

Microgrids: State Policies to Bolster Energy Resilience

BY DANIEL SHEA

Introduction

The United States faces a growing threat from natural disasters and energy infrastructure is in the eye of the storm. The electric grid is considered especially important because power is required to maintain the functionality of most critical infrastructure sectors—those deemed vital to the economy, public health and safety.

The threat from natural disasters has [grown in intensity and frequency](#). The previous decade was far and away the most destructive since the federal government began tracking these storms in 1980—both in terms of the frequency of severe storms and their destruction. In 2021 alone, there were 20 separate “billion-dollar disasters,” causing total losses of nearly \$150 billion.

As state lawmakers consider policies to enhance energy system reliability and resilience, a growing number have looked to the benefits of microgrids. These unique systems represent a specific form of electric resilience—the ability to maintain power locally even in the face of wider system failures. It’s a suite of technologies designed around a pragmatic admission: that the power grid is vulnerable and will at times fail.

However, microgrids often face a variety of financial and regulatory barriers that limit their deployment. The unique characteristics that make microgrids so attractive—including their ability to power critical facilities, enhance community resilience and integrate clean energy resources—are the same characteristics that often leave them in a regulatory grey space.

The reality is that microgrids are much more than simply backup power systems. These advanced systems are designed to operate in concert with the larger grid during normal operations. With the right



incentives and programs, they can support grid reliability in a way that can help absorb larger disturbances.

As state lawmakers consider whether to support microgrid development in their states, it’s important that the full suite of benefits that microgrids can provide are considered. Several states have already taken steps in this direction by enabling new financing tools, addressing regulatory uncertainty and clarifying how they should be compensated for these services.

This issue brief will explain how microgrids operate, the ways in which they can support the reliability and resilience of the power grid and the policies state legislatures have adopted to support their development.

What is a Microgrid?

Microgrids are bespoke energy systems—each designed around the customer’s specific objectives considering both normal and islanded operations. Those objectives can be [motivated by several factors](#), including increased electric reliability and resilience, enhanced power quality, decreasing electricity costs, integrating clean energy resources and powering remote communities.

Feasibility studies, along with engineering, design and business planning, are all common steps in the planning process. Ultimately, a high degree of specialized knowledge is required to justify these investments and support a microgrid’s development, which is why some states have worked to provide access to technical assistance for potential developers.

