is time to reimagine what our electric system should look like and create greater access to cleaner, safer and more reliable energy sources.

Microgrids, working in concert with the utility grid, can help decrease load on vulnerable power grids and can help keep the lights on. This lessens the need for utilities to make grid upgrades or purchase power at peak prices to meet demand. During California's August heat waves, for example, microgrid facilities played a key role in reducing overall system load and preventing additional rolling blackouts across the state.

Consider, for example, that Bloom customers alone provide 265 megawatts of capacity in California – powering the equivalent of 200,000 homes. This illustrates that making microgrids more accessible will improve energy reliability and, in this case, benefit all Californians.

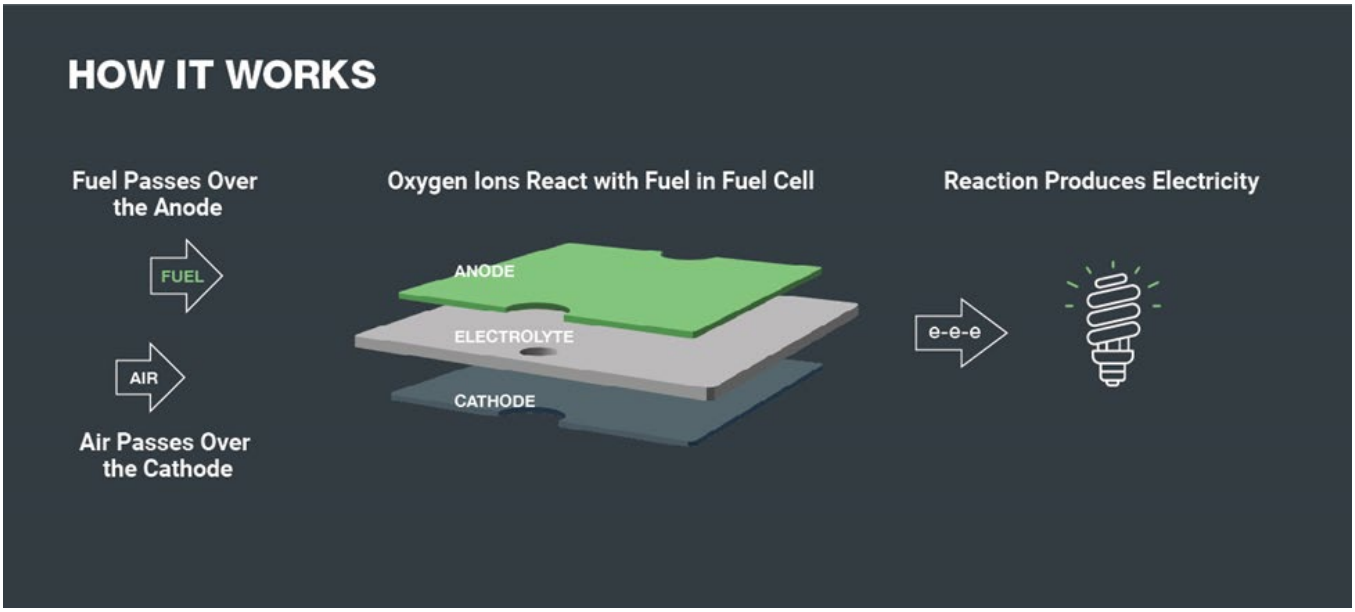


Policymakers have an opportunity to help strengthen the grid and empower more resilient businesses and communities by implementing new microgrid policies. For example, implementing a new, standardized, tech-neutral tariff for customer-owned microgrids. There are three significant points a tariff would accomplish:

1. Enable customer choice and flexibility by allowing businesses to choose the types of clean, microgrid technologies and systems that best meet their specific needs and the needs of the communities they serve.
2. Ensure customers who have chosen to invest in these systems for their energy security only pay for the electricity they use and are compensated fairly for power they provide back to the grid.
3. Expand and not artificially limit access so that everyone who wants to invest in a microgrid for safety, reliability and security is able to do so.

This would also accelerate us toward a clean energy future. Advancing microgrid policies that support a diverse set of innovative technology solutions that will put us on the fast track toward a cleaner, safer and more resilient energy future. Companies will be empowered to accelerate their own emissions reductions by having the flexibility to use a range of low-carbon fuels.

