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PROVIDING OPTIMAL VALUE TO ENERGY CONSUMERS THROUGH MICROGRIDS

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Microgrids are an increasingly popular means of making a smaller, smarter, cleaner, and more resilient energy grid. When Superstorm Sandy hit the northeast states, a few microgrids continued to provide their constituents with energy for weeks while the rest of the grid was down. Microgrids typically involve small-scale energy generation coupled with nearby storage and distribution, and are connected to, but capable of disconnecting from, the macrogrid during a power outage.

This Comment will analyze the economics of microgrids, focusing on the necessity of effective cost-benefit analyses. In order to allow for the development of microgrids, regulators should create appropriate mechanisms for microgrid developers to recover the costs of development and operation. However, when incentivizing microgrid development, regulators must remain focused on maintaining an optimal market for consumers, by accounting for the net utility provided by the microgrid. The benefits and costs of microgrids must be quantified both when planning specific microgrid projects and when creating regulatory frameworks. The efficacy of energy policy relative to microgrids will turn on the accuracy of the cost-benefit analysis used by regulators and developers.

This Comment will begin by introducing what microgrids are, their costs, benefits, barriers, the driving forces behind their development, and some notable

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microgrid success stories. Part I will describe the present uncertainty around microgrid regulation and discuss the need to introduce specific microgrid legislation/regulation to increase certainty. Part II will discuss modern attempts to evaluate the costs and benefits of microgrids and the importance of further developing cost-benefit analyses. Part III will address how microgrids fit into typical laws governing public utilities. Part IV will discuss how states should regulate and incentivize microgrid development, with greater or lesser emphasis on market efficiency. This portion will also analyze creative uses of rate-making to intelligently encourage microgrid development. Lastly, Part V will address a means of fitting energy storage, and through it, microgrids, into wholesale markets, thereby adding an important source of cost recovery to microgrid developers.

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INTRODUCTION

Microgrids trace their origins to the 1880s, the first one being Edison's Manhattan microgrid, supplying light to 59 homes using Edison bulbs and newly installed grid infrastructure.¹ As our transmission technology improved and society became environmentally conscious, power generation moved away from cities, where electricity was predominantly consumed.² Around the same time, states developed franchise laws to ensure cost recovery for public utilities and to protect consumers with rate regulation and other oversight.

A. *Defining a Microgrid*

The Department of Energy defines a microgrid as “a group of interconnected loads and distributed energy resources (DER) within clearly defined electrical boundaries that act 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 and island-mode.”³ One challenge facing microgrids is the lack of definition within state law. The few states that do define microgrids do so differently. Defining is an integral step in regulating and encouraging microgrids.

DER, seen in the definition above, is defined by Massachusetts as “a device or measure that produces electricity or reduces electricity consumption, and is connected to the electrical system, either ‘behind the meter’ in the customer’s premise, or on the utility’s primary distribution system. A DER can include, but is not limited to, energy efficiency, distributed generation, demand response, microgrids, energy storage, energy management systems, and electric vehicles.”⁴ New York and California have very similar definitions. To narrow in even further, “[d]istributed generation, also known as on-site generation or distributed energy, refers to the production of electricity by a small-scale source located at or very near the end users it serves.”⁵

¹ RESILIENCY THROUGH MICROGRIDS TASK FORCE, RESILIENCY THROUGH MICROGRIDS 8 (2014) (exploring the early history of microgrids in New York).

² *Id.* (discussing the historical trend towards out of city power generation).

³ *Microgrid Definitions*, MICROGRIDS AT BERKLEY LAB, <https://building-microgrid.lbl.gov/microgrid-definitions> [<https://perma.cc/6ZEZ-RYYY>] (last visited Jan. 20, 2019) (describing microgrids as having the capability of connecting to power grids or operating independently).

⁴ NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS, NARUC MANUAL ON DISTRIBUTED ENERGY RESOURCES RATE DESIGN AND COMPENSATION 43 (2016) (defining distributed energy resources under Massachusetts law) [hereinafter “NARUC”].

⁵ Sara C. Bronin, *Curbing Energy Sprawl with Microgrids*, 43 CONN. L. REV. 547, 559 (2010) (defining distributed generation, also known as on-site generation).

To summarize, microgrids are relatively small energy systems, typically including small-scale generation, storage, and consumption, which can separate from the grid to feed specific consumers with resilient energy. “When the [microgrid] disconnects from the centralized grid, the islanded area transitions from redundant infrastructure to the primary power source. . . .”⁶ Utilities have in the past objected to non-utility owned microgrids and distributed generation, expressing concerns about technology feasibility and safety.⁷ Commentators argue that national safety standards and interconnection technology have made these arguments less viable.⁸ However, a 2014 survey by Accenture found that a majority of utility company executives believed revenue would fall between now and 2030, and microgrids would impact this revenue reduction.⁹ While certain states have taken the initiative to integrate microgrids into the current energy distribution system, many states are held back by pervasive regulatory uncertainty and the inherent tension between traditional franchised utilities and disruptive microgrid technology.

Microgrids can be confused with many related modern developments in the grid. For instance, “[b]oth [smart grids and microgrids] may use the same technology, and often incorporat[e] DG and energy storage, or include customer-focused technologies such as smart meters.”¹⁰ An important distinction is that smart grids encourage reform from the top down while microgrids provide bottom up changes to the grid. Another example, nanogrids, are one form of a microgrid, and feature “a single backup generator, perhaps with energy storage, to support minimal building operations when the larger grid goes down. These nanogrids are small, usually under 100 kilowatts.”¹¹

⁶ Kevin B. Jones et al., *The Urban Microgrid: Smart Legal and Regulatory Policies to Support Electric Grid Resiliency and Climate Mitigation*, 41 *FORDHAM URB. L.J.* 1695, 1702 (2014).

⁷ Bronin, *supra* note 5, at 569 (noting and criticizing past objections to microgrids by utility companies).

⁸ *See id.* (arguing that utility fears of fires starting due to microgrids supplying a shutdown grid are null due to islanding technology, other interconnection fears can be assuaged by reputable standards for distributed generation interconnection have been developed, and new technology protects against degradation of power quality).

⁹ Heather Payne, *A Tale of Two Solar Installations: How Electricity Regulations Impact Distributed Generation*, 38 *U. HAW. L. REV.* 131, 171 (2016) (citing Jack Azagury et al., *How Can Utilities Survive Energy Demand Disruption?*, *ACCENTURE 2* (2014)).

¹⁰ ELECTRIC POWER RESEARCH INSTITUTE, PROGRAM ON TECHNOLOGY INNOVATION: MICROGRID IMPLEMENTATIONS: LITERATURE REVIEW 1-2 (Jan. 2016) (identifying a basis for the conflation of microgrids and smart grids) [hereinafter “EPRI”].

¹¹ MATT GRIMLEY & JOHN FARRELL, INSTITUTE FOR LOCAL SELF-RELIANCE, MIGHTY MICROGRIDS 6 (2016) (noting the small energy capacity of nanogrids).

As of 2015 Microgrids generated 1.3 gigawatts of capacity, 0.1% of total US electric generation capacity.¹² In North America, microgrid capacity is growing at 44% per year and globally at 70%.¹³ However, in the United States 80% of operational microgrids are located in just seven states.¹⁴ In the U.S. microgrids are built by six different entities, with 10% being built by utilities, 15% by military installations, 25% by universities/research facilities/hospitals, 12% by cities/public institutions, 20% by commercial and industrial complexes, and 18% by remote locations.¹⁵ Projects with utility involvement range from pilot projects to fully operational microgrids with rate based recovery. Ownership of this utility model would benefit from a higher degree of coordination between users and utilities; this could be established by a hybrid utility/user ownership of the model.

B. Value Added with Microgrid Development

Microgrids are encouraged largely for their ability to add reliability and resiliency to the grid, as well as their ability to integrate DER, reduce emissions, protect critical facilities, save money for customers, and reduce infrastructure investment. Recently, additional interest has stemmed from cheaper renewables, integration technology, and opportunities for microgrids to expand into wholesale energy markets. New York State, in its cost-benefit analysis manual (discussed later), outlines microgrid revenue streams, including energy benefits (energy cost savings and capacity cost savings), reliability benefits, power quality benefits, and environmental benefits.¹⁶ The manual notes that offsetting the above benefits are costs which include initial design and planning expenses, capital investments, operation and maintenance, and environmental costs.¹⁷

Regulators should encourage the making of an efficient energy market, which would provide the most value to the consumer. In order to do this, regulators must make the development of microgrids cost effective

¹² *Id.* at 7 (stating the total energy production of microgrids in the United States).

¹³ JOHN CALDWELL, EDISON ELECTRIC INSTITUTE, UTILITY BUSINESS MODELS FOR MICROGRIDS (last visited Jan. 23, 2019) (delineating global trends in microgrid capacity).

¹⁴ GRIMLEY & FARRELL, *supra* note 11, at 7 (noting the concentrated distribution of microgrids within seven states).

¹⁵ CALDWELL, *supra* note 13.

¹⁶ INDUSTRIAL ECONOMICS, INC., ASSESSING THE BENEFITS AND COSTS OF DEVELOPING A MICROGRID: MODEL USER'S GUIDE 13 (2015) (identifying the multitude of benefits associated with microgrids according to the state of New York).

