Microgrid Flex 2.0: Battery as anchor resource

by Arpit Chaturvedi and Matt Holstein

Executive summary

Schneider Electric's Microgrid Flex offers a fast, cost-effective way for commercial and institutional buildings to achieve energy resilience and sustainability. Centered around advanced battery energy storage, this modular solution helps customers reduce utility costs, maintain power during outages, and meet decarbonization goals. It's a plug-and-play microgrid designed to simplify deployment and deliver long-term value.

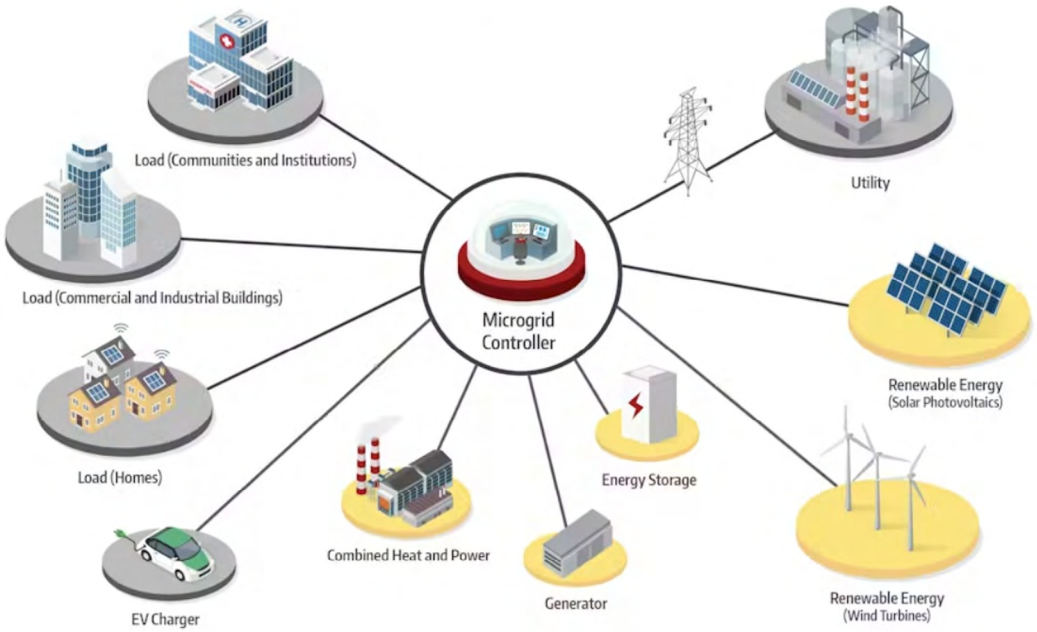
A perfect fit for most US buildings

As extreme weather prompts power outages and utility rates keep increasing over time, there has never been a better time to utilize a microgrid to keep the power flowing for commercial buildings seeking energy security and cost savings. Microgrids not only offer energy independence and predictability but also represent a pathway for decarbonization to reach sustainability targets.

What is a microgrid? The U.S. Department of Energy defines a microgrid in the following way:

A group of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries that acts as a single entity with respect to the grid. Microgrids can connect and disconnect from the grid to enable them to operate in both grid-connected or island mode.