Fuel Cells are the Ideal Building Block for a Microgrid



Bloom has powered customers through 1,500+ outages since 2018 alone, and has a proven track record of deploying microgrids dating back to 2011.

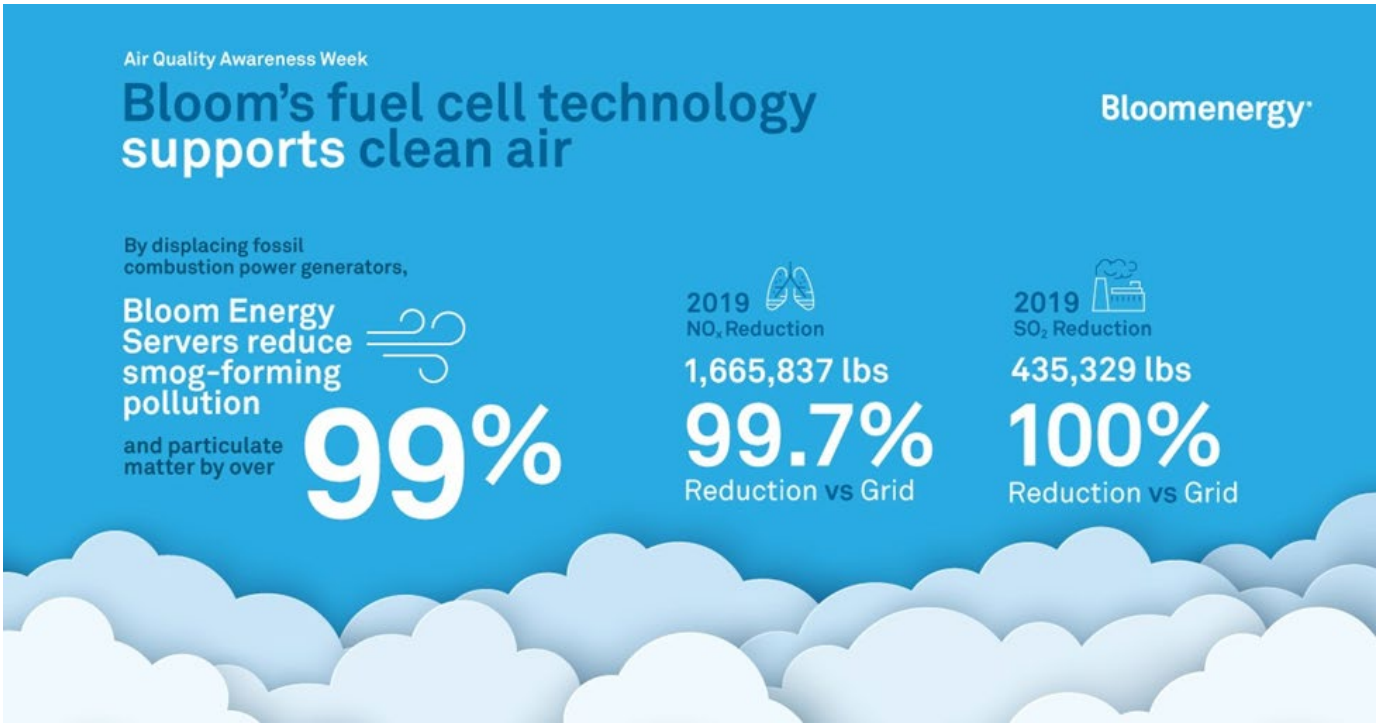
As a leader in microgrids, Bloom has adapted its microgrid solution to enable community continuity in times of emergencies. Our Rapid Microgrid can be deployed in a matter of days to serve critical facilities with the local, reliable power they need.

In fact, at the height of the COVID-19 pandemic, we deployed two microgrid projects in just a few days at California field hospitals built to support expected patient overflow.

Figure 1: Bloom Microgrid powering temporary hospital at Sleep Train Arena in Sacramento

Fuel cells are a non-combustion technology that reduce greenhouse gas emissions and produce virtually zero smog-forming pollutants. Operating on natural gas, biogas and renewable hydrogen, fuel cells can provide clean, reliable power to critical businesses and service providers and seamlessly combine with other technologies.

