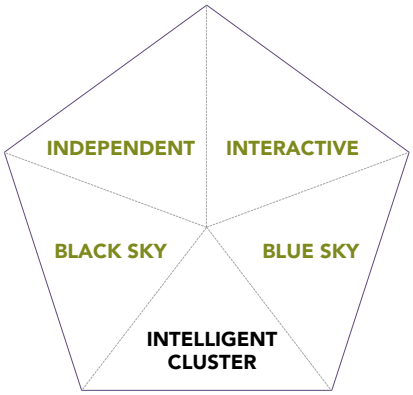
Think Microgrid is dedicated to providing updated, insightful information about microgrids, the opportunities they present and the challenges they face. We believe that microgrids have a vital role to play in addressing pressing resiliency, climate and equity challenges facing our nation. The information presented here is intended to provide journalists and media organizations with relevant information about microgrids today.

What is a microgrid?

A microgrid is an intelligent cluster of local energy resources that are physically interconnected to one another and to the electric grid. As a single cluster, microgrids are able to operate independently or connected to the larger grid. There are five key aspects that characterize microgrids as unique from other distributed energy resources:

1. **Intelligence:** The individual components of a microgrids are coordinated by a single, intelligent microgrid controller that allows the microgrid to optimize its behavior to align with the needs of the customer and the larger electric grid.
2. **Independence:** A microgrid can dynamic connect to and disconnect from the larger electric grid, providing energy independence and resilience in the face of network outages, price volatility or other grid disruptions.
3. **Black Sky Operations:** Because the microgrid can operate independently and because it is physically connected to the load it serves, a microgrid provides resiliency during extended "black sky" conditions lasting for hours or days.
4. **Blue Sky Operations:** Unlike simple backup power, microgrids can also operate effectively during periods of normal operation, allowing for the integration of local clean energy resources.
5. **Interactive:** Perhaps most importantly, microgrids are an extremely flexible energy resource that are highly interactive, providing power to the grid when needed, operating independently when needed and able to respond autonomously to the changing conditions of the grid and the needs of the customers they serve.

A microgrid is a self-contained network that allows customers to generate electricity on-site when it is needed most. When the grid goes down or electricity prices peak, microgrids respond. Microgrids are becoming increasingly important because they allow critical facilities or even entire communities to continue operation when the surrounding electrical grid cannot operate.



Benefits of Microgrids:

Microgrids improve electric reliability, decrease energy costs and act as a climate change solution.

A microgrid improves electric reliability
Microgrids keep the power flowing during an outage by disconnecting from the grid in what's called islanding. The system's controller seamlessly switches from grid power to the microgrid's local power sources when it senses an outage. Solar, generators, battery energy storage or the microgrid's other distributed energy sources then serve its customers until the grid's power is restored.

A microgrid enhances resilience and recovery
In addition to providing reliability, a microgrid provides its customers with energy resilience by avoiding power outages in the first place, or quickly recovering if they do occur. In the case of an outage, the microgrid can be programmed to restore power to an entire facility, or just the most critical components. Once grid power is restored, the facility can resume normal operations more quickly because it did not have to shut down completely.

A microgrid can lower energy costs for consumers and businesses
Microgrids reduce the energy costs of their customers by efficiently managing energy supply, which helps customers budget for energy costs in both the short and long term. Energy prices fluctuate throughout the day and an advanced microgrid can leverage this variability by controlling how much power is drawn from the grid versus local battery storage and generation sources. In areas where electricity costs are high, microgrids may be able to consistently provide energy at a lower cost. Microgrids can also provide a new revenue stream for their customers. Excess energy that's generated on-site can be sold back to the central grid. Other economic benefits can be seen with microgrids through participation in utility demand response programs or state and federal clean energy programs.

A microgrid improves the environment and promotes clean energy

As more businesses and communities strive to meet clean energy goals, they're looking for ways to reduce the impact of their power generation on the planet. Because of their ability to blend distributed energy sources seamlessly and intelligently, microgrids can use a wide range of green power production technologies, such as solar, wind, fuel cells, combined heat and power (CHP) plants, and energy storage. Natural gas generators, used in many CHP plants, fall on the cleaner side of fossil fuels. Using these diverse energy sources together ensures that the microgrid can overcome any downsides of a specific technology. For example, a solar array only provides power when the sun is shining, so a microgrid can tap into other energy sources when the renewable sources aren't available.

A microgrid strengthens the central grid

A microgrid can be used to strengthen the broader electric grid by augmenting normal grid operations or easing the strain on the central grid during periods of peak demand. It becomes another resource that grid operators can call on during these periods. Microgrids can also be less expensive to build and maintain than new grid substations, transmission lines or other grid infrastructure.

A microgrid bolsters cybersecurity

Cyberattacks are a threat to the national power grid, but microgrids are a proactive step that utilities can take to shore up any vulnerabilities. The distributed architecture of a microgrid makes it more resistant to cyberattack because should one generator be attacked, the microgrid has other power sources to rely on to keep the power flowing.