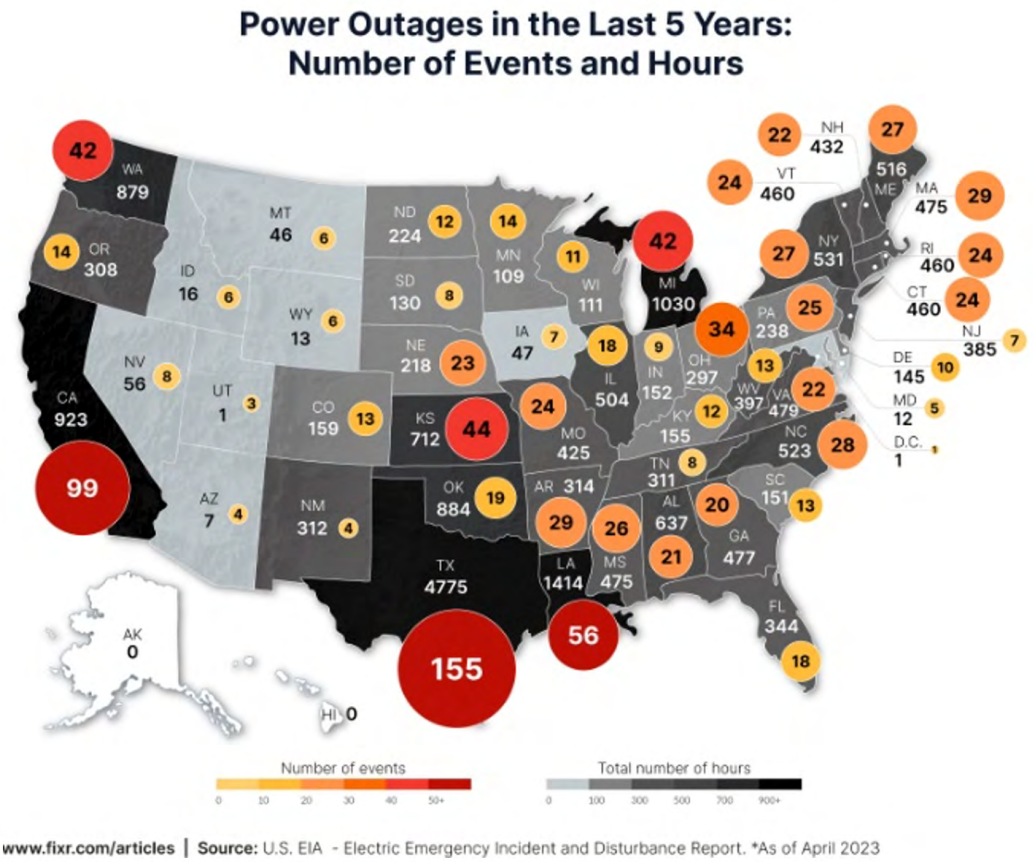
A hypothetical microgrid is illustrated below to show the diversity of resources and types of customers (loads) a microgrid can serve.



Source: Microgrid Knowledge

To break down what a microgrid is, consider these three primary features provided by Microgrid Knowledge, the industry's go-to resource for data and insights:

- **A microgrid is local**. Unlike traditional large power plants transmitting electricity over long distances and losing between 8 to 15% of the power generated, microgrids are more efficient since electricity to generated at the point of consumption.
- **A microgrid is independent**. The key distinguishing feature of a microgrid is the ability to disconnect from the utility grid in the event of an outage. Such outages have increased in the U.S. over time. Whether hurricanes, wildfires, other forms of extreme weather or even terrorist attack, a microgrid can be viewed as insurance that the host will always have power no matter what is happening on the larger utility grid network.
- **A microgrid is intelligent**. Advanced microgrids leverage sophisticated software to manage hardware assets, often with the help of AI and other optimization technologies. The key to the viability of any microgrid is the controls which orchestrates all DERs and other assets to deliver on the goal of the client. These goals can include reducing emissions, deliver cost savings or providing continuous power during an extended outage.



www.fixr.com/articles | **Source:** U.S. EIA - Electric Emergency Incident and Disturbance Report. *As of April 2023

Microgrids have been around for a long time. Some, such as those operating in remote regions of Alaska, have been operating for more than a century. What's changed is today's advanced microgrids focus on sustainable energy and cost optimization via advanced software which can leverage artificial intelligence (AI.) While microgrids used to be – and still can be – customized engineered solutions that meet the precise needs of a specific client, the more advanced and streamlined approach today is a modular, scalable, and repeatable solution. Customization can deliver value but is time-consuming and can increase costs, especially when it comes to hardware, which represents the bulk of the cost of a microgrid. Customized microgrid solutions can also increase support and maintenance costs due to their unique configurations.