In times of uncertainty, grocery stores, hospitals, and other critical facilities can't afford to be without power. So, let's be prepared. Let's ensure our critical facilities are self-reliant and capable of serving their communities in times of need with electricity that is reliable and clean.



Bloom Microgrids and Social Equity

Bloom is focused on accelerating society toward a zero-carbon future. At the same time, we care deeply about focused on energy equity and social justice in energy.

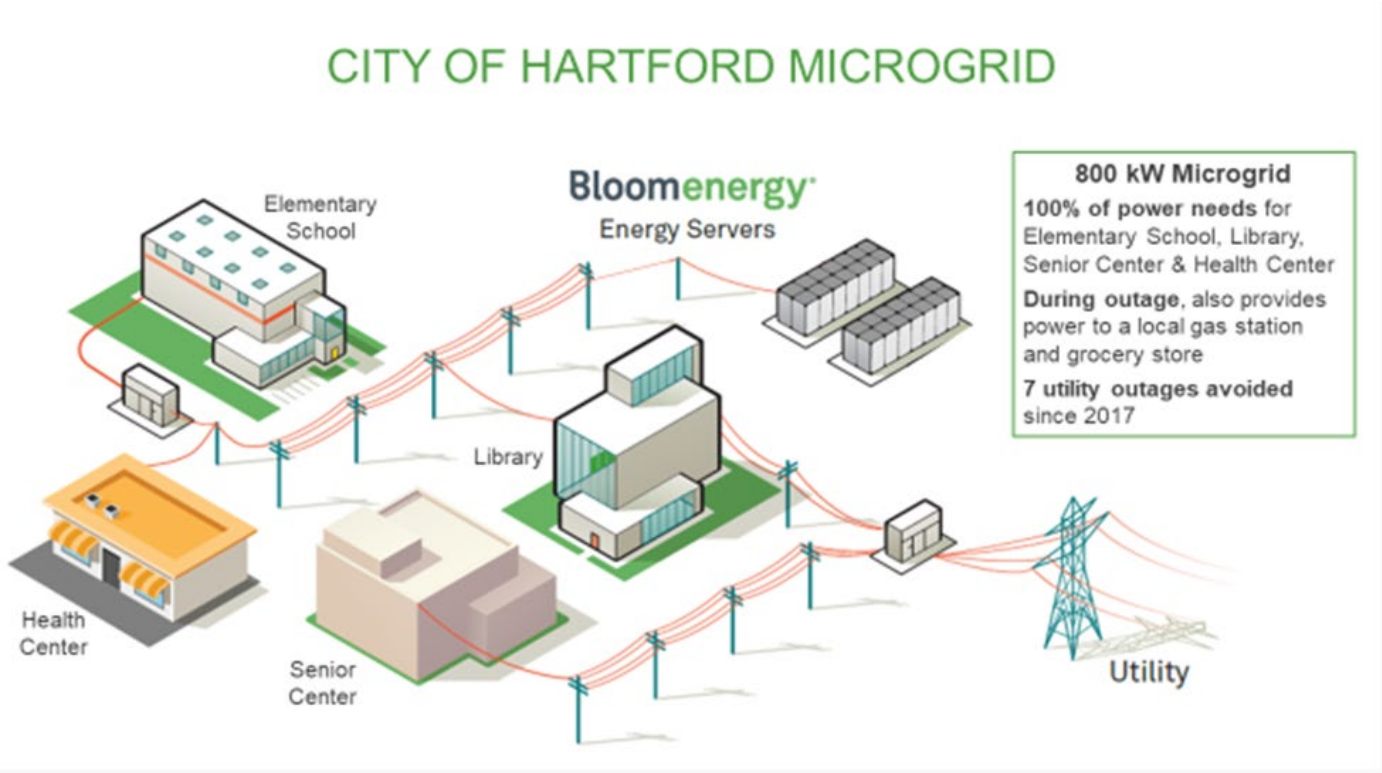
In addition to supporting the hospitals mentioned above, Bloom Microgrids have powered communities throughout the country. However, the challenge is often that regulatory constructs can make it difficult to deploy systems in a manner that fully benefits the community.