A microgrid brings economic value to society

Power outages are costly, especially to research facilities, data centers, manufacturers and grocery stores that lose perishable products. Microgrids offer economic value to society by averting the loss of inventory and productivity during a power outage. They also attract high quality employers to a region and, as local energy plants, they create and keep jobs within the community.

A microgrid improves community well-being

Because of their ability to provide reliable, resilient power, a growing number of communities are installing microgrids to serve their critical infrastructure during outages and disasters. Hospitals, police stations, fire departments, communications centers and wastewater treatment plants are among the top priorities of local governments looking to ensure their ability to provide emergency services. Shelters, grocery stores and gas stations can also be included in the microgrid's service area to help keep the community safe. Microgrids also provide power to underserved and rural communities where no electric grid exists, allowing those areas to grow and thrive economically.

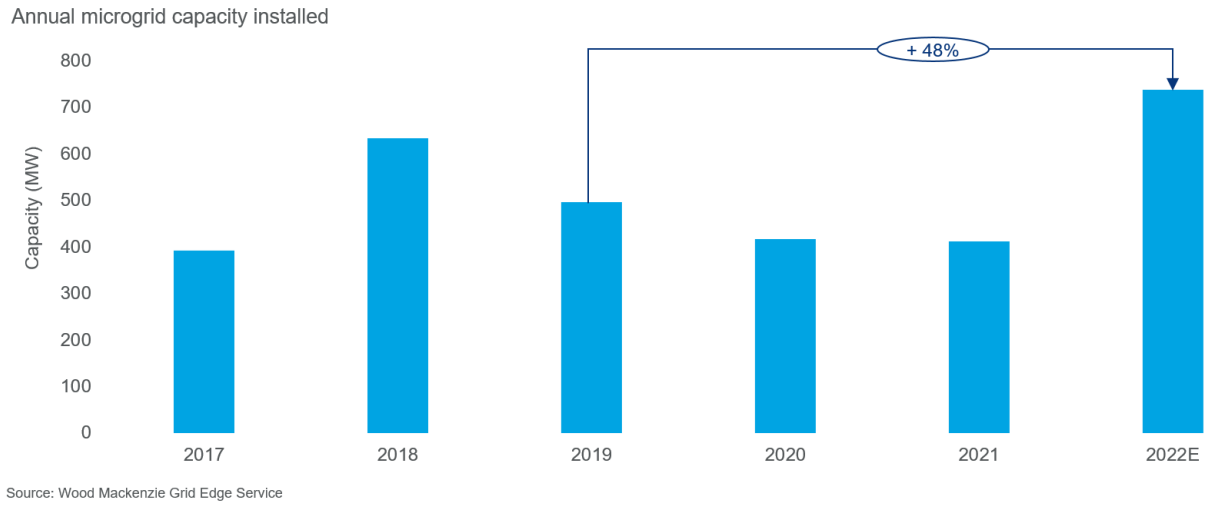
What is the outlook for the microgrid market?

The US microgrid market reached 10 GW in the third quarter of 2022, with more than 7 GW in operation and the rest in planning or construction. Think Microgrid works closely with Wood Mackenzie to identify market and policy trends related to microgrids.

"From a microgrid capacity perspective, if the market continues to develop at a rapid pace, we will see more than 20% growth in annual capacity installation across the US compared to last year," said Elham Akhavan, senior research analyst at Wood Mackenzie.

Commercial and industrial businesses lead microgrid development, specifically retail stores and manufacturing. Next came the government, driven by the military, followed closely by the residential sector and education. Microgrid customers are increasingly choosing third-party financing and ownership rather than owning a microgrid themselves. Called microgrid as a service (MaaS), or energy as a service, use of the model grew 25% from 2019 to Q3 2022, while direct ownership by customers dropped 31%. Microgrids are becoming valuable grid resources as well, providing a range of grid services to wholesale markets and utilities. The revenue earned through this virtual power plant participation defrays the cost of the system to the customer.

Wood Mackenzie pegs total utility microgrid capacity at 1.1 GW with 35 MW of microgrid capacity coming online in 28 states in 2022. Solar and energy storage use within microgrids has grown significantly, up 47% in 2022 over 2019. More than 175 solar- and solar-plus-storage microgrid projects were scheduled to come online by the end of 2022.



Source: Wood Mackenzie Grid Edge Service

For more information on market data, contact:
Elham Akhavan
Elham.Akhavan@woodmac.com

Policy Challenges and Opportunities

What questions should policy makers be asking? Policy makers and regulators are responsible for designing utility markets that are resilient, clean and equitable. This is a daunting task and Think Microgrid is dedicated to ensuring that they do not need to bear this responsibility alone so that they can design the future that every community deserves.

Think Microgrid is focused on bringing practical and pragmatic strategies to modernize the policy landscape in which microgrids operate. Achieving the full potential of microgrids requires dedicated and deliberate action by regulators and policymakers. There is no shortage of private capital ready to invest in microgrids and advanced energy solutions, but that requires more sensible price signals and tariffs. Regulatory reform that focuses on fair value, fair access and fair rates is urgently needed. Unpredictable costs and arbitrary interconnection requirements hamper customer investments in microgrids, denying full achievement of cost savings.