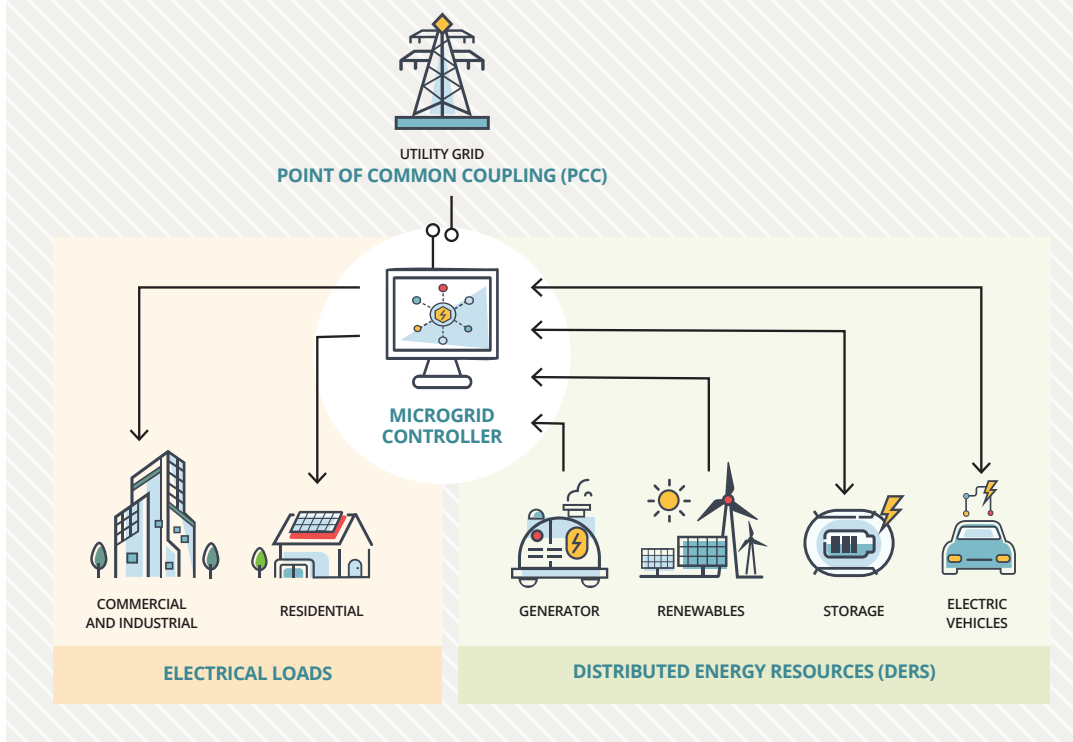
Components of a Microgrid

Electrical loads: The devices and systems that require electricity within a microgrid’s footprint, usually divided into tiers to prioritize service from the highest priority to the lowest.

Distributed energy resources (DERs): The power generation, energy storage and demand-side resources available to provide electric service to a microgrid.

Microgrid controls: The grid management system that controls the microgrid’s operations. These systems determine whether to disconnect or connect with the larger grid, maintain power balance while operating in island-mode, and dispatch the available electricity to support load in order of priority.

Point of common coupling (PCC): This is the point at which the microgrid connects and disconnects to the larger grid, also referred to as the point of interconnection.



Although [microgrids deliver electricity during outage events](#), they are much more sophisticated than backup generators. While backup generators have grown in complexity and quality over the years, they remain exactly what their name implies: backup systems designed to run only during emergency situations.

By contrast, microgrids are designed to run continuously. During normal conditions, microgrids operate harmoniously while tied into the larger power grid, using distributed energy resources (DERs) to offset energy needs and reduce consumption from the local utility—not dissimilar conceptually from rooftop solar installations. Often microgrids will rely on “anchor” resources—in many cases, diesel- or natural gas-fired generators that can supply power on demand—which are complemented by a suite of other technologies, such as renewables and energy storage. The bulk of a microgrid’s operating life will take place as a supplement to normal grid operations.

However, when an outage does occur, the microgrid will disconnect from the larger grid to operate in “island-mode.” When islanded, the microgrid relies on its complement of DERs to supply various connected

loads within the microgrid with electricity. The loads are often designated based on how critical they are, with the most important loads prioritized for uninterruptible service. Using this combination of generation and demand-side management, the microgrid can enable various degrees of redundancy and operational continuity on-site. When the outage ends, the microgrid will reconnect to the larger grid and resume harmonious operations.

Microgrid projects are designed to serve the needs of end customers, which can include businesses and organizations, government entities, utilities and residential customers. The exact design requirements can vary substantially between microgrids, depending on the loads, DERs and other motivating factors for developing a microgrid. For example, a microgrid developed to enhance operational resilience for emergency response services in a community will be driven primarily by public safety considerations. Meanwhile, a commercial or industrial microgrid will often have economic drivers, such as avoided losses in productivity through operational continuity during outages and revenue derived from competitive energy services markets during normal operations.

Additionally, microgrids can vary by scope and structure—from a single customer, single facility microgrid to one that covers the breadth of a college, medical or industrial campus, with multiple customers and multiple facilities. For the purposes of this issue brief, “microgrid developer” will be used broadly to include microgrid project development companies and microgrid owners and operators.

How Microgrids Support a Resilient Electric Grid

Microgrids are often pitched as solutions to power outages, but their advantages extend beyond just emergency applications. Microgrids can also [support the larger grid](#) by providing energy and ancillary services while grid-tied, or act on demand response signals when the larger grid is under stress. By entering island-mode in this situation, the microgrid operator is compensated for reducing the load that the larger grid must serve—all while never losing power to its own critical loads.

Microgrids can lower costs, incorporate clean energy technologies, support the heating and power needs of remote communities, reduce the strain on the larger grid during periods of peak demand and even bolster cybersecurity. Due to the diversity of applications, it’s important that state and market programs are designed with these considerations in mind.



Reasons Customers and Developers Pursue Microgrids

Even though resilience is often the primary driver, microgrids are pursued for a variety of reasons, as outlined in a [2021 joint report](#) from the National Association of Regulatory Utility Commissioners and the National Association of State Energy Officials.



Increased Reliability and Resilience

Often one of the primary objectives, microgrids can enable enhanced reliability and resilience to both routine and unforeseen outages that occur on distribution systems, allowing the microgrid's beneficiaries to maintain electric services to critical loads. These types of outages are responsible for [significant economic losses](#) due to lost productivity. While there is currently no universally accepted method for valuing resilience in the electric system, the topic has garnered significant attention in recent years and several [initiatives are underway to better quantify the benefits](#).