Vendors such as Schneider Electric™ have come forward with a fresh approach that standardizes microgrids with pre-tested components that can reduce the engineering time to design and deploy microgrids by 90%. The configuration adjustments and fine-tuning can be done remotely with software.

Microgrid Flex 2.0

MG Flex from Schneider Electric leverages the robust Schnieder Electric EcoExpert partner program. Its original configuration—MG Flex 1.0—was based on three principal DER components: a solar photovoltaic (PV) system, a battery energy storage system (BESS), and a generator. The generator is typically fueled by natural gas, which emits less pollution and carbon when compared to diesel back-up generators, the default resiliency solution of the past.

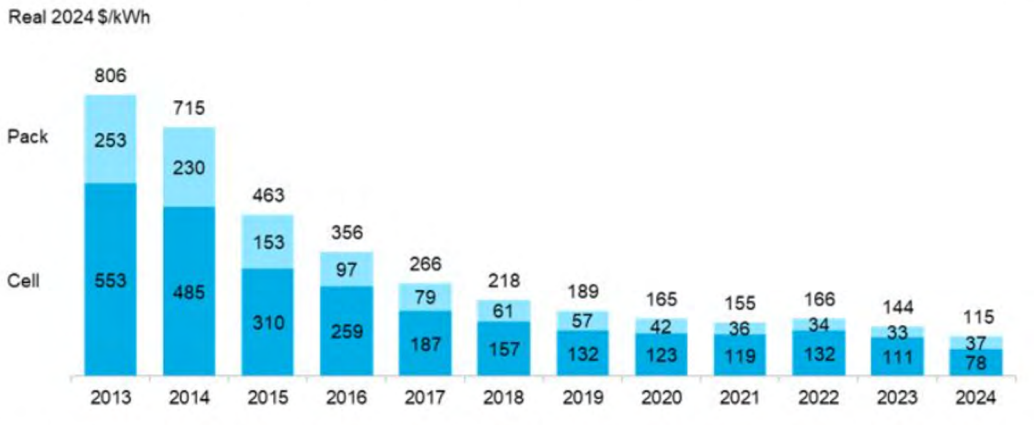
There are four fundamental features of both the original and a second-generation MG Flex product:

- **EcoStruxure™ Microgrid Advisor and Microgrid Operations**: This software tool helps control, forecast and track performance of the assets that comprise the microgrid.
- **EcoStruxure Microgrid Assessment and Microgrid Build**: This part of the standardized solution stack revolves around intuitive digital tools that help the client and vendors alike create a seamless end-to-end solution design, including the critical task of properly sizing the DER assets.
- **Battery Energy Storage System (BESS)**: Virtually all newly designed microgrids include some form of energy storage. The most cost-effective form of energy storage today are lithium-ion (li-ion) batteries, the same kind of batteries used in mobile phones and in electric vehicles. For MG Flex 2.0, multiple capacity configurations are available to choose from, each sized battery validated by design tools and lab testing.
- **Energy Control Center**: This pre-engineered, configurable control center manages any microgrid's multiple DERs during operations to maximize performance. It is the "brains" of the microgrid once it comes on-line.

States with aggressive decarbonization goals, such as California, prefer microgrids without any fossil fuel component. In response to this market need, Schneider Electric rolled out Microgrid Flex 2.0, which is centered around using the BESS as the anchor resource. In the past, most microgrids relied upon some form of prime mover fossil fuel generator as the microgrid's anchor.

One key factor driving the MG Flex 2.0 offering is that the prices for batteries at the module level have dropped dramatically, following a trend established earlier with solar PV modules, a renewable energy resource which is now among the lowest cost options for power generation. See the dramatic decline in lithium-ion batteries in the figure below from BloombergNEF.

