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THE URBAN MICROGRID: SMART LEGAL AND REGULATORY POLICIES TO SUPPORT ELECTRIC GRID RESILIENCY AND CLIMATE MITIGATION

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INTRODUCTION

Urban America has not always focused on being smart, clean, and efficient. As a matter of fact, back during Brooklyn's golden age, "houses were heated by coal: bituminous (made illegal somewhere along the way), anthracite, or something the ads called 'Blue Coal.'"[1] When it came to urban energy resources "coal was the fuel for heating, [and] gas was the fuel for cooking. Wood had become old-fashioned and electricity was newfangled . . . ."[2] Since that time, we have made major progress in eliminating the dominance of coal for urban heating and simultaneously reduced the impact of urban air pollution. Climate change concerns have risen on the list of urban priorities, both from the perspective of the scientific predictions regarding the impending challenges posed by rising global temperatures, as well as the immediate impacts of severe weather events. As our cities begin to seriously engage with these issues, it is clear that our energy policies must rapidly evolve in order to mitigate and adapt to the challenges of a changing climate.

1. ELLIOT WILLENSKY, WHEN BROOKLYN WAS THE WORLD: 1920–1957, at 141 (1986).
2. *Id.* at 142.

Electricity is at the heart of this necessary energy transformation. As Amory Lovins notes in his book *Reinventing Fire*, "[e]lectricity—along with the digital information and communications systems it enables and requires—provides the vital root system that sustains our economy. Electricity has become the connective tissue of the Information Age."[3] Electricity is critical to the continued development of our digital economy because it is "clean, efficient, precise, and flexible, ensuring that major infrastructure systems including communications, buildings, industry, and even transportation will continue to shift to electricity as an energy supply source of choice."[4]

A growing focus of our national energy policy includes transitioning toward smarter energy technologies and policies.[5] Over time, these policies and technologies have become a key component of the transformation toward smart cities. Municipalities, as well as technology companies such as General Electric, IBM, and Siemens, are looking toward smart technologies as solutions to urban infrastructure issues.[6] From an energy perspective, a smarter grid offers a real opportunity for forging ahead, simultaneously on climate change mitigation as well as on adaptation. This opportunity is twofold: reducing greenhouse gas emissions, and improving urban energy security and resiliency.[7] Microgrids are one of the smart energy technologies that has been gaining increasing attention in the urban context. A microgrid is "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. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode."[8] Urban microgrids are one means to advancing energy sustainability, system resiliency, and consumer affordability goals. A critical component of urban microgrids is distributed energy resources, which are smaller scale resources (such as generation, storage, and efficiency) often

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3. AMORY B. LOVINS ET AL., REINVENTING FIRE: BOLD BUSINESS SOLUTIONS FOR THE NEW ENERGY ERA 166 (2011).

4. *Id.*

5. *See* KEVIN B. JONES & DAVID ZOPPO, A SMARTER, GREENER GRID: FORGING ENVIRONMENTAL PROGRESS THROUGH SMART ENERGY POLICIES AND TECHNOLOGIES 3 (2014).

6. *See* ANTHONY M. TOWNSEND, SMART CITIES: BIG DATA, CIVIC HACKERS, AND THE QUEST FOR A NEW UTOPIA 38 (2013).

7. *See* JONES & ZOPPO, *supra* note 5, at 5.

8. Merrill Smith & Dan Ton, *Key Connections*, IEEE POWER & ENERGY MAG., July/Aug. 2013, at 22.

located on the customer side of the electric meter. Over time, distributed energy resources are thought to be cleaner, more reliable, and, perhaps, even cheaper than our current larger scale and more centralized electric grid.

From a societal perspective, a microgrid's relationship to the national electric grid can be analogized to the urban community's relationship to the nation state. Indeed, "[t]he authentic unit of political life, in effect, is the municipality, whether as a whole, if it is humanly scaled, or as its various subdivisions, notably the neighborhood." [9] Accordingly, local microgrids may be an appropriate building block for the future of our national electric system. Transitioning our electricity system away from the centralized supergrid structure toward a series of interconnected local microgrids could return the focus of our electric system to the city or urban neighborhood where it originated under Thomas Edison in the late 1800s.[10]

There is a strong argument that our "institutions, from local schools to community policing, from local churches to museums, are important for communities above and beyond the services they provide. Communities congeal around such institutions." [11] A microgrid offers to electrically link together these important community institutions in a manner which preserves the electrical lifeblood of the community even during the most severe weather events. Proponents of the trend toward smart cities have noted that "[t]he digital revolution didn't kill cities. In fact, cities everywhere are flourishing because new technologies make them even more valuable and effective as face-to-face gathering places."[12] The urban microgrid offers to preserve these important functions of cities even during the most extreme weather events.

This Article looks at both the opportunities and challenges facing urban microgrids by analyzing four urban microgrids that either exist or are under development in San Diego, California; Philadelphia, Pennsylvania; Hartford, Connecticut; and Manhattan, New York. In addition to describing the development of these four urban microgrids, this Article explores the legal and regulatory challenges

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9. MURRAY BOOKCHIN, THE RISE OF URBANIZATION AND THE DECLINE OF CITIZENSHIP 245 (1987).

10. *See* ROBERT L. BRADLEY, JR., EDISON TO ENRON: ENERGY MARKETS AND POLITICAL STRATEGIES 42–44 (2011).

11. AMITAI ETZIONI, THE SPIRIT OF COMMUNITY: RIGHTS, RESPONSIBILITIES, AND THE COMMUNITARIAN AGENDA 135–36 (1995).

12. TOWNSEND, *supra* note 6, at 7.

facing this new urban infrastructure. The Article aims to examine the likely future success of microgrid implementation in offering a smart solution to urban climate change mitigation and adaptation. Part I of this Article provides an overview of microgrid policy and technical development. Part II examines four microgrid case studies. Part III explores the legal and regulatory issues and suggests complementary policies to further the public interest.

I. URBAN AMERICA, THE ELECTRIC GRID, AND OUR CLIMATE

A. The Municipal Role in Microgrids

Municipal government has a special obligation to be involved in microgrid policy development because of the significant leadership role municipalities play in recovering from outages and other service disruptions associated with extreme weather events. Local government is the first body to react to a natural disaster. The Federal Emergency Management Agency recognizes this as a given: "[t]he local government maintains control of all assets used in the response and recovery efforts, regardless of the source of those assets. Local governments must plan and prepare for this role with the support of the state and federal governments."[13] In order to respond to emergency circumstances, the municipal government needs to be aware of its local power system. Much like state legislatures acting as laboratories for policy,[14] local communities have the ability to act as test development sites for early microgrid projects. Community microgrid projects present opportunities for multiple benefits. Citizens, whose electric services are interconnected with the microgrid and the centralized grid, should receive power that is, on balance, of a higher quality and more reliable nature. Despite these benefits, microgrid installation faces significant financial, legal, and regulatory barriers.

1. The Increasing Need for Urban Electric Grid Efficiency and Resiliency

In addition to the traditional challenges of an increasingly centralized grid that often relies on "antique" technology, today's grid

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13. FED. EMERGENCY MGMT. AGENCY, *Unit 3: Disaster Sequence of Events*, *in* STATE DISASTER MANAGEMENT COURSE 3.4 (May 14, 2010), *available at* http://training.fema.gov/emiweb/IS/IS208A/04_SDM_Unit_03_508.pdf.

14. *See* New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932) ("[A] single courageous state may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.").

faces new challenges from extreme weather events. Weather events are the number one cause of power outages.[15] Increasing temperatures, decreasing water availability, increasing storms, flooding, and rising sea level impact the energy sector.[16] For instance, increasing sea level rise and storm surges pose risks to coastal thermoelectric facilities.[17] The increasing intensity and frequency of flooding pose additional risks to inland thermoelectric facilities, and increasing intensity of storm events increases risks to electric transmission and distribution lines.[18] During a power outage, homes and businesses have no light, heat, or electronic power, which reduces residential quality of life and costs the U.S. economy billions of dollars a year.[19] Insecurity in the electric system is not unique to one region or city. Grid failure in one place in a network, radial, or loop system can be felt throughout that system.[20] Storm related power outages cost the U.S. economy $20-55 billion annually.[21]

A different, but equally important concern with the traditional grid is that the electric power sector is the largest source of carbon dioxide (CO_2) emissions in the United States.[22] This is primarily because of its heavy dependence on fossil fuels, which account for about eighty-seven percent of the energy consumed in the United States.[23] As a result, CO_2 emissions from the electric power sector make up a third of the American economy's total greenhouse gas (GHG) emissions and about eight percent of global CO_2 emissions.[24] Moreover, the

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15. *See* EXEC. OFFICE OF THE PRESIDENT, ECONOMIC BENEFITS OF INCREASING ELECTRIC GRID RESILIENCE TO WEATHER OUTAGES 8 (2013), *available at* http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf.