Economic Opportunity

In certain areas of the country, microgrids can help reduce costs and generate revenue through innovative market and rate designs. Additionally, the suite of DERs deployed by a microgrid can reduce bills through [net-metering policies](#) that compensate small-scale generators for power exported to the larger grid, while microgrids operating in areas where DERs can participate in electricity markets are able to generate revenue by [providing a variety of services](#).



Clean Energy Development

While microgrids often rely on fossil fuel "anchor" resources to ensure critical loads are always powered, these generators are often complemented by a variety of clean resources, such as solar PV and energy storage systems. Increasingly, combinations of clean energy resources have been used to anchor microgrids, with fossil fuel-fired generation used in a supporting role.



Enhanced Cybersecurity

By incorporating cybersecurity into the design process from the earliest stages, microgrids can be used to bolster cyber-defenses for customers. This can be particularly [relevant for military installations](#), government facilities and businesses.



Powering Remote Communities

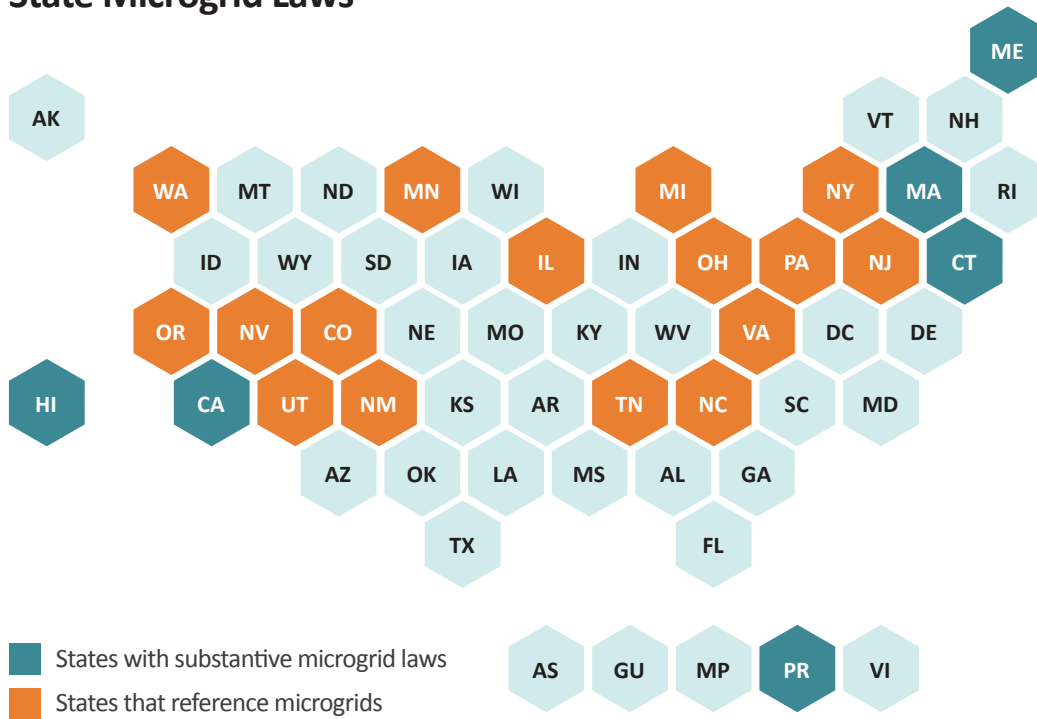
In some areas of the country, geography, population and economics restricts access to a larger power grid. This is especially true for island or rural communities, such as many in Alaska, which have historically been dependent on the periodic delivery of liquid fuels for heating and electricity needs. These communities sometimes pay [up to 10 times the national average](#) for energy and experience regular disruptions that can last for days. Microgrids can offer these communities an opportunity to develop cleaner, cheaper and more resilient energy systems to support local economies and public health and safety.

State Policies to Support Microgrid Development

While myriad inputs can affect whether a customer or developer decides to pursue a microgrid project, state policymakers can play an important role in establishing programs and procedures that incentivize and facilitate the development of microgrids.