Figure 1: Volume-weighted average lithium-ion battery pack and cell price split, 2013-2024



Source: BloombergNEF. Note: Historical prices have been updated to reflect real 2024 dollars. Weighted average survey value includes 343 data points from passenger cars, buses, commercial vehicles and stationary storage.

The inaugural channel partner for the MG Flex 2.0 product is Graybar, a distributor of data, communications, and electrical products. The firm also provides supply chain management and logistics support.

The brilliance behind relying upon a BESS as the anchor resource is that it can capture energy from a variety of DERs, accumulate variable renewable energy from the sun or wind, and then dispatch this energy when needed. When the battery is near full discharge, it can be charged up again from either sun or wind or other electricity resources. BESS assets can serve both microgrids and the larger utility grid. For behind-the-meter (BTM) microgrids, these BESS underly the most common uses cases justifying microgrid deployments, including resiliency, often the primary motivation for a commercial customer to pursue a microgrid project. Yet a BESS can also play a key role in reducing utility demand charges or providing grid support services back to a utility or wholesale market. Other services flowing from BESS include the ability to maximize consumption of renewable energy generated on site by smoothing out the variability of sun due to clouds (and night) or wind due to shifting weather patterns. Finally, the BESS can serve as a key tool in any comprehensive plan for decarbonization.

For MG 2.0, BESS systems come in two primary sizes—small and medium. Either battery can be configured for either 2 hours or 4 hours duration of charge. The smaller battery can be coupled to a microgrid in either a direct current (DC) or alternating current (AC configuration. (The larger battery is AC coupled.)

All the sub-components of the battery are bundled into a single enclosure. Multiple batteries can be integrated into any microgrid to reach the desired energy storage capacity. Along with the batteries themselves, all inverters, cooling systems, transformers, controls, and safety features are integrated within the enclosure. In short, this is a “plug and play” system. The enclosure also meets the latest fire safety standards as outlined in NFPA 855.

BESS can be matched with other assets that have been validated and pre-tested to work together to speed up deployment and streamline ongoing operations and maintenance (O&M). While such a BESS can operate as a stand-alone system, the intent with MG Flex 2.0 is that it can seamlessly integrate with an energy management system (EMS) so that its performance can be optimized in conjunction with the other generation and grid infrastructure assets.

Federal and state energy storage incentives drive deployment opportunities

The declining cost of BESS and li-ion technology has been a game changer for the microgrid industry. As has been the case with solar PV, government incentives often in the form of tax credits and sometimes mandates similar in format to renewable portfolio standards which typically include specific deployment targets by specific dates. This approach provides certainty to private industry that federal, state, or perhaps local government has committed to certain procurement levels.

Another common government incentive is a subsidy spread over a certain time. In the U.S., such incentives typically come in the form of a tax credit, which can be utilized by a private company to reduce taxes during equipment purchases, thereby lowering the effective capital cost. In some cases, such tax credits have been modified by policy

makers to also be applicable to government and non-profit entities that do not have a tax liability.

Federal level incentives

The primary policy driver behind the recent surge in BESS deployments has been the Inflation Reduction Act (IRA). Though these incentives are now in jeopardy due to a change in federal administrations, the IRA has already supported the development of many microgrids with its incentives for BESS and other DERs. The lesson learned from the current uncertainty surrounding federal IRA tax credits and other features that may be disappearing is to move fast. Products such as MG Flex 2.0 address this recent market dynamic since development time is shortened and overall costs are contained. Furthermore, the energy-as-a-service business model leans on Schneider Electric to manage the accounting and financing of a BESS-based microgrid, allowing its team to navigate the shifting federal policy terrain and take on the burden of making the numbers work.