¹⁷ *Id.* at 5 (identifying potential costs of microgrids according to the state of New York).

through allowing the owners of beneficial microgrids to recover costs to an appropriate degree (this could be accomplished through rate-making, access to wholesale markets, charging non-benefiting consumers, or other means). Insufficient research has been done quantifying the economic value of grid resilience. While survivability is a highly valuable trait, at a certain point adding resiliency becomes uneconomical, and proper investigation into the value of resilience should be undertaken. A case study in Broome County, NY showed that for the microgrid to be cost effective, meaning that it provides a net benefit, there must be 17 days or more per year without power.¹⁸ “Amazingly, these case studies have had no discernable impact upon the microgrid bandwagon.”¹⁹

Reformative energy grid legislation typically arises in response to weather induced outages (such as in Connecticut, New Jersey, and New York)²⁰ and is potentially infused with an overzealous and uneconomical desire to create grid resilience.²¹ Any cost-benefit analysis of microgrids would be incomplete without looking at probable outage days per year and the recaptured value provided by resilience.

C. *The Resiliency Appeal of a Microgrid*

The capability of a microgrid to maintain operations while disconnected from the main grid can be tremendously important during extreme weather.²² Superstorm Sandy was the second costliest storm to ever hit the United States, causing \$66 billion in damage and 159 deaths.²³ “The storm spanned almost one thousand miles in breadth, and its intensity caused a

¹⁸ Steve Huntoon, *Microgrids: Where's the Beef?*, PUBLIC UTILITIES FORTNIGHTLY 1, 11 (Nov. 2015), <http://www.energy-counsel.com/docs/Microgrids-Wheres-the-Beef-Fortnightly-November2015.pdf> (criticizing the high rate of downtime necessary to make microgrids cost effective).

¹⁹ *Id.* (asserting that the evidence of inefficiency of microgrids has not tempered popular enthusiasm for them).

²⁰ See discussion *infra* Part IV.

²¹ PETER H. LARSEN ET AL., LAWRENCE BERKLEY NATIONAL LABORATORY, ASSESSING CHANGES IN THE RELIABILITY OF THE U.S. ELECTRIC POWER SYSTEM 37 (2015), <https://emp.lbl.gov/sites/all/files/lbnl-188741.pdf> (finding no clear correlation between increased spending and greater reliability).

²² See generally, Jones et al., *supra* note 6 (repeatedly noting the utility of microgrids during extreme weather events).

²³ James M. Van Nostrand, *Keeping the Lights on during Superstorm Sandy: Climate Change Adaptation and the Resiliency Benefits of Distributed Generation*, 23 N.Y.U. ENVTL. L.J. 92, 94 (2015) (stating the financial and human costs of Hurricane Sandy).

fourteen-foot storm surge at Battery Park in lower Manhattan—a surge that exceeded previous storm tides by over three feet.”²⁴ Approximately 8.5 million utility customers lost power on the east coast.²⁵

Not all communities lost power as a result of Sandy. “With a 15 megawatt (MW) combined heat and power generator as well as 5.3 MW of solar, Princeton University’s microgrid kept its campus live for three days while power was cut during Hurricane Sandy.”²⁶ In Long Island, South Oaks Hospital was segregated from the grid for fifteen days after Sandy, relying on 1.25 MW from its combined heat and power generator and 47 KW of solar.²⁷ This 245 bed healthcare facility took on patients from other sites that lost power during the storm.²⁸

During the summer of 2013, in southern California, the Borrego Springs microgrid successfully islanded during brownouts to provide cooling zones during periods of intense heat.²⁹ During a planned outage in 2015, it also became the first microgrid to rely on solar and storage.³⁰ These two examples provide a certain comfort to the human need for resiliency and consistency, but do little in the way of proving viability based on cost-benefit models.

D. Regulatory Environment and Framework

Present regulatory barriers make it difficult for microgrid developers to recover costs.³¹ Many states require that an entity be labeled an electricity marketer or public utility in order to sell electricity to others.³² Although interconnection with the main grid can be non-standard, and objected to by

²⁴ *Id.*

²⁵ *Id.* (noting the mass number of people affected by power outages on the east coast due to Hurricane Sandy). Five years later New York City residents are still feeling the impact. See Oliver Milman, *Hurricane Sandy, five years later: ‘No one was ready for what happened after’*, THE GUARDIAN (Oct. 28, 2017), <https://www.theguardian.com/us-news/2017/oct/27/hurricane-sandy-five-years-later-climate-change> [<https://perma.cc/YN7V-4HAZ>] (speaking to the impact of Hurricane Sandy on New York residents and residents of surrounding areas).

²⁶ GRIMLEY & FARRELL, *supra* note 11, at 10.

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Id.* at 16.

³⁰ *Id.*

³¹ See, e.g., Alex Porteshawver, *CA Regulations are Hindering Microgrid Development*, CTR. FOR SUSTAINABLE ENERGY (Aug. 9, 2018), <https://energycenter.org/blog/ca-regulations-are-hindering-microgrid-development> [<https://perma.cc/4GUS-CYUM>]

³² See 21ST CENTURY POWER PARTNERSHIP, AN INTRODUCTION TO RETAIL ELECTRICITY CHOICE IN THE UNITED STATES (Aug. 2017), <https://www.nrel.gov/docs/fy18osti/68993.pdf> (“Most retail markets have a rigorous certification, licensing, and registration process for retail electric service providers.”).

the utility, many consider it technically manageable.³³ Finally, legal uncertainty, transaction costs, and technological difficulties can make microgrids more expensive than anticipated.³⁴

As a starting point for reducing barriers to entry, we should create clarity within the regulatory regime of exactly what microgrids are and what responsibilities they bear, deploy a compensation model that allows adequate return on investment and equitable results for consumers, create more flexibility in who can own and operate microgrids, and incentivize the development of microgrids and DER. It is important to be mindful of overall market efficiency in developing this microgrid friendly framework; over incentivizing and under-regulating microgrids will have a negative effect on energy consumers.³⁵ Beyond the regulatory framework and incentives discussed, a plethora of outstanding legal questions exist regarding microgrids, including what entities are allowed to operate microgrids, where costs are to be recovered from, whether exceptions are to be carved out of franchise laws, and how exactly to price island-mode energy services.

I. IMPORTANCE OF REGULATORY CERTAINTY

An important step toward making microgrids as economically effective as possible is improving regulatory certainty to allow effective cost planning. As of March, 2016, Connecticut was the only state to have defined microgrids within its energy regulation framework.³⁶ “Without explicit determination of what a microgrid is and what types of law apply, microgrid financiers and developers face a sizeable degree of uncertainty that may deter project development.”³⁷ Where microgrids have been developed by third parties, especially in California, Pennsylvania, New York, and Connecticut, it has been done by obtaining public interest waivers or fitting into standard-

³³ Since 2003 the Institution of Electric and Electronics Engineers (IEEE) has released standards for interconnecting distributed generation resources to the main grid. *See generally* Standards Coordinating Committee, *IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems*, IEEE STANDARDS 1 (2003).

³⁴ CALDWELL, *supra* note 13.

³⁵ Negative effects arise from rate-making schemes that charge consumers more in order for utilities to gain a return on investment for costs associated with microgrids. Increased costs ultimately fall on consumers and should create a net positive result.

³⁶ *See* CONN. GEN. STAT. ANN. § 16-243(y) (West 2016) (defining microgrids as “a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid and that connects and disconnects from such grid to enable it to operate in both grid-connected or island mode.”). This statute includes exemptions from the utility’s franchise.

³⁷ Jones et al., *supra* note 6, at 1736.

based exceptions within the state's definition of an electric corporation.³⁸ Even after evading state regulatory oversight, the industry remains replete with risk. For instance, the FTC has warned that utilities may try to raise costs or discriminate against third party providers.³⁹

New York provides a good example of present regulatory uncertainty; it is difficult to predict whether a microgrid will be labeled as a public utility by the New York Public Service Commission (PSC). The oversight imposed by New York on public utilities is fairly standard⁴⁰ but "because many of these mechanisms were developed without microgrids in mind, their application to microgrids may not be appropriate."⁴¹ New York asks that microgrids meet the criteria of qualifying facilities, a federal concept under Federal Energy Regulatory Commission (FERC) management, meant to establish "a new class of generating facilities that would receive special rate and regulatory treatment."⁴² New York borrowed this idea, and allows exemptions from utility regulations for qualifying facilities which include specific types of energy production—co-generation, small hydro, alternative energy, and related facilities—with an eighty Megawatt energy production ceiling.⁴³ These specific forms of generation must serve users at or near the project site to receive the exemption. This definition still leads to a large degree of ambiguity, in that it is unclear what it means to be located at or near a project site, a requirement for the qualifying facility exemption.⁴⁴ The New York resiliency report opines that despite the PSC deciding a number of cases dealing with this standard, there are no "firm guidelines that can be followed to ensure a microgrid project will be exempt."⁴⁵ Instead, the PSC offers "different perspectives on what 'at or near' might mean in different contexts."⁴⁶

³⁸ See *id.* at 1711 ("California's regulations support microgrid implementation as long as the microgrid is located on a single piece of property, does not sell electricity to more than two tenants on its property, and does not sell electricity to others outside of its property other than electric corporations or state agencies.").