In some cases, states have established funding mechanisms and technical assistance programs to help prospective customers and developers navigate some of the initial financing and planning hurdles that can easily derail projects in the early stages. In others, states have sought to provide developers with a greater degree of certainty and standardization around the interconnection and operation of microgrids in rela-

State Microgrid Laws



tion to their electric utility—most notably by establishing interconnection requirements, addressing access to rights-of-way and developing microgrid service tariffs. States have also started to consider how energy resilience policies, including microgrids, can be designed to support residents of low-income and elderly communities that are often disproportionately affected by extreme weather events.

Only California, Connecticut, Hawaii, Maine, Massachusetts and Puerto Rico have established state legislative policies designed specifically to facilitate the development of microgrids. More than 15 other states refer to microgrids in passing—often only when outlining the types of projects eligible for certain programs or funding. In several states, including New York and New Jersey, state utility regulatory commissions (PUCs) have taken it upon themselves to establish more robust state-level microgrid regulations, absent direct legislative directive. Similarly, state energy offices in Maryland and Wisconsin have established programs to facilitate microgrid development through their own initiative.

Due to these dynamics, most of the specific policies referenced in this section refer to the above-mentioned states and Puerto Rico.

Defining Microgrids

California, Connecticut, Hawaii, Maine and Puerto Rico have defined microgrids in statute as part of larger policies tailored specifically to facilitate the development of these systems. By defining a microgrid in statute, states can determine the types of systems that qualify under a variety of state programs, and enumerate the goal of a specific policy or program.

The handful of states that do define microgrids generally establish definitions that are substantially similar to the U.S. Department of Energy’s definition.

There are notable exceptions, however. For example, California’s definition expands on DOE’s definition of DERs, referring specifically to “energy storage, demand response tools, or other manage-

“A microgrid is a group of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode,” [according to the U.S. Department of Energy.](#)

ment, forecasting, and analytical tools,” while adding that microgrids “can be managed and isolated to withstand larger disturbances and maintain electrical supply to connected critical infrastructure.”

Meanwhile, Puerto Rico’s definition emphasizes the role microgrids can play in transitioning away from fossil fuels. “The goal of microgrids,” according to the statute, “is to reduce energy consumption based on fossil fuels by opting preferably for local renewable energy generation and strategies to reduce energy consumption.”

It’s also worth noting that some state PUCs have established more detailed definitions. The New Jersey Board of Public Utilities has established [tiers of microgrids](#) based on size and structure:

- **Level 1** microgrids comprise a single facility and owner, with a single interconnection point.
- **Level 2** microgrids consist of a single owner, but with multiple facilities that may be spread over a larger geographic area, such as a college or medical campus, and may have multiple points of interconnection.
- **Level 3** microgrid consists of multiple owners, multiple facilities and multiple points of interconnection.

This distinction can help regulators target the appropriate degree of oversight based on the scale of the project.

Grants, Pilot Programs and Technical Support

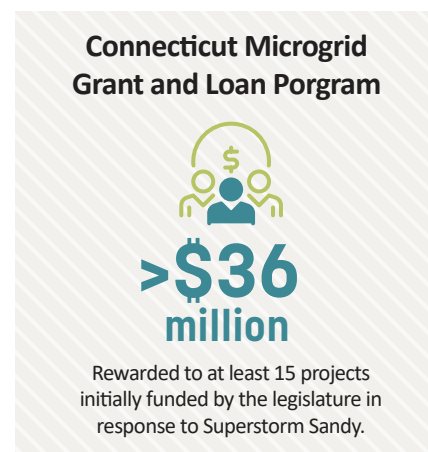
A number of states have established [programs to help potential microgrid developers](#) overcome early hurdles, while others have funded individual pilot or demonstration projects through the budget process. These are often public-facing projects that support a public institution, such as a medical campus or university.

On a larger scale, Connecticut has funded a [Microgrid Grant and Loan Program administered by the state energy office](#) for nearly a decade. The legislature initially funded the grant program in response to Superstorm Sandy, ultimately rewarding at least 15 projects with more than \$36 million. Most recently, the legislature allocated up to \$15 million to continue the program in 2021. The funding is reserved for projects that will support the development of DERs for critical facilities, defined as “any hospital, police station, fire station, water treatment plant, sewage treatment plant, public shelter or correctional facility, any commercial area of a municipality, a municipal center.”

Oregon [HB 2021](#) (enacted, 2021) established a \$50 million grant program to support community energy resilience projects that use “renewable energy systems to support the energy resilience of structures or facilities that are essential to the public welfare.” Under the new law, microgrid enabling technologies are included in the definition of “renewable energy systems.”