Other recent and in flux federal policies that could impact deployments of MG Flex 2.0 are proposed tariffs by the U.S., especially on China, the leading manufacturer of li-ion batteries in the world. Tariffs on Canada and Mexico could also have an impact on components for renewable DERs. Still, the global shift toward sustainable energy seems unstoppable, despite temporary political headwinds. The trends for BESS at the module level are also mirrored by recent trends at the turnkey system level. While there may be temporary cost increase blips due to supply chain disruptions, it is safe to say that the economic viability of BESS-based modular microgrids such as MG Flex 2.0 remains convincing.

States' energy storage incentives

As the role of the federal government shrinks in the near term on sustainable energy projects that could be a good fit for MG Flex 2.0, it is expected that state government support and public policies will grow significantly. Most states have already played a major role in supporting microgrids, with Connecticut passing the first microgrid law about 14 years ago. More recently, states such as California offered incentives for DERs which largely went to distributed BESS deployments under its BTM self-generation incentive program (SGIP.) Yet California is also using mandates embedded in its pioneering building code known as Title 24 to push new building construction projects to become net zero facilities (net zero refers to the combination of renewables and energy efficiency results in no new net emissions of greenhouse gases emanating from these buildings).

All new construction, including commercial buildings, must meet Title 24's mandates for on-site solar PV often paired with a BESS system and then supplemented by aggressive, cutting edge energy efficiency upgrades. This is a whole building approach to decarbonization starting with upfront designs. Complementary tools such as cool roofs and optimized HVAC systems can be bundled with the modular framework of MG Flex 2.0 to provide a complete solution that leverages energy efficiency upgrades to reduce the cost of resiliency.

Stepping back from the focus on California, the two maps below show the states which offer financial incentives for BESS as well as though that now have mandates to install such systems.

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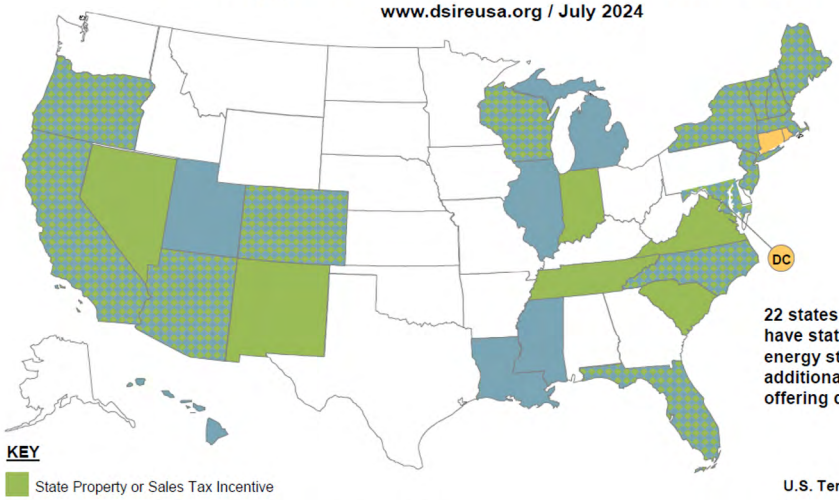
Energy Storage Financial Incentives

www.dsireusa.org / July 2024



22 states plus DC, PR, and VI have statewide incentives for energy storage. An additional 6 have utilities offering direct incentives.

KEY

- State Property or Sales Tax Incentive
- State Grant, Rebate, or Performance-Based Incentive Program
- Utility Rebate Program(s)
- Multiple Statewide Programs and/or Utility Rebate Programs

U.S. Territories:

AS | PR
VI | GU

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Energy Storage Targets

www.dsireusa.org / September 2024

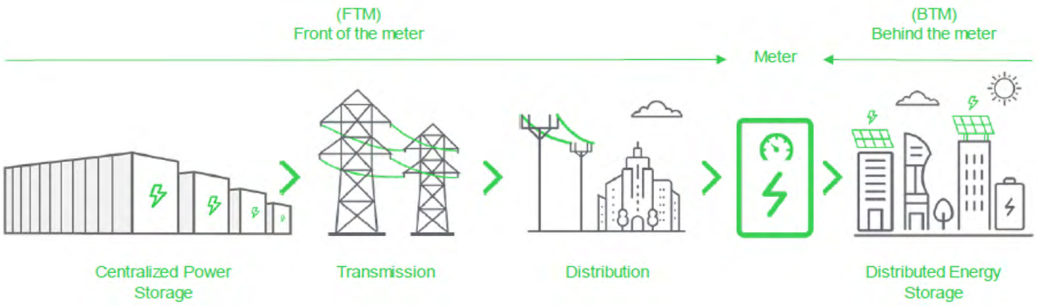
Twelve states have statewide targets for energy storage deployment.

Behind-the-meter commercial and institutional buildings are the target.

There is a need to rapidly deploy microgrids for commercial and institutional buildings ranging from 500 kW up to 2 MW in size—which represent roughly 70% of all buildings in the U.S. These buildings are ideal for modular solutions such as MG Flex 2.0. They have traditionally lacked the resources and sophistication themselves to enact cutting edge sustainable energy solutions such as Flex 2.0.

Why focus on behind-the-meter?

The figure below illustrates the technologies that are typically situated on front-of-the-meter (FTM) versus BTM.

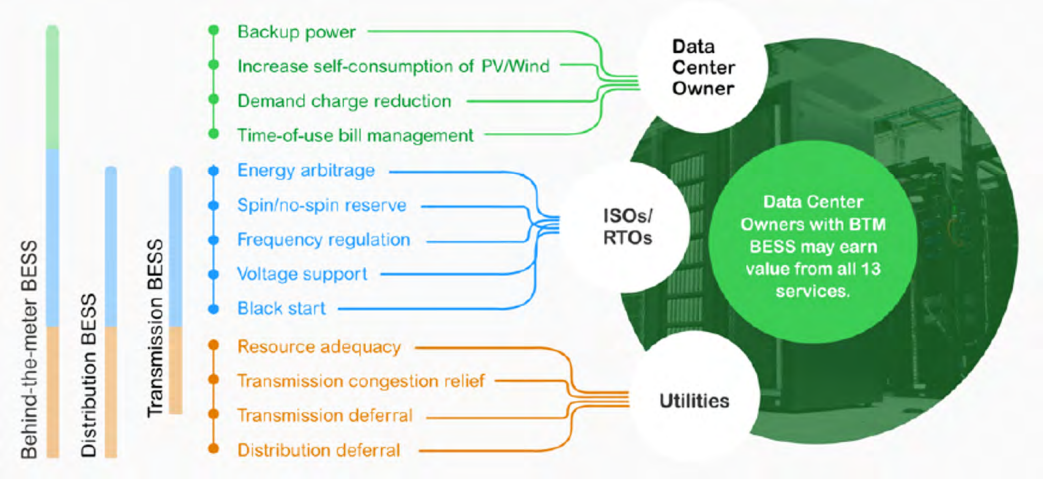


BTM assets are customer-focused solutions. Whereas batteries—typically large-scale systems—installed by utilities to bolster distribution networks or absorb massive amounts of clean energy from large solar or wind farms provide benefits across all customers, they do not lower costs or allow individual customers to increase their resiliency in the wake of grid outages. BMT systems are designed to provide energy services for a building's own consumption. This is a building block approach to sustainability. Not only can BTM lower energy costs by generating on-site when the price of power is high due to high demand on the utility or wholesale side of the power grid, but they can also support the surrounding grid with excess clean energy during times of shortage. These sales of excess on-site generation represent new revenue streams that can improve the ROI for microgrid assets.

Not all BTM batteries are created equally. The key to optimizing batteries for microgrids is the software and ancillary components, such as switchgear, which must work seamlessly with each other to enable islanding for resilience or interaction with the larger grid for revenue stream capture linked to the provision of grid services.