If we're helping retail stores or grocery stores stay open during significant outage events, that's helping businesses serve the community when they're needed most. This is just one example of a more equitable and community-focused energy system.

From a social equity standpoint, one interesting project is a non-wires alternative project in Brooklyn, NY that powers low-income housing with a combination of Bloom fuel cells and energy storage. The utility spent $400 million on a demand response program that saved them $1 billion in infrastructure upgrades, including needing to build a new substation. Bloom was able to participate and structure a deal to serve low income housing to make their power more affordable and more resilient.

This is a great example of what can happen when the utilities, regulators, and technology providers worked together.

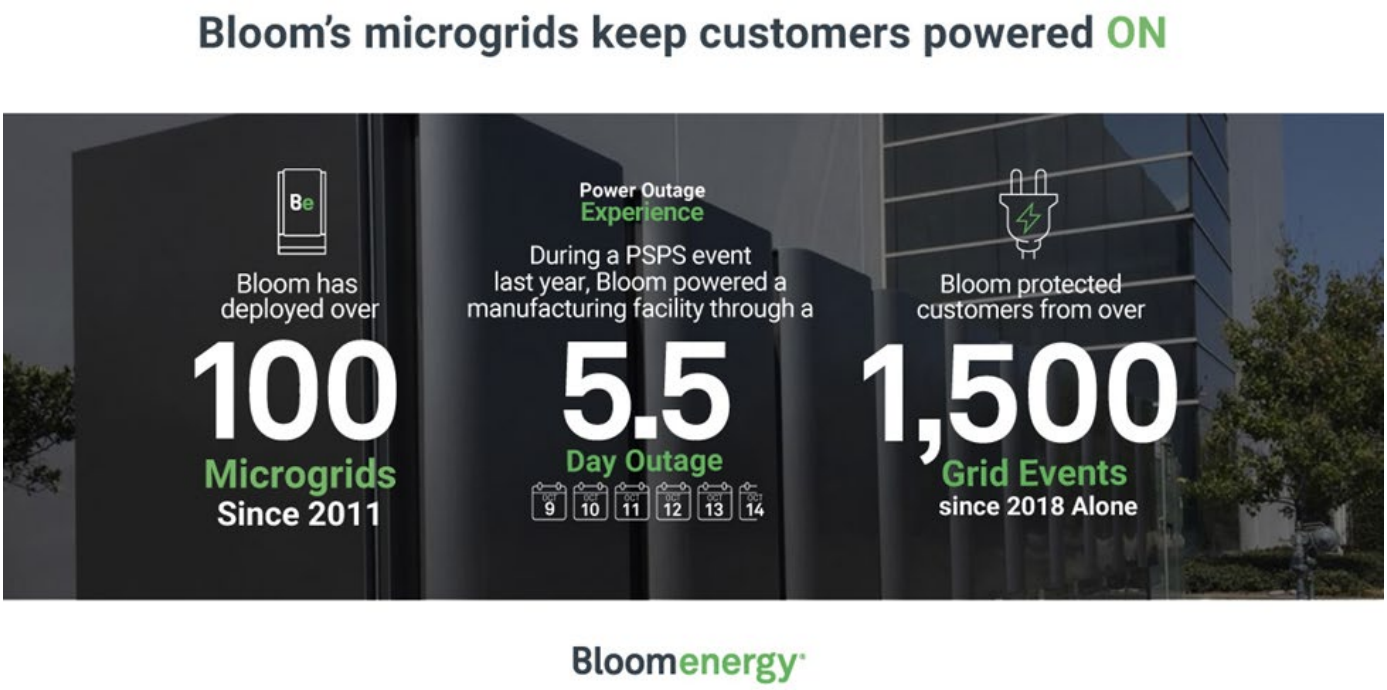
Another example is the City of Hartford, CT where Bloom collaborated with the utility, Constellation, to provide a community microgrid that powers an elementary school, library, senior center, and health center. During grid outages, the microgrid also provides power to a local gas station and grocery store. This ensures the emergency shelters and key facilities are available to the community.



States should embrace the opportunity to step up with some creative structures and making those more the norm. This will ensure deployments like these can be done by municipalities and also enable projects that can serve low-income housing, like in Brooklyn.