Several bills have been introduced to establish a similar program in New York. While none have passed, the administration has funded [a competition](#) managed through the New York State Energy Research and Development Authority to award funding for community resilience projects such as microgrids. Notably, recent legislation considered in New York would have required the state to identify communities that would benefit most from the resilience attributes of a microgrid, including disadvantaged communities. Residents of low-income and elderly communities are often disproportionately affected by extreme weather events, and several states have begun to consider prioritizing these communities for enhanced resilience.

Finally, states have recognized that financing isn’t the only limitation to microgrid development. A high degree of technical expertise is required to move a project from conception to construction. For this reason, several states, including Connecticut, Massachusetts and New York, have introduced legislation to provide local governments with access to the technical expertise necessary to evaluate a project’s feasibility and design optimization. However, none of these measures have been enacted.



It is also worth noting that the microgrid industry has developed its own solutions to reduce the initial investment requirements through financing mechanisms, such as [microgrid-as-a-service \(MaaS\)](#) models. These have been designed to reduce or eliminate upfront investment requirements and hurdles related to operations and maintenance.

State Green and Resilience Banks

A number of states have permitted [state green banks](#), infrastructure banks or resilience banks to support microgrid projects, offering potential developers an additional avenue to finance a qualifying project. Green banks are tasked with delivering innovative, low-cost capital in support of a state's clean energy or resilience goals, including credit enhancement mechanisms, co-investment, on-bill financing and technical assistance. They can offer low-cost capital for qualifying projects.

Connecticut has the nation's longest-running green bank, and in 2014 the legislature [amended existing law](#) to include microgrids under the definition of "energy improvements" that the bank is authorized to help finance through appropriations and the issuance of bonds.



In October 2014, New Jersey established the nation's first [Energy Resilience Bank](#) using a \$200 million allocation from the U.S. Department of Housing and Urban Development's second Community Development Block Grant-Disaster Recovery. The bank ultimately [dispersed the full funding for 12 critical facilities](#), including three wastewater treatment plants and nine hospitals. Of those, nine projects included microgrids.

Microgrid Inclusion in Other Policies

Several states have enacted legislation to include microgrids under existing state programs and incentives. The Connecticut legislature, in particular, has worked to wrap microgrids into state policies designed to support a variety of energy investments for both public and private entities.

First, the state added microgrids to the list of qualifying projects that [municipal energy improvement districts](#) can pursue. These special districts, which any municipality can establish through a vote of its legislative body, are intended to reduce costs and enhance reliability in these areas by permitting them to develop and operate DERs and microgrids.

Later, the state became one of the first to include microgrids under the list of qualifying projects that can be developed [through the state's Commercial Property Assessed Clean Energy \(C-PACE\)](#) financing program. [C-PACE is a financing tool](#) that allows building owners to borrow and repay funds used for qualifying clean energy projects over time through a voluntary special assessment on the building's property taxes.

C-PACE has grown considerably in recent years. At least 38 states and the District of Columbia have [enacted legislation to develop C-PACE programs](#), and programs are active in at least 28 states and the District of Columbia as of early 2022. In recent years, Illinois, New Jersey, Tennessee and Washington all joined Connecticut by including microgrids under the list of qualifying projects in state statute.

Finally, several states have included microgrids under the list of projects that qualify under grid modernization statutes. Colorado, Minnesota and New Mexico have included microgrids under broad grid modernization initiatives.

In Colorado and Minnesota, the legislatures require regulated utilities to develop and submit transmission and distribution system plans to the state PUCs. Microgrids are included in the list of technologies and concepts that can be addressed in these system plans. Similarly, in New Mexico, the legislature enacted a Grid Modernization Roadmap and Grant Program. Microgrids are included under the list of projects to improve transmission and distribution infrastructure, with grants available to support local governments, state agencies and universities, public schools and tribal nations.

Microgrid Tariffs and Interconnection Standardization

California, Hawaii, Maine and Puerto Rico have enacted microgrid-specific legislation to provide greater certainty to developers, utilities and state regulators. Broadly speaking, these policies take aim at common barriers to microgrid deployment, including challenges to interconnecting with the larger grid and uncertainty around how microgrids will be compensated for services they provide to a utility.

