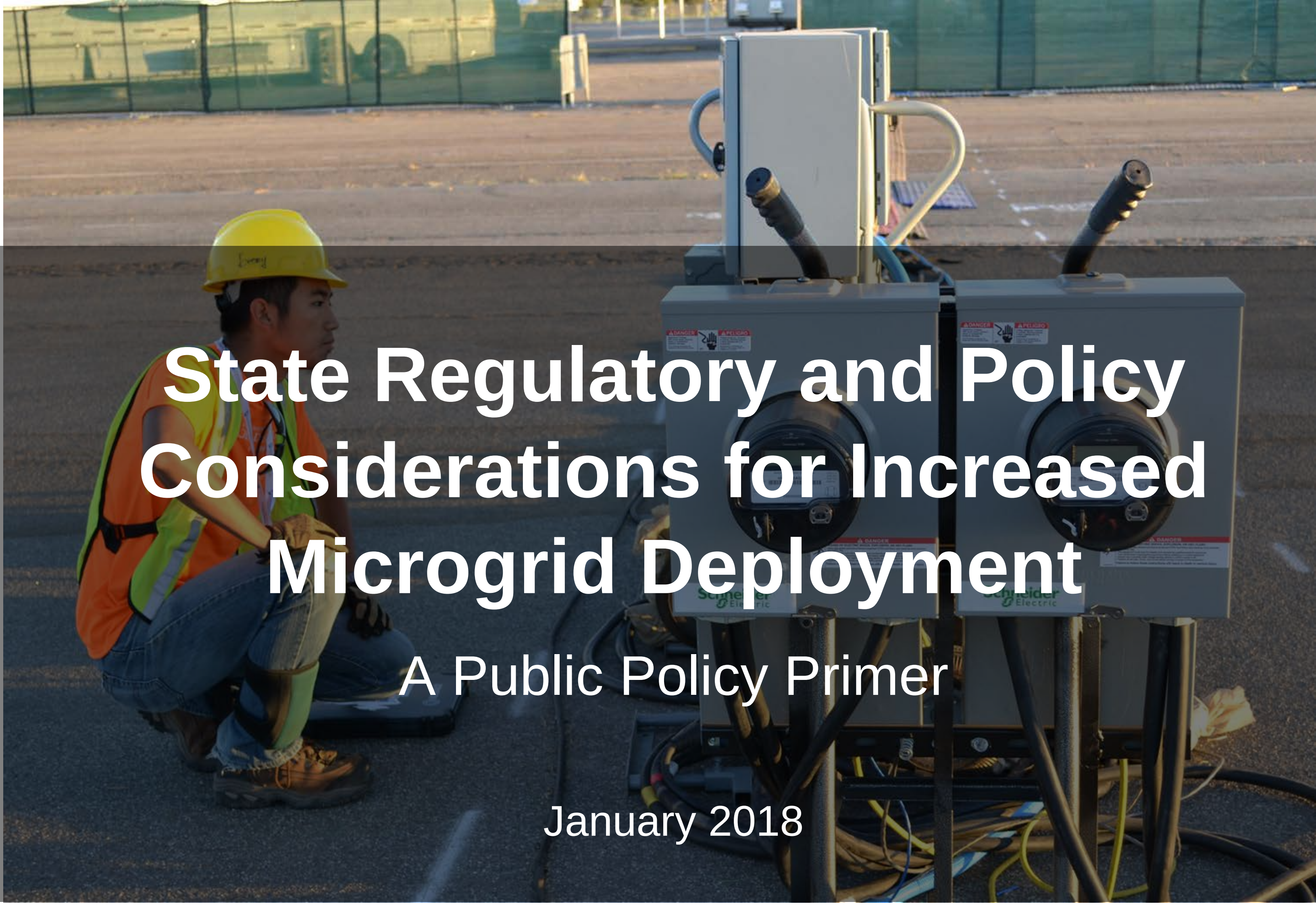

State Regulatory and Policy Considerations for Increased Microgrid Deployment

A Public Policy Primer

January 2018

Published by:

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

www.nema.org

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Executive Summary

Some of the most significant barriers to microgrid deployment are created by policy and regulatory environments that were not designed to enable microgrids. Microgrids are small electric distribution systems that utilize distributed energy resources (DERs) to power a one or a small number of customers (Figure ES-1). Microgrids are usually connected to the local electric grid (or "macrogrid") but can operate independently, as well. A variety of regulations do not anticipate the interaction of microgrids with the macrogrid and can have unanticipated effects on microgrid ownership, operation, and design. In general, barriers exist because existing policy regimes have not been efficiently adapted to make use of microgrid capabilities and to maximize the benefits of microgrids for all stakeholders. The resulting regulatory barriers inhibit microgrid deployment in three ways: by prohibiting the deployment of microgrid technologies, by imposing additional planning and design costs, and by preventing microgrids from operating in the most economically efficient way. Although various solutions to these barriers exist, uncertainty about which solutions will be ultimately chosen inhibits microgrid planners from making choices and investments in specific technologies today.