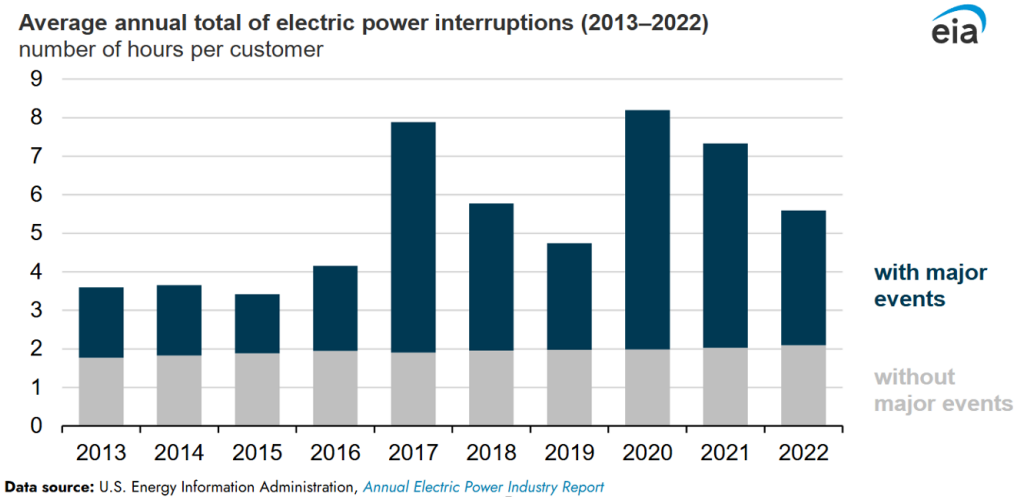
Just how much value can a BESS bring to a BTM microgrid for a fleet of commercial buildings or critical load government facilities such as fire, police, or water agency buildings? According to the Rocky Mountain Institute, BESS provides up to thirteen different services to three different stakeholder groups: customers (i.e., commercial building owners), utilities, and independent system operators/regional transmission organizations (ISOs/RTOs). BTM BESS can provide all thirteen services (Figure 4). BTM BESS services provided to utilities and ISOs/RTOs can often be monetized (for the owner) through grid services programs, participation in reserve markets, and/or indirectly through other offered incentives (e.g., incentive tax credits, net metering programs, etc.). This monetization will reduce the cost of ownership and reduce your building's energy bill. The magnitude of the value generated will depend on what is offered in your location, what you have to offer in terms of load mitigation and energy storage volume, and what you are willing to participate in as the building owner. The figure below from RMI details 13 different services a BESS can provide. Note how

the availability of these grid services changes depending upon where the battery is located on the grid.



Conclusion: MG Flex 2.0 + EaaS = energy security and affordable energy resilience