³⁹ See GRIMLEY & FARRELL, *supra* note 11, at 30 ("The Federal Trade Commission, too, warns New York that utilities will still try to discriminate or raise the costs of third-party providers looking to engage in power production and distribution.").

⁴⁰ Jones et al., *supra* note 6, at 1738.

⁴¹ See NEW YORK STATE ENERGY RESEARCH AND DEV. AUTH. ET AL., MICROGRIDS FOR CRITICAL FACILITY RESILIENCY IN NY STATE 28 (2014) [hereinafter "NYSERDA"].

⁴² *What is a Qualifying Facility?*, FED. ENERGY REG. COMM'N, <https://www.ferc.gov/industries/electric/gen-info/qual-fac/what-is.asp> [<https://perma.cc/76UR-EXZC>] (last visited Jan. 19, 2017).

⁴³ NYSERDA, *supra* note 41, at 29-30 ("This [80 MW] requirement may invite dispute where multiple alternate energy sources are located closely together, while being owned by separate parties, such as in a microgrid.").

⁴⁴ *Id.*

⁴⁵ *Id.* at 30.

⁴⁶ *Id.*

For non-exempted enterprises, regulation still depends on a three-pronged analysis 1) whether a section of the New York Public Service Law is inapplicable on its face; 2) if facially applicable, whether or not an entity can comply; and 3) whether imposing the requirements is necessary to protect the public interest or instead would harm the public interest.⁴⁷ This standard-based public interest approach leaves investors with more uncertainty, risk, and legal and/or regulatory costs than is ideal. Although a public interest standard is necessary to protect consumers, a better solution would involve guidelines articulated explicitly for microgrid developers.

Sara Bronin suggests in her 2010 article that Congress require states to consider model regulations for microgrids.⁴⁸ This type of encouraged behavior has already led to intrastate interconnection standards which, although similar, still retain some differences between states. Even standards within states have helped foster microgrids.⁴⁹ Bronin further recommends that states guide localities in how to site and permit microgrid projects.⁵⁰ The need for uniformity and certainty is evidenced by a compelling, though admittedly old study:

In 2002, researchers at Carnegie Mellon University interviewed utility regulators in eight states to determine how their states treated microgrids. They presented the regulators with several scenarios, including one in which a for-profit commercial firm served twenty customers in an industrial park, as well as a cooperative operated by its customers. Of the eight regulators, three indicated that microgrids in at least one presented scenario could be built, but only one of the three, the representative from Minnesota, indicated that small microgrids might be exempt from public utility classification and regulation.⁵¹

Bronin then presents a model standard, containing a description of state alternative energy policy, a definition for microgrids, and a limit on the size of unregulated microgrids regarding energy and participants.⁵² Her model for exempting microgrids is, however, missing a provision requiring a showing of cost efficiency: if the state is going to grant a microgrid exemption from utility regulation, that microgrid should also be improving the market

⁴⁷ *Id.* at 35.

⁴⁸ *See generally* Bronin, *supra* note 5.

⁴⁹ *Id.* at 552.

⁵⁰ *Id.*

⁵¹ *Id.* at 566.

⁵² *Id.* at 578.

for the benefit of the consumers. This paper was published in 2010 before states began developing cost-benefit tests and frameworks and focuses on encouraging states to think about incentivizing microgrids rather than structuring the process.

Movement in the direction of legal and regulatory certainty will drive down costs, immediately increasing cost-effectiveness of microgrids. While most utilities will not want third parties to be able to distribute energy free of regulation, in some states this already happens, and utilities too would benefit from being able to plan more effectively around a statutory definition and limited exemption for microgrids.

II. EFFECTIVELY EVALUATING COSTS AND BENEFITS OF MICROGRIDS

A. *Properly Valuing Resiliency*

When regulating and incentivizing resiliency, it is imperative to keep in mind the value of resiliency per the specific situation. It is easy to fall into the military inspired mindset of survivability above all else, but it is important to attach specific economic value to power outage prevention. This can be done by placing an economic value on the utility provided to the end users of the microgrid and predicting the number of outages per year in that geography. Care must be taken in using an appropriate prediction model in terms of value and likely outages.

Military installations were some of the first sites to develop microgrids, in large part because resiliency has nearly immeasurable value to the military. “Increased use of renewable energy through independent microgrids at domestic installations decreases the implications of a cyber attack on the commercial electric grid for military preparedness, a crucial mission for domestic security.”⁵³ The islanding ability of microgrids may add immeasurable value to certain critical facilities such as military bases. Beyond that, the value of survivability grows increasingly measurable because most facilities contribute predictable value to GDP each day. The analysis, however, remains difficult to quantify when personal residences rather than commercial buildings are the end users, and when a lack of

⁵³ Ashleigh Acevedo, *Enlisting Renewable Energy: The Military’s Environmental Exceptionalism and a Renewable Energy Initiative in the Face of a National Security Threat*, 45 TEX. ENVTL. L.J. 343, 365. For more information on the military’s use and vision for microgrids see generally ELECTRICITY INNOVATION LAB, ROCKY MOUNTAIN INSTITUTE, ADVANCING MILITARY MICROGRIDS: CHALLENGES AND RECOMMENDATIONS BASED ON INSIGHTS FROM A TWO-DAY WORKSHOP TO SUPPORT NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST’S MICROGRID EFFORTS (2013) (creating potential solutions to ensure energy security at U.S. naval bases).

electricity poses a safety risk. Furthermore, backup generation must be considered as an alternative in considering the costs of a microgrid. State initiatives, public utilities, and private actors must attempt to directly measure the value of resiliency if they hope to provide value to consumers.

In order to preserve their political capital, regulators may feel compelled to take action regardless of actual economic value in response to high profile blackouts. This phenomenon is evident from the strong microgrid responses to severe weather around the country, which has had a deadly effect over the last decade.⁵⁴ Providing constituents with a sense of security undoubtedly has a value beyond the quantifiable, but apart from critical facilities, the rest of the grid should be fortified with an eye toward economics.

The internet is a good example of the downside to applying military priorities to a commercial enterprise. Originally developed by Defense Advanced Research Projects Agency (DARPA), the military adopted an end-user-controlled model for the internet with the chief priority being survivability, as the internet was then a predominantly military resource. As the internet has expanded to its present commercial form, it has remained wedded to its early protocols, creating economic inefficiency as a price for resilience. While the end user-controlled system may have facilitated early expansion, it has proven less than ideal for commercial efficiency. The moral of the story is that military priorities differ from commercial priorities, and we should adopt a model that provides the most value to the energy consumer, which may not be the most resilient model.

One important starting point for assessing the value of resiliency is incorporating climate science and actuarial insurance techniques in predicting the likelihood of a blackout. The technology and resources presently exist to do this analysis. For instance, the Power Outage Annual Report by EATON tracks the outages each year.⁵⁵ An obvious way to predict outages in a certain area is to linearly track the outage pattern over enough years. This technique is handicapped by the variability of large-scale storms.⁵⁶

⁵⁴ See NYSEDA, *supra* note 41, at O-2 (“Extreme weather and other natural disasters can threaten lives, disable communities, disrupt economic activities, and lead to the devastation of power generation, transmission, and distribution infrastructure. According to the U.S. Department of Energy, outages caused by severe weather such as thunderstorms, hurricanes, and blizzards account for 58 percent of outages observed since 2002 and 87 percent of outages affecting 50,000 or more customers.”).

⁵⁵ See generally, EATON, BLACKOUT TRACKER: UNITED STATES ANNUAL REPORT 2015 (2015), http://www.sustainablepowersystems.com/wp-content/uploads/2016/03/US_BlackoutTracker_2015_Final.pdf.

⁵⁶ See *id.* at 3 for a list of outages nationally since 2008:

Traditionally, utilities use the “Power System Simulator for Engineering (PSSE) or comparable software to plan utility infrastructure and power distribution. PSSE executes dynamic simulations of power transmission so engineers can analyze and optimize the grid’s performance.”⁵⁷ Regulators should incorporate these outage prediction models in deciding how intensively to incentivize microgrid development in general, and for specific locations. It is imperative to have a workable means of generating precise values for the expected added resiliency.

B. Creating a Model

One issue with creating a cost/benefit model is that “[m]icrogrid designs are highly unique. It is difficult to compare or extrapolate benefits and costs from one site to another.”⁵⁸ Because of the small-scale nature of microgrids, the diverse nature of DER, and the energy resource differences across the country and even within states, standard rules for cost analysis cannot be made to apply to all microgrids. Furthermore the facilities served, because of the small scale, will vary greatly in the benefits they derive from the microgrid. The extensive and individualized cost-benefit analysis required will add an unavoidable, but worthwhile, transactional cost to developing a microgrid.