16. *See* U.S. DEP'T OF ENERGY, U.S. ENERGY SECTOR VULNERABILITIES TO CLIMATE CHANGE AND EXTREME WEATHER i (2013), *available at* http://energy.gov/sites/prod/files/2013/07/f2/20130716-Energy%20Sector%20 Vulnerabilities%20Report.pdf.

17. *Id.* at 28.

18. *Id.*

19. *Id.* at 35.

20. *See* AM. SOC'Y OF CIVIL ENG'RS, FAILURE TO ACT, THE ECONOMIC IMPACT OF CURRENT INVESTMENT TRENDS IN ELECTRICITY INFRASTRUCTURE 15–19, (2011), *available at* https://www.smartgrid.gov/sites/default/files/doc/files/Failure_to_Act_Economic_Impact_Current_Investment_Trends_in_201104.pdf.

21. *See* U.S. DEP'T OF ENERGY, *supra* note 16, at 35.

22. U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2011, at 2-4 (2013), *available at* http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2013-Main-Text.pdf.

23. *Id.* at 2-9.

24. *See id.* at 2-22 (U.S. calculations are based on a ten-year trend between 2000 and 2010); *see also* U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY REVIEW 309 (2011); *Global Fossil-Fuel CO_2 Emissions*, CARBON DIOXIDE INFO. ANALYSIS

electric power sector is also a significant source of other harmful air pollutants such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM), and mercury, which pose risks to human health and the environment independent of climate change.[25]

The traditional centralized grid thus raises concerns about the decreasing reliability of today's electric system and its contribution to environmental degradation. In 2001, the North American Electric Reliability Corporation (NERC) advised Congress that our grid was not designed to be used in the manner in which it is used today.[26] The grid now carries thousands of megawatts over long distances, although the system was not designed to move large blocks of power from one region to another.[27] Fortuitously, Congress supported the development of the "Smart Grid" in the Energy Independence and Security Act of 2007 (EISA).[28] According to the Act, "[i]t is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth . . . ."[29]

B. The Origin of Federal Smart Grid Policy

With the passage of the EISA, Congress defined a series of goals for grid modernization characterized as the "Smart Grid."[30] Congress defined the goals of a Smart Grid to include:

> (1) Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid.

CENTER, http://cdiac.ornl.gov/trends/emis/tre_glob.html (last visited Dec. 1, 2014) (based on a ten-year average between 2000 and 2010).

25. *See* National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3086, 3103–04 (Jan. 15, 2013) (to be codified at 40 C.F.R. pt. 50); *see also* AM. LUNG ASS'N, TOXIC AIR: THE CASE FOR CLEANING UP COAL-FIRED POWER PLANTS 4 (2011), *available at* http://www.lung.org/assets/documents/healthy-air/toxic-air-report.pdf; U.S. ENVTL. PROT. AGENCY, REGULATORY IMPACT ANALYSIS FOR THE FINAL MERCURY AND AIR TOXIC STANDARDS 5-29 to -36 (2011), *available at* http://www.epa.gov/mats/pdfs/20111221MATSfinalRIA.pdf.

26. *See* David N. Cook, Gen. Counsel, N. Am. Elec. Reliability Council, Hearing Before the United States Senate Committee on Energy and Natural Resources (May 15, 2001), http://www.nerc.com/AboutNERC/keyplayers/Congressional%20Testimony%20DL/Senate_Testimony_051501.pdf.

27. *Id.*

28. *See* Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (codified as amended at 42 U.S.C. §§ 17381–17386 (2012)).

29. 42 U.S.C. § 17381 (2012).

30. *Id.*

> (2) Dynamic optimization of grid operations and resources with full cyber security.
>
> (3) Deployment and integration of distributed resources and generation, including renewable resources.
>
> (4) Development and incorporation of demand response, demand-side resources, and energy-efficiency resources.
>
> (5) Deployment of "smart" technologies . . . for metering, communications concerning grid operation and status, and distribution automation.
>
> (6) Integration of "smart appliances" and consumer devices.
>
> (7) Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
>
> (8) Provision to consumers of timely information and control options.
>
> (9) Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
>
> (10) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.[31]

While Congress included a comprehensive list of policies for grid modernization that were to help attain the goal of building a Smart Grid, Congress did not mention a general expansion of the nation's bulk power system. While this omission does not suggest that federal policy for grid modernization does not include expansion of the bulk power system, it does suggest that it is a separate and distinct policy from those characterized as a Smart Grid under this Act.

C. Overview of Microgrid Development

A microgrid is able to operate independently from the larger system because it is composed of an energy supply source and electric infrastructure to distribute energy from its generation sources. This independent generation and distribution system is a *power island*: "an energized section of circuits separate from the larger system."[32] When the area disconnects from the centralized grid, the islanded area transitions from redundant infrastructure to the primary power

31. *Id.*

32. ALEXANDRA VON MEIER, ELECTRIC POWER SYSTEMS: A CONCEPTUAL INTRODUCTION 152 (2006).

source for all consumers connected to the islanded area.[33] Once islanded, the system maintains its own frequency and voltage.[34] The ability of a small power network to remain operational when disconnected from the centralized grid is a major benefit during extreme weather. When connected to the centralized grid, the microgrid is a secondary electricity system that complements centralized operations.[35] This complement arises from the *redundancy* of infrastructure. Redundancy can be thought of as an extra layer of electricity access.[36] Reliability increases when a system has multiple layers of electricity "because there are multiple paths for power to flow."[37] Not only do microgrids increase the redundancy in the centralized electric system, they also allow for independent operation of that redundant area once disconnected.

Microgrids are used in one of two ways: "(1) [s]ystems that are intended to always be operated in isolation from a large utility grid[; and] (2) [s]ystems that are normally connected with a larger grid."[38] The Institute of Electrical and Electronics Engineers explains the benefits of this type of system: "[w]hen properly planned as part of the overall grid design, [it] can result in better average capacity factors and enhanced power quality; when interconnected with the larger grid, [it] can provide customers with greater reliability than either system can provide independently."[39] Islanded system design gives the grid operator greater flexibility and provides the end-user with a greater product.

In its most elegant form, a microgrid is the ultimate implementation of the smart grid, and one that has a great deal of consumer appeal. The ideal microgrid would feature a digital control system that could integrate solar photovoltaics (PV), efficient combined heat-and-power (CHP) generators, battery storage, thermal storage, demand response, and electric vehicle charging. This system would intelligently manage both supply and demand resources in a manner that ensures high reliability, reduces carbon emissions, and saves consumers money. The microgrid could operate

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33. *See id.* at 153.

34. *See* Michael Montoya et al., *Islands in the Storm: Integrating Microgrids into the Larger Grid*, IEEE POWER & ENERGY MAG., July/Aug. 2013, at 33, 36.

35. *See* Z. YE ET AL., NAT'L RENEWABLE ENERGY LAB., FACILITY MICROGRIDS iii (2005), *available at* http://www.nrel.gov/docs/fy05osti/38019.pdf.

36. *See* VON MEIER, *supra* note 32, at 150.

37. *See id.* (describing the ability of redundant systems to maintain power when part of the operational infrastructure is lost).