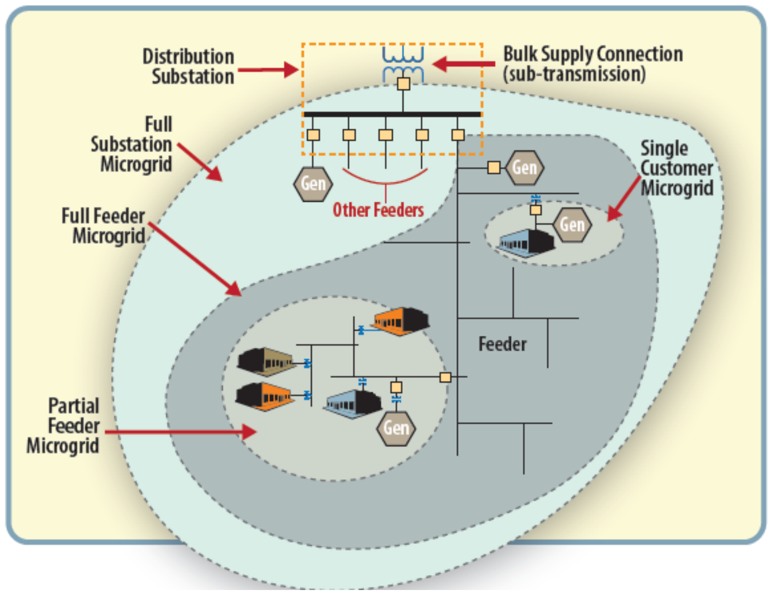

Figure ES-1: Microgrids can exist in a variety of configurations, but always include a generator and at least one load. Source: Sandia 2015.

Underlying all microgrid policy barriers is the set of incumbent assumptions about how to account for and distribute the costs and benefits of electricity generation and distribution infrastructure. Microgrids entail new costs and also supply new benefits. Together, these changes challenge the assumptions underlying existing regulations and raise the question of how to fairly assign those costs and benefits to the various stakeholders. These questions must be addressed by state legislatures and regulators, as they are best equipped to consider the desired balance of interests.

Benefits of microgrids include improved reliability and resilience to disruption, reduced emissions and environmental costs, increased penetration of distributed renewables, and the ability of utilities to defer capacity upgrades to transmission and distribution infrastructure. Microgrids may also be able to offer ancillary services such as voltage/reactive power/frequency regulation support, load shedding, or a load increase, depending on how the microgrid is interconnected and on the state's market structure. Costs include the planning and engineering costs (including compliance costs), capital costs, and operating and maintenance costs (including fuel costs and purchased energy costs).

This study evaluates the six most significant categories of barriers affecting microgrid deployment in four target states: California, Illinois, Tennessee, and Vermont. Table ES-1 outlines the barriers identified in this study, as well as the potential solutions identified in case studies and literature sources.

Table ES-1
Barriers to microgrid deployment and solutions identified in case studies and in literature sources

Barrier	Description	Solutions
Lack of standardized definitions for microgrids	Confusion regarding ownership schemes and customers, stakeholder incentives, cost allocation, and differences in associated regulatory barriers creates uncertainty for policymakers, utilities, and private planners that can stymie microgrid development.	• Standardize microgrid definitions that define divergent pathways for microgrid policy • Pursue pioneer cases with public utilities commissions (PUCs)
Public utility regulations, rights of way, and utility franchises	State regulations for public utilities can impose costly compliance burdens on small, non-utility microgrids. Exemptions for small generators in some states can help but are often limited to few customers or prevent efficient distribution infrastructure planning.	• Utility ownership and operation of microgrids • Split ownership/distribution leasing • Expanded qualifying facility exemptions
Disincentives and uncertainty for utilities in microgrid planning, operation, and ownership	In deregulated states without proactive microgrid demonstration or deployment policies, utilities are unlikely either (1) to make initial risky investments in overcoming barriers to utility ownership of microgrids (i.e., pioneer rate cases) or (2) to take steps that would enable or encourage private microgrids (e.g., standard interconnection tariffs).	• Clear policy directives that establish parallel pathways for utility and non-utility microgrids • Demonstration programs that pioneer regulatory pathways • System reliability and resilience as utility performance goals
Restrictive information sharing and unknown grid constraints	Microgrid planners do not have access to sufficient information about grid congestion and layout to make optimal design decisions or select the most promising sites for new microgrids.	• Utility planning of microgrids • Voluntary data-sharing partnerships • State/local rules requiring data sharing • Comprehensive survey of grid congestion and potential microgrid sites
Underleveraged incentive programs	State programs that promote or mandate deployment of renewables also encourage microgrid deployment by incentivizing utilities and ratepayers to install (DERs such as solar photovoltaics (PV); however, some states with strong renewable deployment policies have very few microgrids.	• In-state generation/DER mandates • Comprehensive survey of grid congestion and potential microgrid sites • Explicit incentives or requirements for reliability
Unclear interconnection requirements, tariffs, and excessive exit fees	The technical requirements for microgrids interconnecting to a distribution utility are not standardized, and excessive protection can increase microgrid costs; unknown tariffs and additional exit fees charged to microgrids can increase microgrid costs.	• Standardized interconnection requirements • Development of model tariffs • Exemption from standby charges and exit fees