An initial step is to identify who benefits from the microgrid, as the costs should be divided equitably—meaning that costs fall on those who benefit from the microgrid. This idea may be more complex than it seems—it is possible for consumers outside the microgrid supply area to benefit, for example, due to investment savings acquired by the utility. The idea is that equitable cost distribution is ethically best and leads to market efficiency.⁵⁹ Despite the variety

Year	Total number of outages	People affected
2008*	2,169	25.8 million
2009	2,840	13.5 million
2010	3,149	17.5 million
2011	3,071	41.8 million
2012	2,808	25.0 million
2013	3,236	14.0 million
2014	3,634	14.2 million
2015	3,571	13.2 million

*Partial-year data. Data collection began on February 16, 2008.

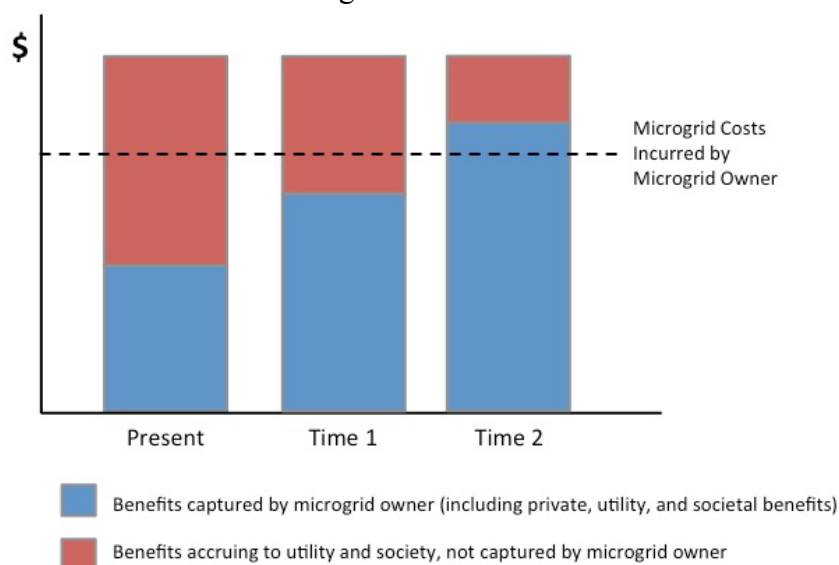
⁵⁷ Oak Ridge National Laboratory, *Predicting electric power outages before they happen*, SCIENCE DAILY (Sept. 26, 2014), <https://www.sciencedaily.com/releases/2014/09/140926213548.htm> [<https://perma.cc/G6PZ-CE6Z>].

⁵⁸ NYSERDA, *supra* note 41, at S-3.

⁵⁹ Equity is subjective and cannot be simply measured, but ideally consumers will feel as though they get the proper value for their energy costs and will continue to purchase energy

of ownership models, whether it is a utility, government entity, non-profit entity, or for-profit entity owning the microgrid, “the net benefits and costs . . . are constant irrespective of who owns and/or controls the microgrid.”⁶⁰ The New York task force report on grid resiliency developed a cost-benefit analysis tool, but opined that “a more expanded version of a benefit cost model should be developed that will satisfy the need to account for the full spectrum of costs and benefits associated with microgrids.”⁶¹ An expansive cost-benefit model should be a top priority for regulators, especially given the growth of expensive microgrid incentive programs. The New York competition’s model mentioned above provides one example.

While the first concern is that microgrids provide value to consumers, it is equally important that the benefits created by the microgrid can be monetized to an appropriate degree by the microgrid owner.⁶² “The ideal scenario is one where, over time, mechanisms are created that allow the benefits produced by microgrids to be capture [sic] by the microgrid owner to incentivize the development of microgrids that provide these and other benefits.”⁶³ The graphic below depicts how different levels of benefit capture may lead to investment in microgrids:⁶⁴



to a societally efficient degree. If consumers are undercharged for the value they derive from energy consumption they will over consume and vice versa.

⁶⁰ NYSERDA, *supra* note 41, at 98.

⁶¹ *Id.* at iii.

⁶² *Id.* at 99.

⁶³ *Id.* at 107.

⁶⁴ *Id.* at 108.

The New York resiliency report found that microgrids supporting critical infrastructure were not usually economically feasible because of the already existing backup generation and the high cost of microgrid infra-structure.⁶⁵ This, however, was not true for tightly clustered critical facilities. Beyond the density of the load, another important element of cost effectiveness is the ability of the microgrid to operate economically more frequently than just during outages. The state can manipulate this by changing net metering laws, removing franchise restrictions, and encouraging microgrid access to wholesale energy markets, all of which appear to cut against public utility goals. Some of these mechanisms are not particularly well suited for micro-grids, for instance net metering economics are complex with microgrids, and struggle to apply to large microgrid projects. For this reason, early cost-effective ventures are likely to be utility run or hybrids with a utility partner. Hybrid ventures may, however, be weighed down by liability issues arising from any degree of third-party control, meaning the utility will require control over key functions in a hybrid situation.⁶⁶

Hybrid approaches and non-utility run projects are difficult because they require “coordination and shared infrastructure such as piping, distribution lines, and monitoring equipment.”⁶⁷ Some scholarship proposes states “impose mandatory microgrid installation in certain small-scale energy districts” in order to overcome “lack of coordination.”⁶⁸ Non-utility microgrids, while potentially able to negotiate better terms than a utility microgrid, are constrained by “the additional cost of negotiating multiple contracts.”⁶⁹ Mandating development of microgrids is unlikely to be cost effective or provide the best service to consumers, as utilities would do so out of fulfillment of obligation rather than economic choice. However, if utilities are not going to invest, regulators must find a means of allowing non-utilities to effectively compete.

Maximizing the cost benefit ratio turns in large part on the location of the microgrid. The New York resiliency report notes that, unfortunately, “[t]here is a lack of information available to potential microgrid developers on site characteristics that favor microgrid development.”⁷⁰ Additionally, the best site may not provide the best means of cost recovery, incentivizing suboptimal microgrid development. A well sited microgrid has a much better chance of social and economic benefit streams to the public, and therefore should be associated with private utility.⁷¹

⁶⁵ *Id.* at S-3.

⁶⁶ *Id.* at 134 (noting that, for liability’s sake, utilities want to directly control voltage).

⁶⁷ Michael Pappas, *Energy Versus Property*, 41 FLA. ST. U. L. REV. 435, 443 (2014).

⁶⁸ *Id.* at 447.

⁶⁹ NYSERDA, *supra* note 41, at 128.

⁷⁰ *Id.* at S-3.

⁷¹ *See id.* at 138–43 (providing a detailed cost benefit analysis).

III. HOW MICROGRIDS FIT INTO CURRENT REGULATORY FRAMEWORKS

A. Understanding Energy Rate Making

It is important to understand how states set rates for public utilities. The retail energy market – selling energy to consumers rather than distributors – is heavily regulated. In broad strokes, most states have a public service commission (PSC) that makes regulations for public utilities. The PSC also reviews annual price proposals from public utilities, which once accepted are binding on the utility for the time frame agreed to. These prices are designed to ensure that the utility recovers its costs, but also mindful of the public interest in not paying unreasonable amounts for electricity or funding unnecessary investments. The retail market is distinguishable from wholesale energy markets, where energy generators can sell to distributors (and future investors) at market determined prices. Part IV(C)(1) of this Comment will elaborate upon creative means of facilitating microgrid development via ratemaking and Part V will discuss microgrid entrance into wholesale markets, but an early explanation is important in order to understand state regulatory schemes.

B. State Incentives and Initiatives

While many states incentivize DER and renewable energy, both pertinent to incentivizing microgrid development, few have regulations or incentives specifically targeting microgrids.⁷² A few state initiatives indirectly or insubstantially target microgrid deployment, for instance Washington “emphasizes small scale [energy] initiatives.”⁷³ Other states place more emphasis specifically on microgrids, for instance Oregon exempts smaller energy providers from utility regulations and provides limited funding to microgrid projects that “demonstrate how energy storage, especially batteries, can improve resiliency.”⁷⁴ New Mexico’s Green Grid Initiatives favor distribution that is smart and has microgrids.⁷⁵

In 2013 Minnesota released a report commissioned “to identify regulatory barriers to and opportunities for microgrid development for energy

⁷² See generally, EPRI, *supra* note 10. Idaho, Washington, Colorado, Arizona, Nevada, Utah, Illinois, Wisconsin, Texas, and Pennsylvania all incentivize renewable and/or DER development, and have microgrids within their borders, but have no specific microgrid legislation or administrative programs. Many of these states allow net metering (with different limits) which can encourage microgrid growth.

⁷³ *Id.* at 2-6.

⁷⁴ *Id.* at 2-2.

⁷⁵ *Id.* at 3-19.

assurance in the state of Minnesota, with recommendations to address barriers and identify pathways to facilitate microgrid development.⁷⁶ Minnesota's report is particularly good about noting that microgrids must be "driven by the need to deliver value for end users."⁷⁷ The report notes that microgrids are not typically implemented as one common investment, but "evolve over multiple phases, centered on demand and consumption reduction, on-site generation and storage, advanced control systems, and automatic grid independence."⁷⁸ The report provides a chart diagramming revenue sources, development costs, and operating expenses for microgrids, and while it describes many ways of creating revenue, it does not suggest an optimal method or means of deciding which avenue to pursue.⁷⁹ The report suggests that in the short and "medium-term" future, utilities are best suited to provide electricity, but that this will likely be eroded.⁸⁰ This report was commissioned in response to severe weather, and while pilot projects are distinct in that they are a means to information, states should remain vigilant against overcompensating active microgrids for uneconomical resiliency. Instead they should focus on the economically optimal development of microgrids.⁸¹ Ultimately the report suggests four policy action steps: defining microgrids within state policy, actively encouraging community leaders, ensuring proper valuation of microgrid benefits, and incorporating modernization trends into state policy.⁸² These proposals advance positive cost-benefit awareness but are general. The report could also place more emphasis on creating revenue streams for the precise value created by the microgrid.