38. YE et al., *supra* note 35, at iii.

39. Montoya, *supra* note 34, at 35–36.

disconnected from the utility system or could reconnect and sell any excess resources back to the interconnected grid.[40]

Many market and technological trends suggest that the microgrid era could be on the not-too-distant horizon. Declining costs for solar PV, low natural gas prices, abundant biofuels, advances in distributed storage alternatives, and the rapid development of energy management technologies suggest a bright future for microgrid development.[41] There are even predictions that a microgrid industry is not only on the rise, but that "just like the independent power industry did for generation, microgrids could break the seal on the utility compact, introducing competition into the energy industry's last great monopoly—the electric distribution business."[42]

II. THE MICROGRID CASE STUDIES

The early focal points of microgrid development are rural village electrification, university campuses, military bases, and, more recently, critical community facilities during emergencies. University campuses and military facilities are a natural fit for microgrid development because their electric loads come from multiple buildings, which are often centrally arranged on a common footprint and often have their own electric distribution facilities. Universities are a niche microgrid market both for their physical as well as intellectual architecture. A university campus is the ideal physical setting given the multiple building loads, favorable infrastructure for CHP, the usual presence of back-up generators, the increasingly common solar PV systems, the presence of campus sustainability plans, and an island-like setting where the university often owns all of the electric distribution system on its side of the utility transformer. On campuses there are also diverse intellectual resources and research budgets to support microgrid development. Military bases, for a number of similar reasons, are also well suited for microgrid development. In our first set of case studies we will examine a leading example of a university campus microgrid at the University of California, San Diego (UCSD), along with the Philadelphia Navy Yard, a former military facility turned into an economic development zone, in order to understand the relative ease of developing urban microgrids in a traditional campus or base-like setting.[43]

40. *See* JONES & ZOPPO, *supra* note 5, at 131.

41. *See id.*

42. Michael T. Burr, *Economy of Small: How DG and Microgrids Change the Game for Utilities*, PUB. UTIL. FORT., May 2013, at 21.

43. *See* JONES & ZOPPO, *supra* note 5, at 131–33.

Following the discussion of these more typical cases we will explore a very different university microgrid on the New York University campus in Manhattan to better understand some of the challenges of a microgrid in a more densely packed urban setting where facilities span across city streets. The NYU microgrid came into focus when hurricane Sandy wreaked havoc on the Northeast, knocking out power to more than eight million people (including much of New York City).[44] During this extreme weather event the NYU microgrid powered on, spurring debate in New York State over the need for public microgrids.[45]

Even prior to Hurricane Sandy, the devastating Hurricanes Katrina and Irene made critical community facilities during an emergency another microgrid focal point.

> In addition to the human suffering caused by these storms, they have clearly demonstrated that critical infrastructure, including the electric grid, is vulnerable to severe weather. Hurricane Irene left over seven hundred thousand electric customers in Connecticut without power, causing Governor Malloy and state legislators to support a grant program to fund the creation of microgrids that keep critical facilities powered during electrical outages. The Connecticut microgrid grant program, which passed in 2012, was the first of its kind in the country.[46]

Since the passage of this legislation, "Connecticut has approved nine projects that will receive $18 million in funding to be implemented within two years" and then followed up on this legislation by appropriating an additional $30 million in community microgrid funding for a second round of awards.[47] We will look at this leading state microgrid policy in detail and explore the approved proposal for a community facility microgrid in Hartford, Connecticut.

A. An Urban Microgrid Serving a Common Footprint: UCSD and the Philadelphia Navy Yard

UCSD has one of the most advanced microgrids in the country. It operates under a strategic partnership with the local utility, San Diego Gas and Electric (SDG&E), and uses engineering and information

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44. Bobby Magill, *Microgrids: Sandy Forced Cities to Rethink Power Supply*, CLIMATE CENT. (Sept. 9, 2013), http://www.climatecentral.org/news/microgrids-hurricane-sandy-forced-cities-to-rethink-power-supply-16426.

45. *Id.*

46. JONES & ZOPPO, *supra* note 5, at 133.

47. *See id.*

technology firms to test and implement state-of-the-art technology.[48] Through testing advanced technologies, UCSD's microgrid has proven to be extremely efficient. It serves as an example of the economic, reliability, and environmental benefits that cutting edge technologies can achieve.

1. UCSD's Microgrid Facility

UCSD's current microgrid started in 2006 when the University began making aggressive plans to reduce its carbon footprint and become a self-sustaining campus.[49] Since 2008, UCSD's microgrid has received $4 million in funding from the California Energy Commission and another $4 million in public and private funding.[50] It serves around 45,000 students, faculty, and employees on the 1200 acre campus.[51] UCSD owns a 69 kilovolt (kV) substation, ninety-six 12 kV underground feeder circuits, and four 12 kV distribution substations.[52] This infrastructure provides UCSD with an ideal framework for its 42 megawatt (MW) microgrid. UCSD's distributed resources include a 30 MW cogeneration system containing two gas turbines and a steam turbine, a 3.8 million gallon thermal energy storage system that aids in campus cooling, 3.0 MW of solar PV covering close to 100% of usable rooftop space, and a 2.8 MW fuel cell powered by biogas from the city sewage treatment plant.[53] UCSD is also becoming a leader in energy storage and electric vehicle charging technology.[54]

The University is in the process of installing a diverse portfolio of energy storage that will be integrated with its PV generation and will soon have installed approximately fifty electric vehicle charging stations.[55] UCSD's diverse distributed resources are optimized by a master controller that monitors and controls the real-time operation of the microgrid, which allows UCSD to "self-generate ninety-two

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48. Byron Washom et al., *Ivory Tower of Power*, IEEE POWER & ENERGY MAG., July/Aug. 2013, at 28.

49. *Id.* at 29.

50. News Release, Cal. Energy Comm'n, Energy Commission Awards More Than $1.8 Million for UC San Diego Microgrid Projects (Jan. 9, 2013), *available at* http://www.energy.ca.gov/releases/2013_releases/2013-01-09_UCSD_nr.html.

51. Washom et al., *supra* note 48, at 29–30.

52. JONES & ZOPPO, *supra* note 5, at 133.

53. *Id.*

54. *Id.*

55. *See* Laura Margoni, *Smart Car Meets Smart Charger at UC San Diego*, UC SAN DIEGO NEWS CENTER (Apr. 10, 2014), http://ucsdnews.ucsd.edu/feature/smart_car_meets_smart_charger_at_uc_san_diego.

percent of its own annual electricity and ninety-five percent of its heating and cooling load."[56] UCSD has worked closely with SDG&E, its local utility provider, to pioneer numerous demonstration projects.[57] As a result, San Diego has one of the most advanced implementations of smart grid technology.[58]

UCSD, with San Diego-based Power Analytics, developed the microgrid master controller. The master controller works with servers and synchrophasors to conduct power system analysis and collect and analyze data on the use and generation of energy on the campus.[59] It can monitor and integrate approximately 84,000 data streams per second coming from all over campus, which allows it to efficiently organize energy generation from its distributed energy resources.[60] The master controller is expected to use all of the data it collects to operate UCSD's microgrid in islanded mode.[61] This will be advantageous to the school in the event of an SDG&E power outage because UCSD will be able to generate, distribute, and use its own energy.[62] The school is currently working on improving the cyber security of its microgrid, including through working with Leidos, a company that specializes in cyber security, among other things.[63] The new security measures are designed to account for future growth of the microgrid, so new tests and operations will benefit from the added security.[64]

UCSD's microgrid uses an array of advanced technologies to produce, distribute, monitor, and store energy. UCSD uses a mix of solar PV and concentrating PV system (CPV) at both on and off campus locations. Every single architecturally and structurally available on-campus rooftop has PV installations.[65] UCSD's CPV panel is mounted on a movable platform atop a metal pole at its East Campus Energy Complex and was installed by Concentrix Solar, a

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56. JONES & ZOPPO, *supra* note 5, at 133.

57. *Id.*

58. *See* Washom et al., *supra* note 48, at 28.

59. *See id.* at 30.

60. *See id.*

61. *See id.*

62. *See id.*

63. *See* Jan Zverina, *SDSC and Leidos to Help Develop New Cybersecurity Reference Architecture for Electrical Microgrids*, UC SAN DIEGO NEWS CENTER (Jan. 20, 2014), http://ucsdnews.ucsd.edu/pressrelease/sdsc_and_leidos_to_help_develop_new_cybersecurity_reference_architecture_fo.