Microgrid tariffs are one mechanism several of these states have pursued to address these uncertainties. Tariffs are designed, in part, to provide for standardized treatment between a customer and a service provider, such as a regulated utility. These legal agreements establish the services that microgrids can provide to the utility and the prices that microgrid operators will receive for those services. They are also [designed to support strategic policy or system-level goals](#), such as enhanced reliability and resilience.

In practical terms, tariffs attempt to provide microgrid owners and operators with fair and predictable compensation for electricity, electric services and other benefits that a microgrid provides to the electric utility. These policies have also directed state agencies to streamline and standardize the processes and requirements for microgrids to interconnect with the larger grid.

In 2018, California and Hawaii each enacted legislation directing public utility commissions to establish microgrid services tariffs. California enacted [SB 1339](#) to establish microgrid services tariffs and standards for interconnection. The law directed the state PUC, in consultation with the California Energy Commission and the state's transmission and market operator, to develop the following:

- Microgrid service standards to meet state and local permitting.
- Methods to reduce barriers for microgrid deployment without shifting costs between ratepayers.
- Guidelines for interconnection, including what impact studies will be required of microgrid developers.
- Separate large utility rates and tariffs necessary to support microgrids.

In a move to incentivize clean DERs within microgrids in the state, the legislature also decided not to compensate microgrid operators for the use of diesel- or natural gas-fired backup generation.

Following this legislation, the state PUC opened multiple [rulemaking proceedings](#) to fulfill the intent of the legislation. In early 2021, the commission [approved microgrid services tariffs](#) for the state's three large investor-owned utilities.

Hawaii [HB 2110](#) and Puerto Rico [Act 17 of 2019](#) similarly direct state agencies to develop tariffs and interconnection standards to establish a level playing field and greater predictability for microgrid developers. While Maine [HB 782](#) (enacted, 2021) doesn't specifically address the development of tariffs, it does direct the state PUC to define the types of services that microgrids can provide while both islanded and grid-connected. It also directs the state PUC to approve microgrid proposals that meet certain requirements.

States have also addressed concerns about microgrid access to rights-of-way. State PUCs are responsible for ensuring that regulated utilities operate the distribution grid safely. Those safety considerations are the primary reason that many states have prohibited non-utility entities—which are not subject to the same safety standards—from stringing wires along existing power lines or across utility rights-of-way. However, those prohibitions also present significant obstacles to developing community or multi-facility microgrids, which often need to access those rights-of-way to distribute power among customers.

Microgrid developers can work with distribution utilities to establish arrangements for this type of infrastructure use, but Maine decided to push this issue through legislation. To ensure microgrid developers have access to public rights-of-way, Maine [HB 782](#) amended a state law that prohibited anyone except transmission or distribution utilities from building or maintaining infrastructure within a public right-of-way. The law now includes individuals or entities that construct, maintain or operate a new microgrids under the list of approved entities.



Federal Grant Opportunities

The Stafford Act of 1988 authorized several Federal Emergency Management Agency hazard mitigation programs that help states develop and improve their hazard mitigation plans. Two of the programs, the [Hazard Mitigation Grant Program \(HMGP\)](#) and the newer [Building Resilient Infrastructure and Communities \(BRIC\)](#) program, can help states improve energy resilience and security. HMGP is reserved for post-disaster mitigation and can only be accessed after a declared disaster to help rebuild in a way that mitigates future losses. BRIC is aimed at pre-disaster mitigation to fund projects, like microgrids, that will reduce expected disaster costs in the future.

From an energy perspective, allowable uses include hardening energy infrastructure, installing renewable energy generation or storage, and building microgrids.

The federal bipartisan [Infrastructure Investment and Jobs Act \(IIJA\)](#), passed in November 2021, included \$1 billion for the BRIC program in addition to its regular funding, and made microgrids eligible for funding under Title 1 of the law aimed at enhancing grid resilience. The IIJA also included \$62 billion to DOE to implement a wide range of [programs](#), including some grants and technical assistance programs where microgrids are eligible projects. Funding received through HMGP or BRIC [could be used to compliment investments through the IIJA](#) to improve states' energy resilience.

i For more information, visit [NCSL's BRIC and HMGP publication](#).

Conclusion

Microgrids are poised to play a large role in the future of energy resilience in the U.S. electric system. However, these systems face financial and regulatory barriers in many states. Several states have already taken steps to enable new financing tools and improve regulatory processes. As lawmakers in other states consider whether to support microgrid development, it's important that policies consider the full value and reflect the suite of benefits that microgrids can provide the power grid to harness their full potential.

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