A few states have engaged significant resources in funding the development and study of microgrids, with the primary purpose of resiliency. Massachusetts, as part of a \$40 million Community Clean Energy Resilience Initiative, included \$14 million in grants for energy resilience projects, including both microgrids and nanogrids.⁸³ Similarly, New Jersey allocated

⁷⁶ MICHAEL BURR ET AL., MICROGRID INSTITUTE FOR THE MINNESOTA DEPARTMENT OF COMMERCE, MINNESOTA MICROGRIDS: BARRIERS, OPPORTUNITIES, AND PATHWAYS TOWARD ENERGY ASSURANCE 7 (2013).

⁷⁷ *Id.* at 62.

⁷⁸ *Id.*

⁷⁹ *Id.* at 70.

⁸⁰ *Id.* at 66.

⁸¹ New York in particular has an advanced cost-benefit model discussed later in this Comment.

⁸² BURR, *supra* note 76, at 75.

⁸³ *Baker-Polito Administration Announces \$14 Million for Energy Resiliency Grant Program*, MASS.GOV (Sept. 22, 2016), <http://www.mass.gov/eea/pr-2016/14-million-for-energy-resiliency-grant-program.html> [<https://perma.cc/E3KA-KWSP>].

\$25 million in the wake of Sandy to develop microgrids with the goal of protecting essential facilities.⁸⁴ The state has recently allocated \$1 million to fund community microgrid feasibility studies.⁸⁵

Connecticut suffers from especially high brownout rates and energy costs, and was one of the earliest to incentivize microgrids via a grant and loan pilot program through the Department of Energy and Environmental Protection.⁸⁶ These grants are assigned to interconnection projects as well as construction projects, and thus far twenty-seven of thirty-six applicants have received funding.⁸⁷ The initial emphasis for Connecticut is on “critical facilities:” “municipal government public safety and wastewater treatment facilities as well as grocery stores, hospitals, cell phone towers, and buildings serving as shelter – during times when the electric grid goes down.”⁸⁸ However, the definition proceeds to include “regulated market actors, specifically television and radio facilities licensed by the Federal Communications Commission” as well as “any other facility or area” deemed worthy.⁸⁹

Maryland released a task force report on the feasibility of microgrid implementation on June 23, 2014. The report detailed a number of recommendations on how to make microgrids fit within its energy regulatory structure, discussed in Part IV Subsection B. At the time of the report only utility owned public purpose microgrids were legally feasible.⁹⁰ Importantly, the Maryland report establishes the notion that it is not a matter of if another superstorm hits, but when and how bad. The next question to analyze, one that New York has answered well, is to address exactly how much are microgrids worth in that context?

New York has, in recent years, released a series of initiatives to incentivize and prioritize microgrid expansion including its Reforming the Energy Vision (REV). “Through regulatory overhaul, REV is remaking New York’s utilities to encourage the cleanest, most advanced, and efficient power system operation. State programs supporting clean energy are being

⁸⁴ EPRI, *supra* note 10, at 6-23.

⁸⁵ Elisa Wood, *New Jersey to Offer Funds for Community Microgrids*, MICROGRID KNOWLEDGE (Aug. 12, 2016), <https://microgridknowledge.com/community-microgrids-3/> [<https://perma.cc/4AGS-KW6M>].

⁸⁶ EPRI, *supra* note 10, at 6-9.

⁸⁷ *Id.* at 6-10. The initial round of funding supported diesel projects primarily, while the second round of funding focused on renewables and storage. GRIMLEY & FARRELL, *supra* note 11, at 11.

⁸⁸ *DEEP Accepting Applications for Microgrid Projects Grants and Loans Available to Provide Power to Critical Facilities*, CONN. DEPT. OF ENERGY AND ENVTL. PROTECT. (Aug. 17, 2017), <https://www.ct.gov/DEep/cwp/view.asp?A=4918&Q=595114> [<https://perma.cc/W49D-LBWC>].

⁸⁹ Jones et al., *supra* note 6, at 1750.

⁹⁰ See RESILIENCY THROUGH MICROGRIDS TASK FORCE, *supra* note 1, at iv (explaining the short-term versus the long-term energy goals, with third-party microgrids being a long-term goal).

redesigned to accelerate market growth and unlock private investment. And under REV, New York is deploying innovative energy solutions across State-owned buildings, university campuses, and State vehicle fleets.”⁹¹

In practice this has meant a number of initiatives, for example, in 2014 REV launched the “straw proposal,” a coordinating body for deployment of DERs on the grid with the goal of morphing utilities into Distributed System Platform (DSP) Providers.⁹² REV is separated into two tracks of initiatives: “Track 1 focuses on the development of distributed resource markets and the utility as the DSP providers. Track 2 focuses on reforming utility ratemaking practices and revenue streams to accommodate the DSP provider model.”⁹³ Many stakeholders filed comments with regulators in early 2016, and utility stakeholders and others were “largely supportive” of the regulatory guidance.⁹⁴ Criticisms came from the alternative energy community who thought the utilities should be required to provide more comprehensive and more thoroughly vetted reports.⁹⁵ One Track 2 proposal for encouraging utility investment in DER is to allow public utilities to keep unspent capital budget if they will use it for DER investment even though it is typically redistributed to consumers via lower rates per “clawback provisions.”⁹⁶ The overall goal is to transition utilities to profiting through market based earnings rather than traditional large-scale energy production. Generally, utilities are supportive of the initiative though skeptical of implementation.⁹⁷

One part of this comprehensive program is \$40 million in prize money to fund feasibility studies for municipal microgrids.⁹⁸ Thus far the program has awarded grants to eighty-three studies, fifty-eight more than intended.⁹⁹ Included in the resources available to applicants is a cost-benefit analysis guide, along with a cost-benefit spreadsheet, and questionnaire.¹⁰⁰ The model provided is

⁹¹ N.Y. STATE, REFORMING THE ENERGY VISION (Mar. 2016), <https://www.ny.gov/sites/ny.gov/files/atoms/files/WhitePaperREVMarch2016.pdf>.

⁹² Gavin Bade, *REV in 2016: The Year that Could Transform Utility Business Models in New York*, UTILITYDIVE (Jan. 20, 2016), <http://www.utilitydive.com/news/rev-in-2016-the-year-that-could-transform-utility-business-models-in-new-y/412410/> [<https://perma.cc/6866-KDSH>].

⁹³ *Id.*

⁹⁴ *Id.*

⁹⁵ *Id.*

⁹⁶ *Id.*

⁹⁷ *Id.*

⁹⁸ GRIMLEY & FARRELL, *supra* note 11, at 11.

⁹⁹ *Id.*

¹⁰⁰ “The model evaluates the economic viability of a microgrid based on the user’s specification of project costs, the project’s design and operating characteristics, and the facilities and services the project is designed to support. The model analyzes discrete operating scenarios specified by the user; it does not identify an optimal project design or operating strategy.” INDUSTRIAL ECONOMICS, INC., *supra* note 16, at 3.

highly dependent on user inputs, and analyzes various scenarios described by the user, without specifying an optimal design.¹⁰¹ The model is useful in part because it accounts for costs and benefits annualized based on the anticipated engineering life with time adjusted values of money (per 2014 dollars).¹⁰² The worksheet requires that the user specify several key assumptions, including “[t]he duration of the major power outage to be analyzed as part of the BCA, the probability of an outage of that duration in any year, and the discount rate to be employed in calculating present values and annualized values.”¹⁰³ As mentioned in this Comment,¹⁰⁴ the outage probability calculations are pivotal to an accurate prediction of microgrid benefits, and the New York guide provides an intuitive spreadsheet for converting outage probability into time adjusted money.¹⁰⁵ However, this is dependent on developers effectively predicting weather induced outages up to twenty years into the future.

The model has a cost analysis and benefits analysis section.¹⁰⁶ It breaks cost inputs into initial design and planning, capital investments, operation and maintenance, and environmentalism costs.¹⁰⁷ It breaks the benefits into energy benefits (energy cost savings and capacity cost savings), reliability benefits, power quality benefits, environmentalism benefits, and benefits of avoiding major power outages, maintaining critical, and other services.¹⁰⁸ This system, while necessarily reliant on individual inputs, is the most comprehensive publicly available guide and effectively walks the line between easily accessible and detail oriented. It also incorporates some of the more difficult to quantify environmental costs and benefits, by putting values on amounts of greenhouse gasses emitted or reduced.¹⁰⁹

C. *Fitting into Franchise Laws*

Franchise laws in the United States protect public utility monopolies on energy distribution to varying degrees.¹¹⁰ While no fifty-state survey exists, South Carolina and Connecticut provide examples of the broad range of state laws.