64. *See id.*

65. Washom et al., *supra* note 48, at 29.

German CPV technology manufacturer.[66] The CPV technology has an average efficiency of 27.2%, or nearly twice that of conventional PV technology.[67] To better integrate the intermittent solar energy into the system, UCSD has developed solar forecasting optimization algorithms.[68] Every minute, two sky-imaging systems look for clouds over the university campus and forecast the clouds' positions with respect to the PV systems on campus from one to fifteen minutes into the future.[69] The system also forecasts the next day's weather by running high-resolution models of the atmosphere over southern California and the Pacific Ocean to forecast the burn-off time of the marine-layer clouds and project other weather events. The forecasts are then blended and optimized to estimate electricity output from PV systems and make charge and discharge decisions for energy storage.[70]

UCSD has the most diversified energy storage system of any university campus in the world.[71] It has a 3.8 million gallon thermal energy storage system, a 2.8 MW fuel cell powered by biogas from a local sewage treatment plant, and seven energy storage systems with a total capacity of 2.7 MW and 5 MWh.[72] The seven battery storage systems are primarily used to integrate the school's PV generation.[73] The school is also testing used electric vehicle (EV) storage batteries of 108 kW and 180 kWh lithium-ion batteries to demonstrate the usefulness of used batteries.[74]

UCSD's microgrid has many benefits for the school, the local utility, and others. Through its microgrid, the school saves more than $800,000 a month when compared to buying all of its energy from the grid.[75] Much of the microgrid relies on smart grid data analytics that present real improvements in energy efficiency and reductions in energy cost. The smart technologies ultimately make the production,

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66. Rex Graham, *UC San Diego Installs High Efficiency Sun-Tracking Solar Panels*, UC SAN DIEGO NEWS CENTER (July 27, 2009), http://ucsdnews.ucsd.edu/archive/newsrel/science/07-09Concentrix.asp.

67. *Id.*

68. Washom et al., *supra* note 48, at 29.

69. *Id.*

70. *Id.*

71. *See id.* at 30.

72. *Id.* at 30.

73. *See id.*

74. *Id.*

75. *Id.* at 29.

monitoring, distribution, and use of energy more efficient and reduce the need for investing in additional physical infrastructure.[76]

Furthermore, UCSD's microgrid supports the reliability of San Diego's electric grid. The school provides nearly all of its energy needs, which reduces the demand placed on San Diego's transmission and distribution system (T&D) and helps defer SDG&E's need to expand its T&D infrastructure in the future.[77] In the event of a power outage in San Diego, the microgrid can run in islanded mode and can provide "black start" service to the main distribution grid.[78] A facility with black start service has the ability to assist an electric system in restoring power from collapse to normal operation;[79] this is necessary to reestablish power in the event of grid failure.[80] UCSD's microgrid can help energize the local distribution grid when such an event occurs. UCSD has also been able to create a strong relationship with SDG&E.

UCSD's integration of efficient CHP and renewable energy into its microgrid has reduced its GHG emissions.[81] The school's CHP plant is roughly fifty percent more efficient and produces about seventy-five percent fewer emissions than a conventional natural gas plant.[82] As a result of its energy management efforts, the school is working towards a climate action plan of reducing GHGs to 1990 levels by 2020 and achieving climate neutrality by 2025.[83]

2. Current California Policies Affecting Microgrids

UCSD's microgrid benefits from California's energy and environmental goals, which are some of the most progressive in the nation.[84] California has set goals to reduce its GHG emissions to 1990 levels by 2020[85] and to implement a carbon market that would

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76. *See id.* at 31.

77. *Id.* at 32.

78. *See id.*

79. *See Black Start Service*, PJM, http://pjm.com/markets-and-operations/ancillary-services/black-start-service.aspx (last visited Dec. 1, 2014).

80. *See* Washom et al., *supra* note 48, at 32.

81. *See id.* at 32.

82. *See Clean Energy Production*, UC SAN DIEGO, http://sustainability.ucsd.edu/initiatives/energy.html (last visited Dec. 1, 2014).

83. *See Climate Action*, UC SAN DIEGO, http://sustainability.ucsd.edu/initiatives/climate.html (last visited Dec. 1, 2014).

84. California has leading state policies on renewable energy and energy storage procurement. *See, e.g.*, *California Incentives/Policies for Renewables & Efficiency*, DSIRE, http://www.dsireusa.org/incentives/allsummaries.cfm?State=CA&&re=0&ee=0 (last visited Dec. 1, 2014).

85. CAL. HEALTH & SAFETY CODE § 38550 (West 2007).

associate a cost with carbon from the electric sector.[86] It has also set goals to produce 33% of its electricity from renewable sources by 2020,[87] with 12 GW of distributed generation, 3 GW of Solar PV,[88] and 1.3 GW of battery storage.[89] In 2013, California's three large investor-owned utilities (IOUs) served over 20% of their retail customers with renewable energy.[90] In order to achieve the state's progressive goals by 2020, the California Public Utility Commission (CPUC) has created several regulations and financial incentives to promote distributed generation.

The CPUC defines the scope and authority of public utilities and electrical corporations, but it also lists many exemptions for distributed generation. The CPUC states: "'[p]ublic utility' includes every . . . electrical corporation . . . where the service is performed for, or the commodity is delivered to, the public or any portion thereof."[91] Further, if the electrical corporation receives compensation or payment of any kind for its services, the electrical corporation "is a public utility subject to the jurisdiction, control, and regulation of the commission."[92] Lastly, the CPUC states:

> When any person or corporation performs any service for, or delivers any commodity to, any person, private corporation, municipality, or other political subdivision of the state, that in turn either directly or indirectly, mediately or immediately, performs that service for, or delivers that commodity to, the public or any portion thereof, that person or corporation is a public utility subject to the jurisdiction, control, and regulation of the commission and the provisions of this part.[93]

However, the CPUC has created many regulations that exempt distributed generation from being regulated as electric corporations.

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86. CAL. HEALTH & SAFETY CODE § 38570 (West 2007).

87. CAL. PUB. UTIL. CODE § 399.11(a) (West 2013).

88. J. David Erickson, Cal. Pub. Util. Comm'n, Presentation at the International District Energy Conference: Overview of Regulatory Implications of Microgrid Implementation in California (Feb. 19, 2013), *available at* http://www.districtenergy.org/assets/pdfs/2013CampConference/MicroGrids/Microgrids-and-Reliability/ERICKSONPUCMicrogrids-for-IDEA-v3.pdf.

89. *See* Dana Hull, *California Adopts First-in-Nation Energy Storage Plan*, SAN JOSE MERCURY NEWS, Oct. 17, 2013, *available at* http://www.mercurynews.com/business/ci_24331470/california-adopts-first-nation-energy-storage-plan.

90. *See California Renewables Portfolio Standard (RPS)*, CAL. PUB. UTIL. COMMISSION, http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm (last visited Dec. 1, 2014).

91. CAL. PUB. UTIL. CODE § 216(a) (West 2012).

92. *Id.* § 216(b).

93. *Id.* § 216(c).

According to Section 218 of the California Public Utility Code, electrical generators are exempt from status as a corporation when:

(1) The producer generates or distributes electricity "through private property solely for its own use or the use of its tenants and not for sale or transmission to others."[94]

(2) The producer generates and sells electricity to no more than two other corporations or persons who are located on the property where the electricity is generated or on the adjacent property. However, if there is an intervening public road between the two properties, and the two properties are not under common ownership or the tenants are not affiliates or subsidiaries of the generator, then the producer is not exempt from being an electrical corporation.[95]

(3) The producer sells or transmits electricity "to an electrical corporation or state or local public agency, but not for sale or transmission to others."[96]

Thus, 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. Section 218 specifically states that cogeneration, landfill gas, digester gas, solar energy,[97] and small power producers[98] are not considered electrical corporations as long as they meet the criteria set forth in the section.

Furthermore, "in order to promote the more rapid development of new sources of natural gas and electric energy . . . and to promote the efficient utilization and distribution of energy," the CPUC has created regulations that allow "private energy producers," such as microgrids, to generate electricity without being subject to CPUC regulations.[99] Private energy producers are "every person, corporation, city, county, district, and public agency of the state generating or producing electricity not generated from conventional sources or natural gas for energy."[100] Conventional power sources are nuclear, hydropower facilities greater than 30 MW, or fossil fuel

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94. CAL. PUB. UTIL. CODE § 218(a) (West 2009).
95. *Id.* § 218(b)(2).
96. *Id.* § 218(b)(3).
97. *Id.* § 218(b)–(e).
98. *Id.* § 218.5(b).
99. CAL. PUB. UTIL. CODE § 2801 (West 1976).
100. CAL. PUB. UTIL. CODE § 2802 (West 1978).

combustion, unless it is cogeneration.[101] Thus, microgrids can employ diverse types of energy production, ranging from solar PV, wind, or fuel cells, without being subject to CPUC jurisdiction.