Think Microgrid believes that states, regulators and agencies should prioritize developing creative solutions that allow microgrids to fulfill their potential to create solutions we need today. These issues include:

- Regulatory Treatment of microgrids
- Rate Design & Tariff Development
- Organized Market Access
- Locational Value
- Resilience Value
- Rights-of-Way Restrictions
- Interconnection Policy

Resources

Think Microgrid Vision Paper
https://www.thinkmicrogrid.org/assets/Think-Microgrid-Vision-Paper.pdf

Think Microgrid State Assessment
https://e9radar.link/thinkassessment

Think Microgrid Recommended Actions for State Officials
https://e9radar.link/thinkstates

Microgrids in Action

In September 2022, Bloom Energy partnered with Taylor Farms to implement 6 MW fuel cells, 2MW of solar power from Concept Clean Energy, and a 2MW/4MWh battery to power one of the largest healthy food producers in the country. This landmark partnership in California is slighted to power the 450,000 sq. ft. facility completely independent of the electricity grid.

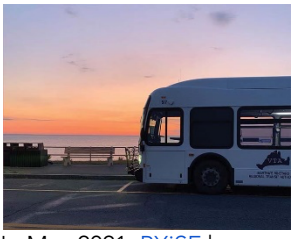
In September 2022, Schneider Electric partnered with Citizens Energy to implement a 1.4 MWh battery and 1.2 MW of solar capacity to create a microgrid at the Daughters of Mary Campus in Connecticut. The $7 million project was approved by DEEP to make the campus a renewable energy stronghold and use the 137-acre project to support the state's load.

In March 2021, Schneider Electric announced the full functionality of the microgrid in Miramar. The microgrid includes 4 MW of diesel, 3 MW of natural gas, 3.2 MW of landfill gas and 1.3 MW of solar capacity. The microgrid was used by local utility SDG&E twice in the fall of 2020 to support peak load reduction.

In November 2021, Schneider Electric announced its first microgrid implementation in Spain in Puente la Reina, in partnership with ACCIONA Energía. The facilities have 852 kW of solar capacity, five charging points for electric vehicles, and 80 kWh of battery storage. This site employs 350 people and is one of the largest microgrid initiatives in the country.

In December 2020, Eaton and EnelX partnered to implement a microgrid at Eaton's facility in Areceribo that consists of 5 MW solar PV with 1.1 MW/2.2 MWh of battery storage. The unit will generate 50% of its power from its solar capacity and include off-grid island operational capacity.

In 2019, PowerSecure converted this company's headquarters into a fully functional microgrid that features 6 MW of generators, 16 MW solar pv, 700 EV chargers, 12 MW/ 4 MWh of storage, and 4 MW of fuel cells. The site is 100% powered by renewable energy per these modifications.



In May 2021, PXiSE began work on electrifying transportation in Martha's Vineyard through an integrated microgrid. The project went on to receive national recognition and in July 2022 was awarded an achievement in DER excellence. The site includes a 0.5-MW/1.5-MWh battery energy storage system, 466 kW of solar PV, a backup diesel generator, and the bus chargers.
Enchanted Rock

In June 2022, Enchanted Rock announced approval to create a microgrid with Microsoft to create the state of California's largest microgrid fully supported by renewable natural gas. This effort is combined with Microsoft's goal of being carbon negative by 2030 and will cover all of the 240 data centers owned by the company in the state.

In July 2022, Sunnova announced building solar and storage capacity available for customers at Home Depots across Puerto Rico. Since 2017, Sunnova has installed 17,000 batteries in Puerto Rico. These battery-solar combinations helps expand the 30,000 solar customers already active in Puerto Rico and provides microgrid capacity for individual customers.

About Think Microgrid

Launched in 2021, Think Microgrid is the unified voice for the microgrid industry, highlighting the role that microgrids can play in addressing pressing challenges related to grid resilience, energy equity and climate change at this unique moment in history. Toward this end, Think Microgrid engages with the public policy community to provide education to policymakers, advance constructive dialogues regarding microgrid policy and identify barriers that can be proactively addressed to create new markets and applications for microgrids.

Cameron Brooks
Executive Director

Cameron Brooks is the Executive Director of Think Microgrid, a membership coalition that represents the microgrid industry in critical policy, legislative and regulatory discussions taking place in Washington, D.C., and at the state level across the country. Cameron also serves as the President of E9 Insight, a research firm focused on the US utility industry and the policy landscape surrounding it. E9's clients include a wide range of technology companies, advocacy coalitions and government agencies, including Department of Energy and Lawrence Berkeley National Labs. Cameron founded Tolerable Planet Enterprises, an advisory firm that provides regulatory engagement and business development services, including a strong focus of developing coalitions for distributed energy technologies and open markets. Cameron has served in executive roles with clean energy companies and non-profits, including Opus One Solutions, Tendril, Renewable Choice Energy and the Clean Energy States Alliance. He studied Ecologic Design at Yale University and holds an MBA from Cornell. E9 and Cameron are based in Boulder, Colorado.