¹⁰¹ *Id.* For an example summary worksheet, *see id.* at 4.

¹⁰² *Id.*

¹⁰³ *Id.* at 3.

¹⁰⁴ *See supra*, Section II.

¹⁰⁵ *Id.* at 5.

¹⁰⁶ *Id.*

¹⁰⁷ *Id.* at i.

¹⁰⁸ *Id.*

¹⁰⁹ *Id.* at 22.

¹¹⁰ Institute for Local Self-Reliance, UTILITY FRANCHISE FEES (2019), <https://ilsr.org/energy/utility-franchise-fees/> [<https://perma.cc/A2HC-XZ8K>].

In South Carolina, the simple sale of electricity from the owner of solar panels installed on a rooftop to the host end user results in public utility commission jurisdiction over the sale. By contrast, the Connecticut Supreme Court has ruled that, so long as no facilities are installed in public streets, extending a distribution wire from one parcel to another and selling power across that line doesn't encroach on a utility franchise.¹¹¹

While utilities would like for all energy distributors to be subject to their level of regulation, even without this regulation they can still profit via interconnection and backup charges on microgrids.¹¹²

New York issued a report in December of 2014 addressing Microgrids for Critical Facility Resiliency. The report examined how microgrids fit into public utility regulations and provides a representative look at state commission rules as applied to microgrids.¹¹³ The report concluded that the Public Service Commission (PSC) may be able to consider the microgrid a utility and subject to Article 4 (public utility) regulations, or consent to reduced regulations due to the microgrid's unique structure and purpose.¹¹⁴ Regulations imposed under Article 4 include rates, quality of service, general supervision, billing, administration, public reports, corporate finance/structure, incorporation, and residential service.¹¹⁵ Furthermore the microgrid may, but is unlikely to be, required to serve as a provider of last resort. New York laws and regulations also stipulate how “[n]onutility owned DERs interact with the utility through mechanisms such as interconnect rules, standby rates, net-metering laws, and buy-back tariffs. Also, there are other mechanisms that are not currently practiced in New York but may be considered in the future, such as a ‘microgrid wheeling charge.’”¹¹⁶ Alternative energy based generation is subject to net metering in New York, while fossil fuel generation is not; microgrids that have both renewable and non-renewable generation may be able to separate the qualifying from the non-

¹¹¹ Sara C. Bronin & Paul K. McCary, *Peaceful Coexistence*, 151 NO. 3 PUB. UTIL. FORT-NIGHTLY 38, 40 (2013).

¹¹² See e.g., Jones et al., *supra* note 6, at 1743 (“NYU does pay for backup services from Con Edison. Not only does paying for a standby service benefit NYU, which can operate a simpler and cheaper microgrid while having the redundancy of the grid to back it up during system failure, but this also provides some financial benefit to Con Edison in regards to recovering fixed costs necessary for providing reliable service.”).

¹¹³ NYSERDA, *supra* note 41.

¹¹⁴ *Id.* at 15.

¹¹⁵ *Id.* at 16-17.

¹¹⁶ *Id.* at 24. A wheeling charge means that the utility could extract payment for facilitating the distribution of energy services.

qualifying for the purposes of net-metering.¹¹⁷ New York has more progressive energy laws than most states, and has taken steps such as the REV to incorporate and foster microgrids and DER. Yet, even in New York there is no simple way of fitting microgrids into the franchise laws.

Franchise laws are based on the concept that it is economically best to grant an energy distribution monopoly in a given area.¹¹⁸ This theory is losing ground as third parties and consumers gain the ability to generate electricity near the load.¹¹⁹ Similar to the previously discussed New York programs, Maryland has begun initiatives to encourage competition in energy markets:

Accordingly, there has been some movement to allow for competition for the provision of on-site generation, which combines elements of electric distribution and electric generation services. Recognizing this shift, the Maryland Public Utilities Article exempts parties that provide ‘onsite generated electricity’ from regulation as either an electric company . . . or electricity supplier.¹²⁰

Despite this narrow exemption, the Maryland General Assembly would have to grant franchise to every third party microgrid.¹²¹ While only a few states, for instance Maryland, New York, and Connecticut, have taken overt steps to weaken and transform franchise laws, the trend is spreading.

IV. DEVELOPING REGULATIONS THAT IMPROVE MARKET EFFICIENCY AND ENCOURAGE MICROGRID DEVELOPMENT

A. *Why Incentivize*

Small-scale distributed generation of energy derived in part from renewable sources¹²² can add strength and stability to the grid and value to the consumer. Despite the “troubling effects of large, out-of-the-way develop-

¹¹⁷ *Id.* at 38.

¹¹⁸ *Utilities Law and Legal Definition*, USLEGAL, <https://definitions.uslegal.com/u/utilities-law/> [<https://perma.cc/S7GH-PNN7>] (last visited Jan. 21, 2017) (“Deregulation of the industry has recently gained momentum to allow more competition in providing electricity to customers.”).

¹¹⁹ New York’s REV initiative is an example of regulators accommodating and encouraging generation of energy from third parties and requiring/encouraging utilities to incorporate that energy into its infrastructure.

¹²⁰ RESILIENCY THROUGH MICROGRIDS TASK FORCE, *supra* note 1, at 41.

¹²¹ *Id.* at 45.

¹²² Many microgrids are installed with gas-generation to add certainty of operation while islanded.

ments, government continues to direct significant support to projects with many hundreds or thousands of end users.”¹²³ Studies suggest that through microgrids users can save twenty to twenty-five percent in energy costs over individually owned distributed generation.¹²⁴ Microgrids offer the potential for an economically favored middle ground between individualized power supply and our current macrogrid,¹²⁵ though it is one that requires complex cost-benefit analysis for realization.

Regulations should incentivize peer-to-peer controls of new microgrids. “The peer-to-peer controls of the Santa Rita Jail allow the grid to self-heal and, perhaps most importantly, easily add new distributed energy without having to completely redesign the control system. The result of peer-to-peer control technology is a more sustainable and adaptable microgrid.”¹²⁶ States are only beginning to develop microgrid policy and utilities are in the early stages of implementation, and mindfulness of technology options such as peer-to-peer controls is extremely important.

B. Intelligently Dismantling Protectionism and Reallocating Value

An initial step toward encouraging investment in microgrids is intelligently scaling back protections of public utilities. One, albeit flawed, means of providing value to microgrid owners, at the potential expense of utilities, is net metering which gives monetary credit for energy put onto the grid. As previously mentioned, microgrids do not fit well into net metering schemes when they use non-renewable sources and are relatively large in scale.¹²⁷ The energy cap on net metering credits should be set at a carefully decided value, weighing the interests of encouraging cost-effectiveness in the

¹²³ Bronin, *supra* note 5, at 556.

¹²⁴ *Id.* at 563 (citing Douglas E. King, *Electric Power Micro-grids: Opportunities and Challenges for an Emerging Distributed Energy Architecture* 3, 47 (May 2006) (unpublished Ph.D. dissertation) (on file at Carnegie Mellon University, <https://www.scribd.com/document/22903781/Electric-Power-Micro-grids-PhDThesis200-good-6> [<https://perma.cc/66ZH-UWCC>])). This study looked at San Diego and tracked the percent savings from installing DER resources and then the additional percent savings from compiling those DER into a microgrid.

¹²⁵ The current values created by microgrids being reduced power outages, reduced grid sourced energy, heating fuel, sale of ancillary services to macrogrid, sale of excess energy, demand response programs, and credits for pollutant reduction, while the costs include equipment, installation, interconnection, operation, fuel expense, (less incentives), and regulatory expenses. *See* CALDWELL, *supra* note 13. *See also* EPRI, *supra* note 10, at 1–3 (providing a comprehensive list of costs and benefits of microgrids).

¹²⁶ GRIMLEY, *supra* note 11, at 14.

¹²⁷ *See supra*, Section II.B.

effected microgrids without overly disrupting utility function. Some commentators take a different tact, arguing that “[t]o encourage microgrids and, with them, resiliency, any net metering limit based on expected electrical consumption should be removed.”¹²⁸ The author notes that caps are based on utility protectionism “rather than on the need for grid stability or reliability.”¹²⁹ However, protecting utilities to a degree is necessary for grid stability at least in the short term. Ultimately, regulators must envision a path to cost recovery for utilities while encouraging microgrid development. New York has realized this with its REV goal of transitioning utilities to compilers of DERs.