Through these regulations, the CPUC has made it possible for individuals, businesses, universities, hospitals, or others to create their own microgrids without being considered "electrical corporations," as long as they follow statutory provisions. In addition, the CPUC has also created many kinds of incentive programs to encourage the implementation of distributed generation, whether for a microgrid or not. The Self-Generation Incentive Program (SGIP) is one of several CPUC programs that give financial incentives to individuals, businesses, schools, or others to implement their own distributed generation.[102] The program began in 2001 in response to California's energy crisis as a means of reducing peak-load demand and is currently funded through 2015.[103] In 2011, California Senate Bill 412 modified the primary purpose of SGIP from reducing peak load to also reducing greenhouse gases. "Eligible technologies include wind turbines, pressure reduction turbines, fuel cells, advanced energy storage, waste heat capture and CHP internal combustion engines, microturbines and gas turbines."[104] In San Diego alone, SGIP has awarded over $53 million to different projects,[105] including funding for UCSD's seven energy storage systems.[106] SGIP is but one example of several financial incentive programs the CPUC has established that help encourage the implementation of microgrids. Others include the California Solar Initiative, California Solar Initiative-Thermal, and Multifamily Affordable Solar Housing.[107]

However, while many regulations and incentives support microgrid implementation, certain regulations limit the potential physical expansion of microgrids. If, for example, UCSD wanted to expand its microgrid to include a neighboring hospital or other critical community facility not affiliated with UCSD, the construction would violate CPUC Section 218 because a public street divides UCSD and

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101. *See* CAL. PUB. UTIL. CODE § 2805 (West 1980).

102. *See SGIP Background*, CAL. CENTER FOR SUSTAINABLE ENERGY, https://energycenter.org/programs/self-generation-incentive-program/background (last visited Dec. 1, 2014).

103. *See id.*

104. *Id.*

105. *See id.* CSE is the Self-Generation Program Administrator for only the San Diego Gas and Electric territory. *See id.*

106. Washom et al., *supra* note 48, at 30.

107. *See Programs*, CAL. CENTER FOR SUSTAINABLE ENERGY, https://energycenter.org/programs (last visited Dec. 1, 2014).

the hospital.[108] Accordingly, neighboring critical community facilities would not be able to connect to and become part of UCSD's microgrid unless current regulations change to allow microgrids to cross public streets onto property owned by others. An additional restriction prevents a microgrid from selling power to more than two tenants on a property.[109] Property owners with numerous tenants, such as apartment complexes, malls, commercial office parks, or other businesses, could not sell electricity to more than two tenants, eliminating the incentive for property owners to invest in a microgrid. Thus, these regulations, while supporting microgrids in certain situations, limit their growth in others.

3. Philadelphia Navy Yard's Commercial Microgrid

Similar to UCSD's microgrid, the Philadelphia Navy Yard owns its own electric distribution system and is contained on the footprint of a former military base. Today, the Philadelphia Navy Yard is a 1200 acre commercial urban development property located in Philadelphia, Pennsylvania.[110] The property includes its own electric microgrid structure that is outside of the Pennsylvania Public Utility Commission's regulatory authority.[111] The Navy Yard's microgrid infrastructure includes smart grid technologies, distributed generation, demand response, and efficiency.[112] These modern developments offer substantial future benefits in regards to efficiency, system reliability, and environmental protection.

In 2000, the U.S. Navy conveyed the Navy Yard property to the Philadelphia Authority for Industrial Development (PAID).[113] On behalf of PAID, the Philadelphia Industrial Development Corporation (PIDC) is directing the redevelopment and management of the Navy Yard.[114] The Navy Yard, historically used as a shipbuilding facility, previously managed its own electric, water, wastewater, and steam infrastructure.[115] The Navy Yard later decommissioned its steam infrastructure and transferred its water and

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108. *See* CAL. PUB. UTIL. CODE § 218(b)(1)–(2) (West 2009).
109. *Id.* § 218(b)(2).
110. *History*, NAVY YARD, http://www.navyyard.org/history (last visited Dec. 1, 2014).
111. *See* PHILA. INDUS. DEV. CORP., THE NAVY YARD ENERGY MASTER PLAN 1-3 (2013) [hereinafter ENERGY MASTER PLAN]
112. *Id.*
113. *Id.*
114. *Id.*
115. *Id.*

wastewater systems to the Philadelphia Water Department.[116] However, PIDC decided to retain the electric distribution grid because it was seen as a valuable asset to the future economic development of the Navy Yard.[117]

Currently, the Navy Yard enjoys a unique regulatory status. According to the Pennsylvania law, as long as the PIDC does not sell electricity outside of its boundaries, the Navy Yard is not considered a public utility.[118] This non-utility status exempts the Navy Yard electric distribution network from regulation by the Public Utility Commission (PUC).[119] Accordingly, PIDC may set rates and alter the grid infrastructure without the approval of the PUC.[120] Unencumbered by the regulatory process, PIDC can implement its own innovative microgrid design including dynamic pricing mechanisms, demand response, efficiency, and distributed generation.[121] PIDC has taken advantage of the Navy Yard's unique regulatory status by implementing various energy innovation initiatives to evolve Navy Yard into a green corporate campus, home to more than 11,000 employees and 143 companies,[122] with active initiatives on sustainable building and innovative energy management.[123]

The Navy Yard ranks among the largest non-municipal distribution system in the nation in terms of area served and electricity consumption.[124] The microgrid is currently operated by the DTE Energy Service under contract with PIDC.[125] It purchases wholesale power from Exelon, which is delivered to the Navy Yard at two main substations through 13.2 kV main feeders owned by PECO, a subsidiary of Exelon.[126] The two substations distribute power into two independent grids inside the Navy Yard.[127] The current electric

116. *Id.*

117. *Id.*

118. *Id.* at 2-6.

119. *Id.*

120. *See id.*

121. *See id.*

122. *About the Navy Yard*, NAVY YARD, www.navyyard.org (last visited Dec. 1, 2014).

123. *See generally Energy Innovation*, NAVY YARD, www.navyyard.org/energy-innovation (last visited Dec. 1, 2014).

124. ENERGY MASTER PLAN, *supra* note 111, at 1-3.

125. *Id.*

126. *Id.* at 3-4.

127. *Id.* at 3-3.

infrastructure includes more than 100 miles of underground cable, 158 transformers, 107 switch gears, and 490 meters.[128]

In 2012, the Navy Yard consumed a total of 130 MWh of power and had a peak demand of 23 MW.[129] Electricity sales generate almost all of PIDC's revenue.[130] Wholesale electricity accounts for around 82% of the PIDC's costs.[131] Sixteen percent of the total costs are fixed costs that the PIDC pays to its on-site provider DTE Energy Services.[132] The remaining 2% of costs are fixed and are comprised of payments to EnerNOC for its energy procurement services, and to PAID for administrative services.[133] Navy Yard's electricity demand is projected to grow as it continues to expand through urban development. Specifically, peak demand in the next ten years is projected to increase to more than 82 MW, which is more than three times the current peak demand of 26.6 MW.[134] This increased demand is beyond the capacity of Navy Yard's current electric grid systems.[135] Realizing this need, PIDC commissioned a Navy Yard Energy Master Plan (the Plan) for a comprehensive energy, infrastructure, technology, and business plan to guide the future development of electric distribution at Navy Yard.[136]

The Plan was created with a vision to provide Navy Yard with a "state of the art distribution system offering competitively priced, high quality, reliable power along with progressive energy efficiency programs and tariffs."[137] The Plan considered various approaches to meeting demand over the next 10 years,[138] and ultimately recommended a "balanced approach" as the preferred model for the Navy Yard.[139] This approach calls for an increase in electricity purchase from PECO as well as substantial use of efficiency, demand response, distributed generation, and smart grid technologies in order to meet the future demand. More specifically, the Plan includes