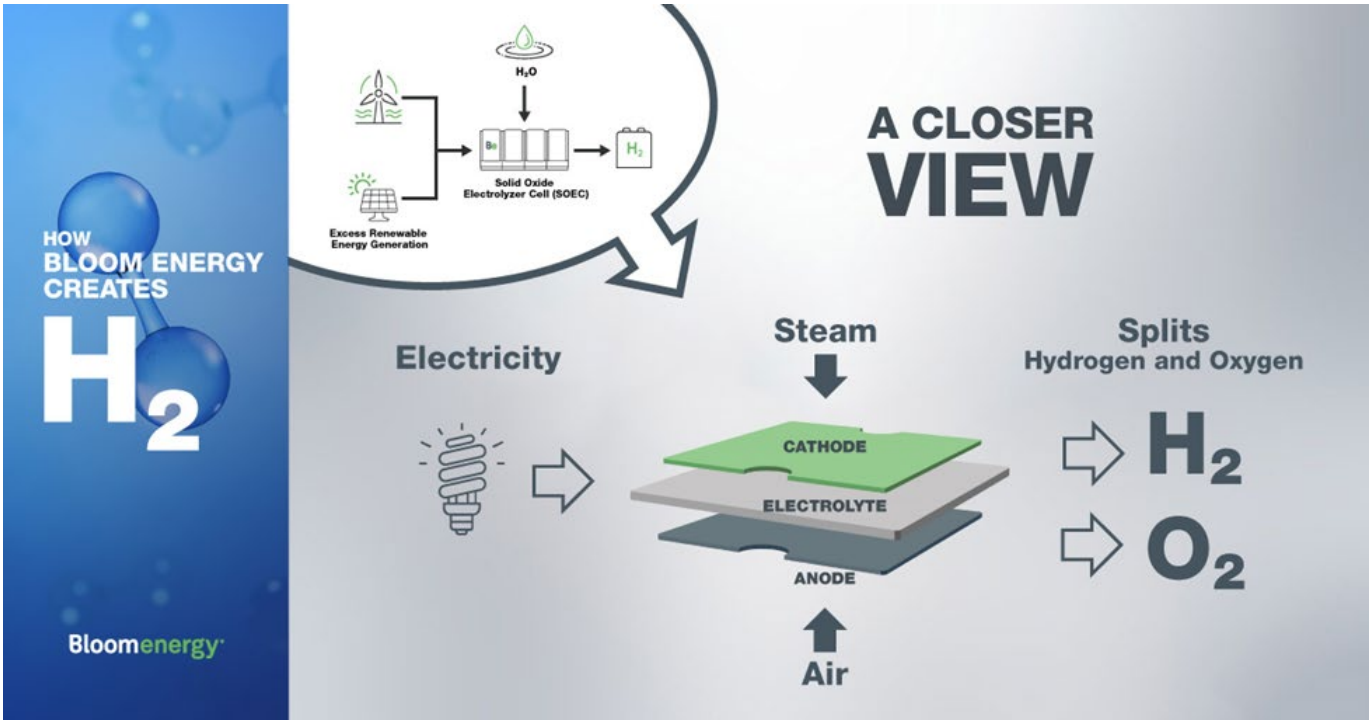
Bloom is a Trusted Partner for a Sustainable Future

Reducing greenhouse gas emissions will require technological advancement, collaboration and policy support. Bloom is committed to constant product innovation, including the continued reduction of carbon emissions from our products. We are engaged in multiple efforts to align Bloom's product roadmap with a zero emission trajectory.