Microgrids often generate value streams, ancillary services, and social benefits like reduced emissions,¹³⁰ yet our regulations do not provide mechanisms for owner compensation. As previously mentioned, certain states including New York, New Jersey, Connecticut, and California have begun specifically funding microgrid development. Congress has gotten involved to a limited extent, but has not explicitly directed funds toward microgrids: “Under the Disaster Relief Appropriations Act of 2013, Congress made a total of \$16 billion available through the CDBG fund . . . to sponsor ‘disaster relief, long-term recovery, restoration of infrastructure and housing, and economic revitalization.’”¹³¹

Utilities may face regulatory challenges owning distributed generation (DG) inside the infrastructure of microgrids. Explicitly allowing utility ownership of DG “might encourage utility microgrid development by reducing obstacles to the full utility microgrid model.”¹³² This allowance should be dependent on providing rate payer benefits, meaning that regulators should not stifle non-utility microgrid investment. The New York resiliency report suggests that the exception be “contingent on providing substantial ratepayer benefits via the provision of safety and security benefits through serving critical infrastructure in scenarios where nonutility investment is unlikely.”¹³³

In 2014 Maryland released a task force report on Resiliency through Microgrids which, true to its title, focused on the resiliency benefits of microgrids, but unfortunately paid much less mind to cost-benefit analyses than did the New York report. Maryland stated its purpose as twofold:

¹²⁸ Payne, *supra* note 9, at 178.

¹²⁹ *Id.*

¹³⁰ Reduced emissions are, too an extent, compensated via cap-in-trade programs that award Reduced Emission Completions (RECs).

¹³¹ Jones et al., *supra* note 6, at 1726 (citing Disaster Relief Appropriations Act, Pub. L. No. 113-2, 127 Stat. 4 (2013)).

¹³² NYSERDA, *supra* note 41, at 136.

¹³³ *Id.*

First, Maryland should focus on the development of geographically dispersed, dynamic, and resilient public purpose microgrid projects throughout the State. . . . Second, Maryland's public purpose microgrid grants should assist projects that will serve as case studies for the coordination between regulators, policymakers, local governments, utilities, and other relevant entities in order to identify opportunities, barriers, and risks to the development of future public purpose microgrids and distributed energy systems.¹³⁴

Maryland suggests that more robust cost-benefit analysis could be done, but regardless of the awareness, the report could do more to emphasize the centrality of a cost-benefit analysis system to any regulatory framework.

Still, the Maryland report developed useful recommendations for advancing microgrid policy. The task force recommended that the state, in the short term, encourage the deployment of utility owned public purpose microgrids with advocacy and incentives. It assessed current law and found that it likely granted authority to the Maryland PSC to allow public utility microgrids. Importantly, the report recommended that Maryland “conduct a holistic analysis of tariffs that help define the value of distributed generation to the macrogrid, as well as engage in a comprehensive review of siting, interconnection, and commissioning procedures,” an important step in developing an efficient market.¹³⁵

The task force then recommended a long term approach of reducing barriers to third parties trying to invest in “public purpose microgrid services to multiple customers” even if this is done redundantly over existing distribution. While more study needs to be done to strike an appropriate balance, the task force believed that allowing private microgrids can “[i]ncent innovation, provide better reliability and resiliency to its citizens, and still allow traditional utilities to compete.”¹³⁶ This recommendation strikes at the inherent tension in microgrid development, between incentivizing and allowing private microgrids in the energy marketplace and protecting the traditional and highly regulated public energy utilities. The balance proposed by Maryland is intelligent but requires fleshing out with structures to ensure continued utility cost recovery in the face of third-party entrants.

¹³⁴ RESILIENCY THROUGH MICROGRIDS TASK FORCE, *supra* note 1, at 22.

¹³⁵ *Id.* at i–ii.

¹³⁶ *Id.* at ii.

C. Rate Making for Microgrids

1. Applying General Rate Making Principles to Microgrid Policy

State energy commissions face a plethora of options, each with pros and cons, in setting energy rates. An initial decision, for utility-owned microgrids, is to determine what a microgrid is for the purpose of ratemaking. The answer to this question will help inform rate makers on whether to include costs in the general rate base or charge a tariff directly to the direct microgrid beneficiaries. At first blush it seems as though a tariff is much more reasonable, however, installing the microgrid may save all consumers money by replacing upgrades the utility would have had to install.¹³⁷ Alternatively, states such as Maryland and New York have expressed interest in transitioning to a system that better incorporates DG and where utilities take on more of an aggregator and distributor role.¹³⁸

Rate-making can also be used proactively to force utilities to consider microgrid development. In the wake of Superstorm Sandy Con Edison filed with the NYPSC to raise rates to fund traditional methods of “storm hardening” the grid. In response, the PSC rejected the traditional approach and ordered Con Edison to “take specific steps to pursue integration of DG resources in its service territory and to investigate the feasibility of microgrid installations.”¹³⁹ On February 21, 2014, the PSC approved a four-year billion dollar plan to strengthen its systems and required Con Edison to “develop an implementation plan for a microgrid pilot project,” and “[d]evelop and apply a cost/benefit analysis approach for future capital investment that . . . assesses the relative benefits and costs of resilience of existing utility infrastructure and alternative resilience approaches such as microgrids.”¹⁴⁰ Not only did rate-makers use their authority to encourage investigation and investment, they did so in a way that assessed market based cost-benefit analysis, including the value of resilience. Because of their regulatory authority over public utilities, state PSCs are in a unique position to require the development of infrastructure most beneficial to the consumer, as was done here.

¹³⁷ See, e.g., *Borrego Springs*, MICROGRIDS AT BERKELEY LABS (2019), <https://building-microgrid.lbl.gov/borrego-springs> [<https://perma.cc/7FA7-2F27>] (last visited Jan. 21, 2017) (showing that the Borrego Springs Project—a joint venture with the utility providing distribution and private enterprises providing generation—provides “a potential alternative to building additional transmission capacity”).

¹³⁸ NYSERDA, *supra* note 41, at 122; see also RESILIENCY THROUGH MICROGRIDS TASK FORCE, *supra* note 1, at 34–5 (deciding whether to charge consumers for additional services or “recover distribution system upgrade costs from its entire rate base”).

¹³⁹ Nostrand, *supra* note 23, at 124.

¹⁴⁰ Jones et al., *supra* note 6, at 1734.

Commentators have suggested the use of multiple doctrines common to rate making jurisprudence to promote DG and microgrid investment. For example, the standard of prudence in rate regulation could require utilities to investigate the benefits of DG investment. Additionally, the used and useful doctrine could “come into play as a legal tool for promoting DG resources by demonstrating that these resources are a means of avoiding the ‘lumpiness’ associated with the central generation model.”¹⁴¹ The author here further contends that cost-causation principles applied to “just and reasonable” rates could be used to encourage DG, because regulators could require rates that reflect the (hotly-debated) benefits of DG resources.¹⁴² Another means of encouraging microgrid growth is to encourage their participation in competitive wholesale energy markets, with these rates set by market forces rather than regulators.

2. Recent DER Rate Making Models

In November of 2016 the National Association of Regulatory Utility Commissioners (NARUC) released a manual on Distributed Energy Resource (DER) rate design. While this doesn’t directly address rate design for microgrids, the principles correlate because the microgrids best suited to provide resiliency and to add renewable resources to the grid are fed primarily by DER. Still, there will be subtle differences in rate-making decisions from the amalgamating function and requisite infrastructure of microgrids as opposed to DER.

An initial question addressed by the manual is whether to create different classes of energy customers, or to change all rates with the implementation of DER. “In the case of DER-owning customers, there is now a group of customers that differs significantly in both usage patterns and the effects of rate levels on decision making from others in the same class.”¹⁴³ The manual advises against a flat volumetric charge, because this runs the risk of revenue erosion. It also advises that equitable cost distribution based on consumption and benefits is good for both market efficiency and equity. It is also important that the price signifies the cost of the energy.¹⁴⁴ However, if rate makers choose demand based charges, which come

¹⁴¹ Nostrand, *supra* note 23, at 140. Here lumpiness refers to the way utilities typically add energy generation, in large chunks, whereas DG investment will allow an energy addition precisely tailored to the needs of the consumers.

¹⁴² *Id.* at 155.

¹⁴³ NARUC, *supra* note 4, at 86.

¹⁴⁴ The manual offers regulators questions to ask when deciding whether to transfer customers to a new rate schedule: 1) Do DER customers have a unique service, usage, or cost characteristic that should be tracked by a separate rate class? 2) Are there currently or are there expected to be a sufficient number of customers to justify a new rate class? 3) Does the utility provider have

with revenue certainty and rate recovery but no price signal, they must encourage education of consumers on how they're being charged.¹⁴⁵

While net metering was discussed earlier as a positive incentive for the development of microgrids and consumer owned DER, a poorly tailored net metering system will unduly harm utilities. Often, net metering does not account for negative metering (selling more to the grid than the customer takes off). Furthermore, net metering, if it is to encourage market efficiency, must distinguish between the value of energy and the cost of the service of providing energy (the utility charges a higher rate than the value of the energy because it incurs the costs of providing the service). Net metering schemes must account for the time and location value of energy: the value added to the grid should correspond with the amount earned through the net metering scheme.

The NARUC manual provides three valuation methodologies, value of resource, value of service, and transactive energy. The value of resource method separates costs and benefits of utility services derived from DER systems from values derived from other utility services.¹⁴⁶ The value of service methodology treats the distribution grid as network, with each piece adding a quantifiable value to the whole.¹⁴⁷ Finally, the manual offers a more innovative and new valuation method, called transactive energy (TE):

TE is both a technical architecture and an economic dispatch system highly reliant on price signals, robust development of technology on both the grid side and the customer side, and rules allowing for markets to develop that enable a wide variety of participants to provide services directly to each other. This 'peer-to-peer' component differentiates TE from many of the other options discussed herein.¹⁴⁸

sufficient capability/technology (such as metering/billing) to separate the customers and bill them differently? *Id.* at 90. Different states have taken different approaches: California offered a 20 year grandfathering period for current customers of its Net Energy Metering program, Kansas created a 15 year grandfathering period from 2014 to 2029 for renewable owners, and Nevada created a 20 year period for customers with applications installed before 2016. *Id.* at 93.