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128. Will Agate, Vice President, The Navy Yard, Presentation to the Philadelphia Navy Yard, *available at* http://energy.gov/sites/prod/files/Presentation%20to%20the%20EAC%20-%20Philadelphia%20Navy%20Yard%20-%20Will%20Agate.pdf.
129. ENERGY MASTER PLAN, *supra* note 111, at 1-3.
130. *Id.* at 3-4.
131. *Id.* at 3-7.
132. *Id.*
133. *Id.*
134. *Id.* at 1-4, 2-4.
135. *See id.* at 2-6.
136. *See* at 2-4.
137. *Id.* at 2-4.
138. *See generally id.*
139. *Id.* at 1-5.

additional importation of 32 MW from PECO; reduction in peak demand by more than 13 MW through energy efficiency and demand response; reduction of total energy use by 20%, to 61 MWh by 2022; and addition of 11 MW of onsite distributed generation, CHP, and renewable energy facilities.[140] The Plan is estimated to cost $95.3 million over ten years; PIDC responsible for an estimated $45.6 million.[141] The rest of the funds are anticipated to come from third-party investment and private ownership of select energy assets.[142] The Navy Yard currently lacks smart grid technology.[143] There has been very limited use of smart meters, and there is no active Supervisory Control and Data Acquisition (SCADA) system for remote monitoring and control functions.[144] The Plan calls for both active dispatch of smart grid technologies for demand response and integrated distributed generation with capacity for load islanding. Total investment in smart grid technology is estimated around $13.4 million dollars.[145] This investment will establish the Navy Yard Network Operation Center (NOC), provide smart meters to all accounts, and establish grid communication between the NOC and the smart meters.[146]

The smart grid implementation is categorized into two phases. The first phase is foundational, which spans a period of two years and will focus on building the NOC and installing smart metering technology.[147] These will provide improved building and grid monitoring capacity leading to full SCADA capabilities.[148] An easy-access customer portal will also be created to allow the electric customers to monitor, analyze, and manage their demand.[149] The second phase builds upon the first phase. It will focus on improving operating economics and reliability through digital substation and advanced NOC functions, including Volt-VAR control and situational awareness schemes that will lead to additional savings.[150] These advanced applications and smart grid technologies enable the Navy Yard to evolve into a smart campus.

140. *See id.* at 1-5.
141. *Id.* at 1-5.
142. *Id.* at 1-5 to 1-6.
143. *Id.* at 2-7.
144. *Id.* at 2-6.
145. *See id.* at 1-5.
146. *Id.*
147. *Id.* at 1-7.
148. *Id.*
149. *Id.*
150. *Id.*

The Navy Yard is currently moving forward with the first phase of microgrid modernization by installing smart meters and creating the NOC. In the beginning of 2014, a Request for Information (RFI) process began to gather market research to understand the state of the industry and identify qualified vendors to develop the smart metering and communication and control systems within the Navy Yard.[151] Smart meters will allow for data collection, registration, multiple source logging, and remote configuration.[152] The communication network would include Wide Area Network (WAN) and Local Area Network (LAN) connections to the smart meters and control devices to provide a "high level of cyber security, segmentation, and quality of service to prioritize latency sensitivity communications."[153] The installation is anticipated to be completed mid-2015.[154] The Navy Yard's modernization efforts are limited to its boundaries. The Plan does not seek to "extend" service to critical facilities beyond its campus territory. The Navy Yard has, however, started a process to identify critical facilities that are inside its territory to create a method to island those facilities during system outages.[155]

4. The Electric Regulatory Regime in Pennsylvania

The legal rights to build and operate a microgrid depend greatly on whether the microgrid is defined as a public utility.[156] If a microgrid is considered a public utility, there are significant hurdles to overcome before it may operate within the service territory of another public utility.[157] The microgrid structure at the Navy Yard is an anomaly—it operates independent of state regulation.[158] In Pennsylvania, a public utility is defined as:

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151. *See* PHILA. INDUS. DEV. CORP., REQUEST FOR INFORMATION 7 (2014), *available at* http://www.pidc-pa.org/uploads/files/rfps/118.pdf.

152. *See id.* at 8.

153. *Id.*

154. E-mail from Will Agate, Senior Vice President, Navy Yard Mgmt. & Dev., to Achyut Shrestha, Research Associate, Smart Grid Team, Institute for Energy and the Environment (Apr. 25, 2014) (on file with author).

155. *Id.*

156. *See* Douglas E. King, *The Regulatory Environment for Interconnected Electric Power Micro-grids: Insights From State Regulatory Officials* 5 (Carnegie Mellon Elec. Indus. Ctr., Working Paper CEIC-05-08) *available at* https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_05_08.pdf.

157. *See id.*

158. *See* ENERGY MASTER PLAN, *supra* note 111, at 2-6.

> Any person or corporation now or hereafter owning or operating in this Commonwealth equipment or facilities for . . . producing, generating, transmitting, distributing . . . electricity . . . for the public for compensation . . . [*but*] *does not include* . . . any building or facility owner/operators who hold ownership over and manage the internal distribution system serving the building or facility and who supply electric power and other related electric power service . . . .[159]

Since the Navy Yard is a separate facility with ownership of its internal distribution of the facility, it is not considered a "public utility."[160] The Navy Yard does not fall within the jurisdiction conveyed by these statutes. Accordingly, it has no requirement to provide open access to its service area.

Pennsylvania law does not define microgrid structures or provide any means for consumers to participate in new microgrid environments. The closest definition to "microgrid" in the Pennsylvania Statutes is under the state Alternative Energy Portfolio Standards Act, which defines "customer-generator" as:

> A nonutility owner or operator or a net metered distributed generation system . . . who make[s] their systems available to operate in parallel with the electric utility during grid emergencies as defined by the regional transmission organization or where a microgrid is in place for the primary or secondary purpose of maintaining critical infrastructure . . . .[161]

These customer-generators are allowed to participate in the net metered program and receive "alternative energy credits"[162] when a portion of the electricity generated by the "alternative energy generating system"[163] is used to generate electricity.[164] The Public Service Commission develops "the technical and net metering interconnection rules for customer-generators intending to operate renewable onsite generators in parallel with the electric utility grid."[165] However, these statutes are targeted towards net metering

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159. 66 PA. CONS. STAT. ANN. § 102 (West 2004) (emphasis added).

160. *See* ENERGY MASTER PLAN, *supra* note 111, at 2-6.

161. 73 PA. STAT. ANN. § 1648.2 (West 2007).

162. An alternative energy credit is defined as "[a] tradable instrument that is used to establish, verify and monitor compliance with [the Alternative Energy Portfolio Standards Act]. A unit of credit shall equal one megawatt hour of electricity [generated] from an alternative energy source." *Id.*

163. An alternative energy generating system is defined as "a facility or energy system that uses a form of alternative energy source to generate [and deliver] electricity." *Id.*

164. *See* 73 PA. STAT. ANN. § 1648.3(e)(12) (West 2007).

165. 73 PA. STAT. ANN. § 1648.5 (West 2007).

of distributed generation rather than providing a framework for microgrids.

B. An Urban Microgrid Within a Dense Urban Network: The NYU Microgrid

In New York City (NYC or the City), microgrids have received significant and increasing levels of attention from city, state, and federal entities. As severe weather events have shaken electric reliability on NYC's otherwise highly dependable distribution system, microgrids have been touted for their grid-hardening and emergency-planning benefits. Meaningful realization of these benefits, however, faces many hurdles in terms of engineering, cost effectiveness, and regulatory planning. The following sections will describe currently unfolding microgrid planning and development efforts in NYC by looking at the underlying political impetus for these projects, the NYU microgrid, and the current legal status of microgrids, including related law and policy concerns that should be addressed to support microgrid development.

1. *The Need for Grid-Hardening in NYC*

Much of the recent attention paid to microgrids in NYC stems from the increasing frequency and severity of extreme weather events, particularly Hurricane Sandy. Sandy was perhaps the most serious electric reliability problem that NYC has ever seen. This single weather event caused the longest-duration power outage in the history of Consolidated Edison (Con Edison),[166] which was unable to completely restore service to all of its customers for fourteen days.[167] The blackout left more than two million NYC residents without power for varying degrees of time.[168] Despite the facts that Con Edison protects its network by locating approximately eighty-six percent of its lines underground and has the lowest average interruption frequency of any investor-owned utility in the United States,[169] Sandy proved that electricity grids are simply not impervious to extreme events.