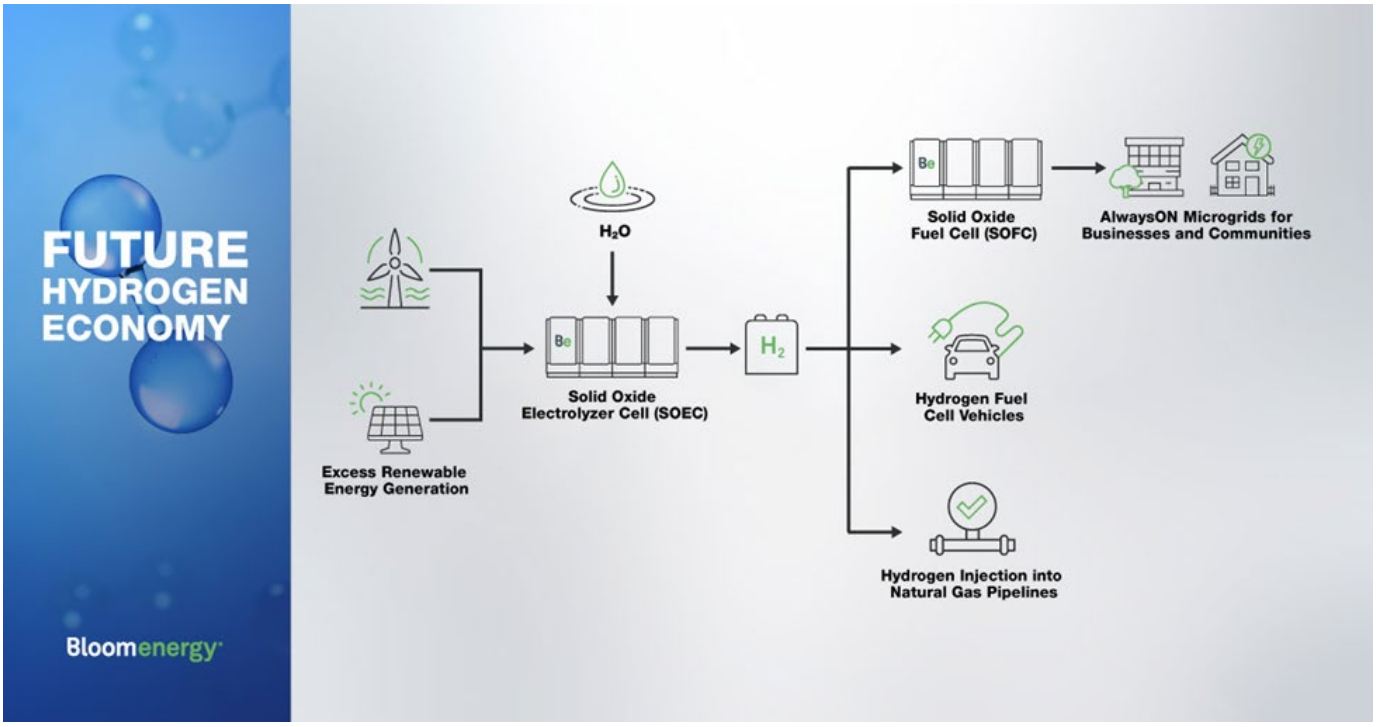
Bloom's Energy Servers can use biogas from landfills, dairies, or wastewater treatment plants to create clean electricity. Using biogas as fuel helps reduce the impact on climate change because it prevents venting or flaring of methane into the atmosphere.

Bloom is working to realize the widespread deployment of renewable hydrogen by deploying hydrogen-powered fuel cells.