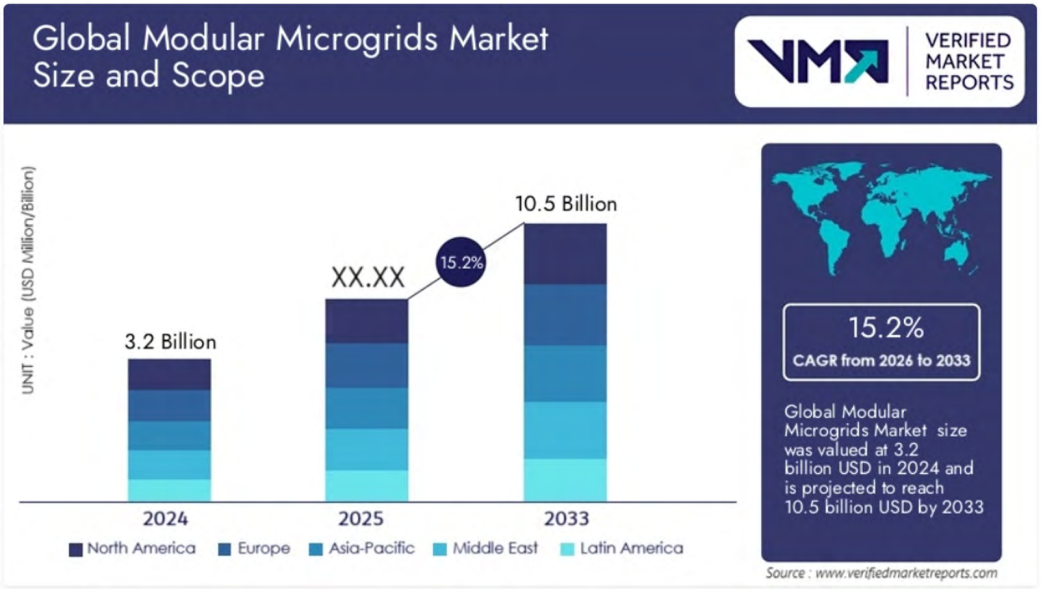
The advent of modular microgrid offerings such as MG Flex 2.0 reflects the maturation of this industry. Advanced microgrids featuring a more sustainable mix of DERs are no longer just science projects that delight engineers who love to solve complex challenges; they are now a fully commercial offering that can be replicated for a set of customers who know what the value of resiliency is: commercial entities. Since regulators rarely assign a value for resilience, microgrids have been justified in the past without applying any value to their key distinguishing feature: the ability to island. Commercial—and industrial—customers do know the value of resiliency if they have suffered through multiple and prolonged power outages. They can calculate how much revenue they lose due to lost production or delivery of services or parts during recent power outages. The Gartner analyst firm estimates that outages costs over $5,000 per minute for down data center servers. The chart below from the U.S. Energy Information Administration (EIA) highlights outage trends in the U.S.



The advantage of MG Flex 2.0—as well as other modular microgrids that focus on sustainability—can be summed up in the following ways:

- Modular, standardized microgrids for medium-sized C&I enterprises can be implemented within less than a year's time with no upfront capital investment or performance risk.
- Modular microgrids can reduce carbon and other pollutant emissions while keeping critical loads up and running during emergencies such as wildfires, hurricanes, and other extreme weather events.
- Modular microgrids also offer protection against cyber-attacks on grid infrastructure, an increasing threat to the integrity of our legacy power grids.
- Modular microgrids can be designed to create customer bill savings by leveraging artificial intelligence (AI) and machine-learning-powered analytics to optimize when to generate, buy, or sell electricity from a microgrid that is interconnected to a balancing authority with viable market structures.
- With the help of AI and deep data optimizing opportunities in major markets, modular microgrids can also generate substantial bill savings with the right software platforms.
- With Schneider Electric's energy-as-a-service financing option, customers can install a modular Microgrid Flex 2.0 with no upfront capital expense and not worry about ongoing O&M or performance issues. The "microgrid in a box" is finally here.

Just how big is the market for products like MG Flex 2.0? That is a matter of speculation. Yet trends toward more modular microgrids were first identified in a report published by Guidehouse Insights in December 2019. Though definitions of what qualifies as a modular microgrid may differ, a recent market forecast implies this is a global market that features a robust 15.2% compounded annual growth rate beginning next year.



This report notes that "one key aspect driving the adoption of modular microgrids is the demand for energy storage systems which allow for the efficient management of intermittent renewable energy resources…Energy storage technologies are therefore vital in enhancing the reliability and effectiveness of microgrids."

https://www.verifiedmarketreports.com/product/modular-microgrids-market/

About the author

Matt Holstein has a passion for driving sustainable change and is committed to expanding global renewable energy adoption. His history of on-site power generation design and implementation helps him work with energy professionals around the country to implement Microgrids and Energy Storage Systems.

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