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166. Con Edison is the electricity distribution utility responsible for most of NYC. *See* THE CITY OF NEW YORK, PLANYC: A STRONGER, MORE RESILIENT NEW YORK 113 (2013), *available at* http://s-media.nyc.gov/agencies/sirr/SIRR_spreads_Hi_Res.pdf [hereinafter PLANYC].

167. *See id.*

168. *See id.*

169. *See id.* at 107, 111.

The severity of the impacts of these outages truly highlights the impetus for serious microgrid planning. The financial damages alone were incredible as NYC realized approximately $19 billion in damage, electrical infrastructure included.[170] More importantly, $6 billion of this was attributable to loss of economic productivity[171] (although some estimates show substantially higher figures, with suspended business losses at $20 billion).[172] Without power, offices and industry were dark and unheated, and skyscrapers in Manhattan could not power elevators to transport employees. Without transit, employees faced additional challenges in getting to their offices even if they were useable.[173]

The outages also had a frightening human component. In any emergency, access to telecommunications, transportation, and especially healthcare are hugely important, but, unfortunately, all of these services depend upon access to electricity.[174] Although individuals needed to leave residences with inoperable water pumps, no heat, and no refrigeration (all related to electricity loss), subways and gas stations were inoperable.[175] Despite injuries and health concerns arising from the storm, six hospitals closed and 6500 hospital and nursing home patients were evacuated.[176] Loss of cable, internet, and wireless services, and the inability to charge cell phones added to the chaos.[177]

Unfortunately, grid reliability concerns are also arising from other extreme weather events, and many of these problems may increase in frequency and magnitude from climate change. Heat waves, for example, have been other problematic weather events for NYC electric utilities. As recently as 2006, a major heat wave caused an outage affecting 250,000 residents in Queens due to substantially increased air conditioning demand and heat-induced strain on transmission and distribution equipment.[178] Heat waves have historically been the most frequent cause of power outages in NYC

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170. *Id.* at 33.
171. *Id.*
172. *See, e.g.*, Jim Gallagher, Exec. Dir., N.Y. State Smart Grid Consortium, & Carol Garcia, NY Rising Communities, Community Microgrid Webinar 17 (Jan. 30, 2014), *available at* http://nyssmartgrid.com/wp-content/uploads/NYSSMARTGRID_WEBINAR_013014_FINAL_v7.pdf [hereinafter Microgrid Webinar].
173. *See* PLANYC, *supra* note 166, at 107.
174. *See id.* at 14.
175. *See id.* at 17, 107; *see also* Magill, *supra* note 44.
176. *See* PLANYC, *supra* note 166, at 11, 16.
177. *See id.* at 16.
178. *See id.* at 120.

and are expected to further increase in frequency and severity.[179] In fact, estimates from the New York Panel on Climate Change suggest that by 2050, "[h]eat waves could more than triple in frequency, lasting on average one and a half times longer than they do today."[180] Similarly, due to rising sea levels, increasing ocean temperatures and increasing rainfall, hurricanes affecting NYC are likely to be more dangerous and cause as much as five times more economic damage than Sandy as soon as 2050.[181] Given the extent of the economic and social problems that outages have created and are likely to create in the future, planning for grid resiliency in NYC is clearly becoming an important topic in NYC urban planning.

2. The NYU Microgrid

Perhaps the most visible reason that microgrids have received so much attention as a resiliency option in NYC is because of the proven success of New York University's (NYU) microgrid. During and after Hurricane Sandy, despite a prolonged electric outage in lower Manhattan (due mostly to a flooded transmission substation and some preemptive shutdowns),[182] NYU's Washington Square Campus remained heated and electrified.[183] Because NYU's CHP microgrid was able to disconnect and island from the Con Edison network, NYU avoided the much of the blackout and many of the aforementioned problems caused by Hurricane Sandy.

NYU's Washington Square Campus has owned generation and distribution assets for some time. As early as 1960, NYU produced some energy on campus, and in 1980, NYU built a 7.5 MW oil boiler plant that produced steam and electricity.[184] Importantly, in 1980 NYU's system first expanded to cross public streets, requiring NYU to negotiate a right-of-way with the City, allowing use of public

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179. *Id.*

180. *See id.* at 30, 120.

181. *See id.* at "Foreword from the Mayor".

182. *See id.* at 114.

183. Julia Pyper, *Are Microgrids the Answer to City-Disrupting Disasters?*, SCI. AM. (Sept. 11, 2013), http://www.scientificamerican.com/article/are-microgrids-the-answer-to-city-disrupting-disasters/.

184. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., MICROGRIDS: AN ASSESSMENT OF THE VALUE, OPPORTUNITIES AND BARRIERS TO DEVELOPMENT IN NEW YORK STATE A-32 (2010); *see generally* Telephone Interview with Tom Mimnagh, Acting Gen. Manager Energy Servs., Consol. Edison Co. of N.Y., Inc. & Deidre Altobell, Senior Energy Policy Advisor, Consol. Edison Co. of N.Y., Inc. (Apr. 3, 2014); *Case Study: New York University,* SOURCEONE, http://www.sourceone-energy.com/resources/case-studies/new-york-university-cogeneration-plant (last visited Dec. 1, 2014).

property to interconnect their buildings.[185] Concrete encased facilities currently run under the Manhattan streets allowing for distribution of heat, hot water, and electricity from its generation.[186]

Today, NYU's microgrid is much larger and more efficient. The system consists of two natural gas turbines, which both power two 5.5 MW electrical generators while simultaneously sending excess heat to steam generators.[187] The steam generators then pipe steam to a single 2.4 MW steam turbine electrical generator, and then on to two hot water heat exchangers (which transfer the steam heat to water for heating and hot water use), and to one steam driven chiller (which provides cold water and air conditioning).[188] Overall, this CHP microgrid supplies heating, air conditioning, and hot and cold water to between thirty-seven and forty of the fifty buildings on NYU's Washington Square Campus.[189] Additionally, the electrical generation capacity, which amounts to 13.4 MW, operates as the primary power source for approximately twenty-two to twenty-six buildings.[190] The electricity is carried by three 5 kV radial circuits from the generators to each building, at which point a transformer reduces the voltage for end use.[191]

Another important aspect of NYU's system is that it is interconnected with Con Edison's distribution system, which provides a number of benefits for NYU. Specifically, six different feeders connect NYU and Con Edison, and automatic transfer switches allow the microgrid to immediately draw from Con Edison in the event that the microgrid fails or otherwise cannot meet demand.[192] The main benefit to NYU is that without backup and automatic transfer, a failure in their radial circuits will necessarily lead to an outage that could last twenty-four to thirty-two hours.[193] While NYU could have built a more intricate loop circuit to solve this problem, backup from

185. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at A-37.

186. *See* Telephone Interview with Tom Mimnagh & Diedre Altobell, *supra* note 184.

187. *New York University*, MICROGRIDS BERKELEY LAB, http://building-microgrid.lbl.gov/new-york-university (last visited Dec. 1, 2014).

188. *How NYU's New Cogeneration Plant Works*, N.Y. UNIV., http://www.nyu.edu/content/dam/nyu/publicAffairs/documents/PDF/NYU-CoGen-plant-How-it-works.pdf (last visited Dec. 1, 2014).

189. *See Case Study: New York University*, *supra* note 184; Pyper, *supra* note 183.

190. *See Case Study: New York University*, *supra* note 184; Pyper, *supra* note 183.

191. *See* Telephone Interview with Tom Mimnagh & Diedre Altobell, *supra* note 184.

192. *See id.*

193. *See id.*

Con Edison serves the same purpose without the additional infrastructure investment.[194]

For this backup service, NYU pays for 13 MW of "high tension" backup through Con Edison at their service classification (SC) 11 rate.[195] This standby rate provides Con Edison with monthly Customer Charges and a Delivery Service Contract Demand Charge based upon factors such as Contract Demand (13 MW), the higher voltage (high tension) that NYU is able to accept, and the SC that NYU would otherwise fall under.[196] There are also charges for interconnection, reactive power demand, and additional delivery charges for actual kilowatt-hours consumed during backup situations.[197]

A secondary advantage to NYU from interconnection with Con Edison is that NYU can provide power back to the grid—thereby enabling NYU to earn revenue from excess generation while providing distributed energy benefits to the grid.[198] NYU's earnings, like their cost obligations, are based on Con Edison's SC 11 tariff, under which cogeneration facilities are compensated at the hourly wholesale electric price or the monthly average, depending on the maximum capacity delivered.[199] According to NYU, their modern microgrid as a whole has led to $5 million in annual energy cost reductions,[200] and the ability to sell excess generation back is likely a notable portion of such reductions.