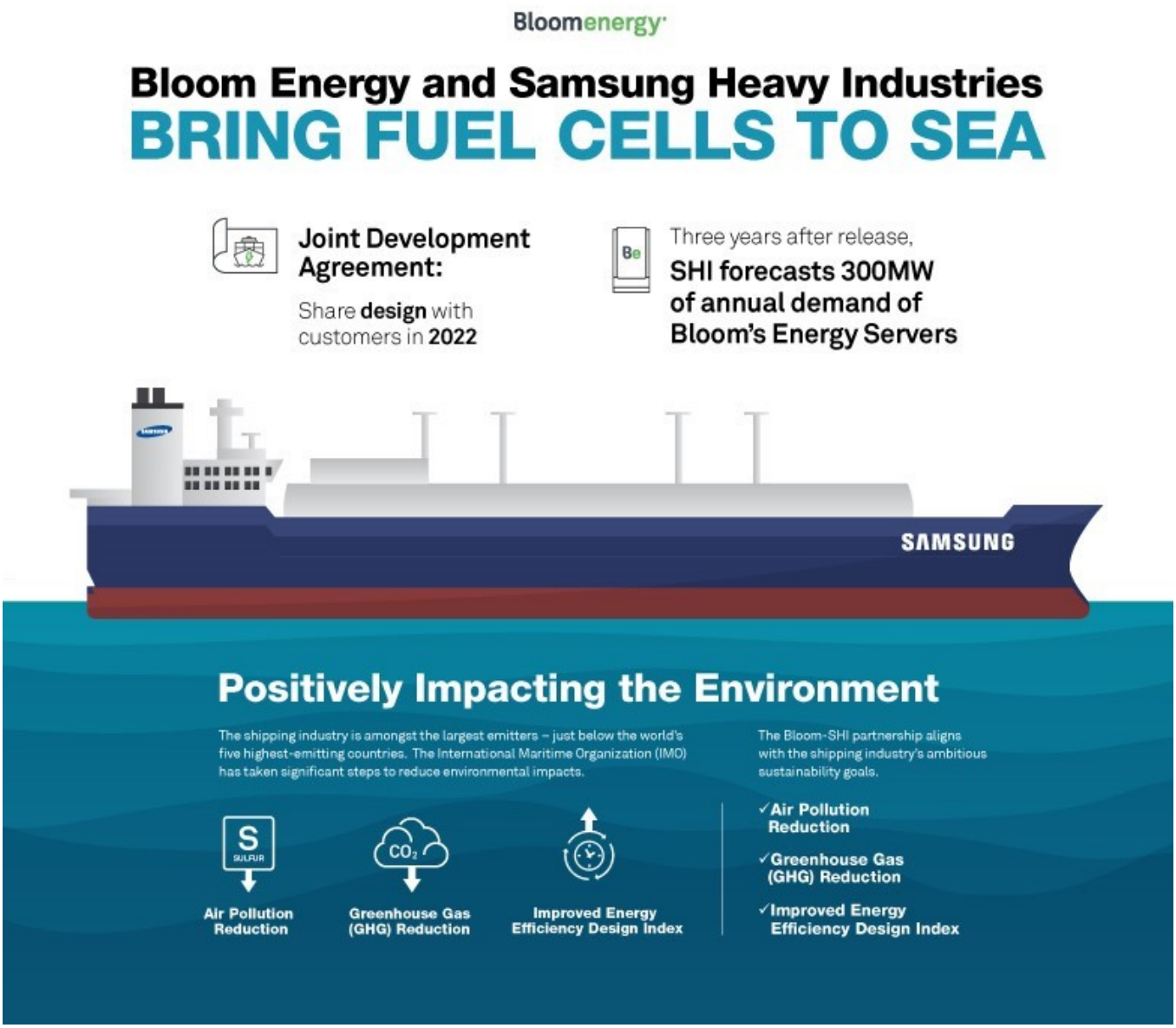
In a complimentary effort, Bloom is accelerating toward that future by entering the commercial hydrogen market with the introduction of fuel cell electrolyzers that produce renewable hydrogen. In areas with large amounts of wind and solar power, excess renewables can be used to produce hydrogen from water via electrolysis.

Today, fuel cells and renewables each separately reduce greenhouse gas emissions; in the future, they will work symbiotically to further reduce emissions by producing and generating 24/7 electricity from hydrogen. The renewable hydrogen, when produced in this manner, can fuel transportation vehicles, power resilient AlwaysON Microgrids, or be injected into natural gas pipelines to reduce carbon emissions.



We've formed a partnership with Samsung Heavy Industries to help forge the marine transport market's sustainable future through the design and development of a fuel-cell powered ship. Today, marine

shipping emits approximately 3% of global CO2 emissions. In a business-as-usual scenario, shipping could represent 10% of global GHG emissions by 2050. If global shipping were a country, it would be the sixth largest producer of greenhouse gas emissions. The partnership helps address the significant need for new technologies and energy sources to help the shipping industry meet the International Maritime Organization's 2030 and 2050 environmental targets around air pollution, greenhouse gas emissions, and energy efficiency.



Conclusion

With energy challenges on the rise, practical technology solutions exist today that can strengthen our power system, de-risk our businesses, and provide safety to our communities. With policy and legislative support, microgrids for climate resilience can be deployed with greater ease, while at the same time moving our society toward a more sustainable and equitable energy future.

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