¹⁴⁵ *Id.* at 99. Utilities can also recover cost via standby charges, backup charges, interconnection fees, and metering charges. "The advantages of an interconnection fee or a metering charge are usually based on principles of cost causation. The cost of the DER connecting to the distribution system and the cost of metering services for that DER is charged to the customer imposing those costs." *Id.* at 125.

¹⁴⁶ *Id.* at 133.

¹⁴⁷ *Id.* at 136.

¹⁴⁸ NARUC, *supra* note 4, at 139. This method is the least developed but may provide the most promise for "enabling new compensation models, including fee-based models." *Id.* at 140-41.

There are many factors in deciding what rate scheme and valuation methodology a rate maker should choose. The NARUC manual is a useful resource, and it is important to keep in mind the individual priorities and circumstances of the state when deciding a rate system.¹⁴⁹ New York released a staff report on October 27, 2016 for the purpose of developing “accurate pricing for DERs that reflects the actual value DERs create.”¹⁵⁰ Similar to the NARUC manual, New York placed high value on accurate price signals, for the purpose of monetizing products and “ensuring efficient market operations.”¹⁵¹ New York plans to initially create an interim methodology to value DER (VDER), and immediately begin developing a more nuanced “Phase Two VDER” methodology.¹⁵² The goals for this methodology are parallel to the thrust of this Comment, that we should encourage a gradual, market-sensitive, transition toward microgrids (although the New York report deals with DER rather than microgrids explicitly) using a predictable and certain framework. Hopefully, New York’s final methodology embodies its foundational goals.

V. ENCOURAGING MICROGRIDS THROUGH ENERGY STORAGE REGULATION

One of the largest remaining technological and regulatory barriers to microgrid development is energy storage technology. Microgrids often rely on DERs, which fluctuate in production. Energy storage provides stability to intermittent energy flow, supplements the resilience of these microgrids, and even resupplies the macrogrid during periods of high demand.¹⁵³ The ability to sell storage back to the grid, via wholesale energy markets or net metering schemes would provide microgrids a useful means of cost recovery. Today, “[e]nergy storage comes in a variety of packages, including lithium ion batteries,

¹⁴⁹ *See id.* at 143-47, 151-55 (providing a list of questions to support a regulator, as well as information on rate design and costs-benefit analysis).

¹⁵⁰ DEPT. OF PUBLIC SERVICE, STAFF REPORT AND RECOMMENDATIONS IN THE VALUE OF DISTRIBUTED ENERGY RESOURCES PROCEEDING 4 (Oct. 27, 2016).

¹⁵¹ *Id.* at 6.

¹⁵² *See id.* at 13 (“At a minimum, the Phase One methodology should establish a valuation and compensation foundation that can evolve as new knowledge and capabilities are developed. It should also recognize environmental attributes, while providing for a market transition consistent with the principles of gradualism and predictability.”).

¹⁵³ *See* Samantha Ruiz, Katie R. Thomas, and Kevin B. Jones, *Promoting Clean Reliable Energy through Smart Technologies and Policies: Lessons from Three Distributed Energy Case Studies*, 6 SAN DIEGO J. CLIMATE & ENERGY L. 39, 65 (2014-2015) (noting that the Kauai Island Utility Cooperative (KIUC) “continues to implement sufficient battery storage to ensure necessary reinforcement for its intermittent renewables”).

flywheels, compressed air, and pumped hydro projects.”¹⁵⁴ States are beginning to recognize the benefits of increased storage capacity and improved technology; for example, California passed a mandate in 2013 that investor owned utilities “install 1,325 MW in energy storage projects by 2020.”¹⁵⁵

Before regulators can effectively allow participation of microgrids with energy storage in energy markets, they must define storage within energy regulations. Storage poses a regulatory challenge in that it does not fit cleanly into current energy regulation definitions, therefore it is hindered by regulatory uncertainty and the potential for generation or distribution regulations. Some states have begun addressing this deficiency in a myriad of ways. Arkansas defines solar as well as solar plus storage; Kansas and Kentucky deal with storage in interconnection agreements; Michigan provides RECs for systems with “advanced electric storage technology.”¹⁵⁶ North Carolina, on the other hand, has hitched a rational though burdensome anchor to storage development by prohibiting “gaming,” charging a battery during off peak hours then putting electricity back into the system during peak demand.¹⁵⁷

In its report on microgrids for grid resiliency, Maryland acknowledged the benefits of battery storage for renewable energy systems and the grid. Maryland noted the “quick dispatch nature of battery storage, meaning the ability to push or pull power very quickly, makes distributed energy storage very attractive to grid operators, energy developers, and system hosts alike.”¹⁵⁸ Storage will very likely play an important role in easing the transition from present day centralized generation toward more reliance on distributed generation, including microgrids.

FERC has recently noted that “market rules designed for traditional generation resources can create barriers to entry for emerging technologies.”¹⁵⁹ On

¹⁵⁴ *Id.* at 52. For more information on these technologies, see *Energy Storage Technologies*, ENERGY STORAGE ASS’N (last visited Jan. 21, 2017), <http://energystorage.org/energy-storage/energy-storage-technologies> [<https://perma.cc/ZW24-YM5V>] (providing additional detail on how these technologies function).

¹⁵⁵ Ruiz et. al, *supra* note 153, at 52. For three case studies representing different models, see *generally id.* (examining as case studies the distributed energy models of San Diego Gas & Electric, the Sacramento Municipal Utility District, and the Kauai Island Utility Cooperative).

¹⁵⁶ Payne, *supra* note 9, at 171.

¹⁵⁷ *See id.* (“North Carolina views this as an illegal manipulation of a time-of-use tariff.”).

¹⁵⁸ *See* MARYLAND ENERGY ADMINISTRATION TASK FORCE, RESILIENCY THROUGH MICROGRIDS TASK FORCE REPORT 24 (last visited Mar. 24, 2019) (“[G]rid operators are given another tool to keep the lights on, developers can offer customers a better product, and Maryland’s businesses and homeowners can potentially island from the grid during outages”).

¹⁵⁹ Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent Systems Operation, 157 FERC ¶ 61,121, 11 (proposed Nov. 17, 2016) (to be codified at 18 CFR pt. 35).

November 17, 2016, FERC released a Notice of Proposed Rulemaking (NOPR), to amend its regulations under the Federal Power Act “to remove barriers to the participation of electric storage resources and distributed energy resource aggregations in the capacity, energy, and ancillary service markets operated by regional transmission organizations (RTO) and independent system operators (ISO).”¹⁶⁰ The NOPR proposes to “require RTOs and ISOs to revise their tariffs to 1) establish a participation model for electric storage resources in wholesale electric markets and 2) define DER aggregators as participants in wholesale electric markets under a model that best accommodates the physical and operational characteristics” of DER.¹⁶¹

FERC notes the many benefits of including electric storage resources in the organized wholesale markets, including more efficient operation of thermal generation, improved reliability, congestion relief, integration of variable energy resources, and lessening the burden on the transmission system.¹⁶² FERC failed to mention microgrids, but by including storage facilities into electric markets, the commission will increase the ability for microgrids to recover costs, spurring their development. The NOPR goes on to note the present inclusion of storage by various RTOs and ISOs around the country, including MISO, NISO, PJM, and SPP.¹⁶³

While the NOPR was not designed for the purpose of microgrids, it gives note to a potential effect, stating that the market participation agreement proposed for DER aggregators should not prevent microgrids from participating in wholesale electric markets.¹⁶⁴ The country is in the midst of energy storage regulatory reform at the state and national level, and it is important that this reform be mindful of its impact on microgrid development, as energy storage will play an increasing role in microgrid development.

CONCLUSION

The purpose of this Comment is to spin a tale of cautionary optimism. Microgrids offer an incredible array of potential societal benefits—incorporation of renewable energy into the grid, resilience against natural and human attacks on energy systems, and greenhouse emission reduction, to name just a few. The aim is to caution against overvaluing or failing to take proper care in valuing

¹⁶⁰ *Id.* at 1.

¹⁶¹ *Id.*

¹⁶² *Id.* at 23.

¹⁶³ *See id.* at 23-24 (describing the roles that these listed ISOs and RTOs allow energy storage to play).

¹⁶⁴ *Id.* at 119.

these benefits. For all their promise, microgrids are costly and disruptive¹⁶⁵ endeavors, and regulators must avoid wearing rose colored glasses as they encourage microgrid development. With that being said, most states do not do enough to allow microgrid developers to be compensated for all the benefits that microgrids create. If these revenue streams became available, microgrids would become more cost effective to develop, leading to a more optimal grid and maximum benefit to the consumer.

¹⁶⁵ Microgrids are disruptive in that they can, if carelessly developed, hinder public utilities ability recuperate costs, driving up energy costs for average consumers.