Though this study does not attempt to assess the relationship between specific policies or regulations and microgrid deployment across all 50 states, some notable characteristics of microgrid deployment are highlighted below. First, the level of deployment of DERs in a state appears to have a significant influence on microgrid penetration. Policies that encourage DERs, such as renewable portfolio standards (RPSs) and energy efficiency resource standards (EERSs), are important tools for microgrid deployment. This is especially true if they require solar PV or combined heat and power (CHP) sources, which are more likely to be DERs than other renewable or efficiency resources. Solar PV is the most common generating technology used in microgrids in the U.S. (Navigant 2017). In New York and California, strong RPS policies have encouraged significant DER deployment (CEC 2017, EIA 2017). Illinois also has an RPS policy, requiring that 75% of renewable energy under the RPS be sourced by wind, which is a less commonly represented technology within microgrids (DSIRE 2016). Tennessee, which has no RPS, has very little distributed generation and only one microgrid. Table ES-2 shows the solar penetration in each target state.

Table ES-2
Installed nameplate solar capacity in each target state in 2016. *Source: EIA 2017*.

	All	***Solar (PV+Thermal)***		***Deployment Policy***
	MW	**MW**	**%**	
California	76,840	9,789	12.7%	RPS + EERS
Illinois	44,843	33	0.1%	RPS + EERS
Tennessee	21,355	70	0.3%	N/A
Vermont	691	66	9.5%	RPS + EERS

The most common attribute among policy and regulatory barriers to microgrid deployment is the role of uncertainty in inhibiting microgrid planning. In addressing any of the barriers identified in this paper, the goal of microgrid policy should be to establish clear pathways for microgrid planners, including establishing well-defined conceptual models of microgrid ownership, design, and compliance, and proceeding with statutory or regulatory reforms that address these needs.

CONTENTS

Background

This study evaluates the policy and regulatory barriers to and opportunities for increased microgrid deployment. A microgrid is typically a small, geographically distinct electric network that utilizes distributed energy resources (DERs), local distribution infrastructure, and an integrated control system. During normal operation, microgrids are connected to the regional electric distribution grid (or "macrogrid"), sectioning off small groups of loads from the regional system, and operate in sync with the local distribution utility. However, during periods of disruption, microgrids can "island," separating themselves from the macrogrid and providing self-supplied, uninterrupted power to microgrid customers.[1] These local systems can serve any type of load but often support critical facilities (such as hospitals, police/fire stations, and government buildings), commercial and industrial districts, institutional campuses, or residential buildings and neighborhoods.

Microgrids can provide a variety of benefits, depending on the technology, location, and customers, as well as the context of the macrogrid at the point where the two systems interconnect. Benefits generally include improved reliability and resilience to disruption,[2] reduced emissions and environmental costs, increased penetration of distributed renewables, and supplementary power generation and grid capacity that allows utilities to defer upgrades to transmission and distribution infrastructure. Microgrids may also be able to offer ancillary services such as voltage/reactive power/frequency regulation support, load shedding, or a load increase, depending on how the microgrid is interconnected and on the state's market structure.

Alongside the benefits come associated costs. Microgrids require additional infrastructure (such as DERs and energy storage systems), so microgrid design and installation typically increase costs for ratepayers. A benefit–cost analysis (BCA) can help in determining whether the initial costs are offset by the benefits a microgrid can provide (i.e., whether a particular microgrid is worth the investment). Achieving a positive BCA is the most critical concern for microgrid planners, as there is currently little institutional pressure and few positive incentives to adapt incumbent power distribution systems otherwise.

Policy and regulatory barriers can inhibit the organic formation of microgrids by adding to the costs of microgrid designs or by prohibiting microgrid planners from designing microgrids in locations with the greatest likelihood of having positive BCAs. Considerations such as the status and obligations of regulated utilities, the ownership and operation of generation and distribution infrastructure, the types and sizes of DERs, and the number and characteristics of microgrid customers create unique sets of barriers to various microgrid designs and ownership structures in every state.

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[1] The definition of microgrid is not standardized, and a wide variety of definitions exist to characterize the unique attributes of microgrids. The inclusive definition provided here differs from the various, increasingly specific definitions outlined in the section titled "Lack of Standardized Definitions."

[2] Reliability and resilience benefits are often cited in parallel in the literature, but they have different technical meanings relevant to the benefits of microgrids. Reliability is typically defined as the uptime of electric service and is typically quantified with metrics such as the System Average Interruption Duration Index (SAIDI), which measures the average duration of outages for a utility's customers, or the System Average Interruption Frequency Index (SAIFI), which measures the average number of outages a customer experiences (EIA 2016). Resilience is often used to address broader concepts than reliability; the most concise definition used by federal agencies is: "The term 'resilience' means the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents" (White House 2013). In the literature, "grid resilience" is also used to refer to the capability of systems to withstand external stressors, exclusive of the system's ability to recover (Taft 2017). Since microgrids improve both these factors, the former definition is used in this paper.