One other related point is that NYU is interconnected to and dependent upon Con Edison's natural gas service to power its microgrid. Fortunately, the gas system seems to be more secure from storms like Hurricane Sandy, and gas is also much more feasibly stored than electricity.[201] However, the necessary dependence of NYU's microgrid on natural gas supply is still a vulnerability that impacts this model's efficacy for grid hardening.

A final beneficial aspect of NYU's microgrid, apart from reliability and finances, has been its environmental performance. Specifically,

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194. *See id.*

195. *See id.*

196. CONSOL. EDISON CO. OF N.Y., INC., PUB. SERVICE COMM'N COMPLIANCE FILING 85 (Feb. 20, 2012), *available at* http://www.coned.com/documents/elecPSC10/SCs.pdf.

197. *Id.* at 86–87.

198. N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at S-4 to S-5.

199. *See* Telephone Interview with Tom Mimnagh & Diedre Altobell, *supra* note 184.

200. *Case Study: New York University*, *supra* note 184.

201. *See* PLANYC, *supra* note 166, at 117.

NYU notes a 23% reduction in GHG emissions and 68% reductions in criteria air pollutants from their system when compared with use of "conventionally produced energy."[202] Likely due to a high operating efficiency (between 75 and 90%),[203] the CHP system saves approximately 5000 tons of greenhouse gas emissions per year,[204] and as much as 43,400 tons of CO_2 per year, compared to the previous oil boiler system.[205] This is perhaps also economically beneficial for NYU as the CHP generation "requires approximately 27 percent less fuel than supplying electricity from the grid and producing steam with a boiler."[206] Overall, these statistics were enough to earn NYU one of five of the U.S. Environmental Protection Agency's 2013 EnergyStar CHP Awards.[207]

It should be noted that while NYU's microgrid is perhaps the most visible and touted example of NYC microgrid resilience during Sandy, it is not the only example. Co-op City in the Bronx, the largest residential development in the United States, used its 40 MW CHP microgrid to keep power and heating flowing to over 60,000 residents during Sandy.[208] Their microgrid consists of two 12.9 MW gas turbines, two once-through steam generators, an auxiliary boiler, and a 15 MW steam turbine.[209] Similar to NYU's microgrid, Co-op City's microgrid is a principal source of power (as opposed to an emergency/backup system), is interconnected to Con Edison and can sell back power, and claims to be saving the owners in yearly energy costs,[210] with "utility savings estimated [at] $15,000,000 per year."[211] Additionally, as will be relevant in subsequent sections discussing regulatory feasibility, Co-op City is owned by a single entity, sells power/heat only to itself, and presumably does not cross public streets.

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202. *See How NYU's New Cogeneration Plant Works*, *supra* note 188.

203. *See id.; see also Case Study: New York University, supra* note 184.

204. *See id.*

205. *See* Microgrid Webinar, *supra* note 172, at 21; *Case Study: New York University*, *supra* note 184.

206. *Winners of the 2013 Energy Star CHP Award*, U.S. ENVTL. PROT. AGENCY (Nov. 2013), http://www.epa.gov/chp/documents/past_award_winners.pdf.

207. *Id.*

208. William Pentland, *Lessons From Where the Lights Stayed on During Sandy*, FORBES (Oct. 31, 2012), http://www.forbes.com/sites/williampentland/2012/10/31/where-the-lights-stayed-on-during-hurricane-sandy/.

209. *Id.*

210. *Id.*

211. Microgrid Webinar, *supra* note 172.

Looking at just these two microgrid models, the benefits in terms of economics, reliability, demand and congestion mitigation, and even greenhouse gas emission reductions are quite persuasive. It is therefore no surprise that after the devastation caused by Hurricane Sandy, utilities, regulators, system planners, non-profits, and more, all began directing their attention towards microgrid research and development. As will be discussed, the NYU and Co-op City models are not the only proposed options, as utility owned microgrids and other alternatives have certain benefits. However, the basic structure and convincing success are important drivers in microgrid development efforts in NYC.

3. NYC Microgrid Support and Efforts

Microgrid discussion and early implementation efforts in NYC are arising from multiple sectors across the city, state, and even nation, with all levels of government and non-governmental entities getting involved. This section will focus on these early efforts and how different groups and individuals are contributing to future microgrid models in NYC. Issues examined will include microgrid funding, microgrid ownership and operation, and substantive and notable goals for microgrid implementation.

a. Federal Support for Microgrids in New York

After the discussion of Hurricane Sandy, it is not surprising that federal support for microgrids in New York has arisen in conjunction with Sandy relief and future storm prevention programs. Perhaps also not surprising is that the bulk of this federal support has been through funding opportunities and broad policy statements. Hurricane Sandy Rebuilding Task Force (Task Force) proposals are perhaps the most direct source of microgrid support at the federal level. Created by President Obama's Executive Order 13632, "Establishing the Hurricane Sandy Rebuilding Task Force," the Task Force is an amalgamation of twenty-five federal offices and agencies (not including, but closely associated with, the Federal Emergency Management Agency—FEMA) headed by the Department of Housing and Urban Development (HUD).[212] While the term "rebuilding" and association with FEMA might arouse ideas that the Task Force is merely a response and repair entity, the Task Force was created to provide recommendations for long-term energy security and resiliency policy, of which microgrids are a part.

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212. Exec. Order No. 13,632, 3 C.F.R. § 13632 (2013).

The Task Force released the Hurricane Sandy Rebuilding Strategy in August 2013. This report provides sixty-nine proposals for various federal and state agencies to adopt, and three of these proposals explicitly reference microgrid research and development.[213] The first two, Recommendations 11 and 12, address methods of optimizing funding and encouraging best practices for resiliency.[214] Recommendation 11 notes that HUD and the DOE have provided at least $30 million from HUD's Community Development Block Grant (CDBG) program to support energy infrastructure resiliency, and in New York, this was intended to fund a "Resilience Retrofit program."[215] The Task Force envisioned this retrofit program supporting smart grid, CHP, microgrid, fuel cells, and storage, and this proposal has moved forward into implementation to some extent.[216] The third proposal, Recommendation 14, focuses on improving electric grid policies and technical standards, and suggests that DOE and the Institute of Electrical and Electronic Engineers cooperate with states to meet these objectives.[217] Furthermore, the recommendation asserts that improvements are needed in terms of isolating outages and keeping essential services up and running, and specifies smart grid, microgrid, distributed generation (including CHP), and other technologies as possible solutions which deserve technical and policy support.[218]

Beyond the Task Force, the federal government has also encouraged microgrid adoption through HUD CDBG funding. Under the Disaster Relief Appropriations Act of 2013, Congress made a total of $16 billion available through the CDBG fund (later reduced to $15.18 billion as a result of a presidential sequestration order) to sponsor "disaster relief, long-term recovery, restoration of infrastructure and housing, and economic revitalization."[219] While the statutory goals of the project seemed to favor simple recovery over future resilience, Congress provided that HUD could establish "alternative requirements for . . . the use of these funds by a grantee."[220] HUD took advantage of this authority in its second

213. *See* HURRICANE SANDY REBUILDING TASK FORCE, HURRICANE SANDY REBUILDING STRATEGY 64 (2013), *available at* http://portal.hud.gov/hudportal/documents/huddoc?id=hsrebuildingstrategy.pdf

214. *Id.* at 62–67.

215. *Id.* at 64.

216. *Id.* at 61, 63.

217. *Id.* at 68.

218. *Id.*

219. Disaster Relief Appropriations Act, Pub. L. No. 113-2, 127 Stat. 4 (2013).

220. *Id.*

round of funding allocation. In response to Executive Order 13632, which required executive entities to "align their relevant programs and authorities with the [Hurricane Sandy Rebuilding] Strategy," the second allocation of CDBG funds for Sandy Relief encourages grantees to incorporate energy infrastructure resiliency projects into their Action Plans (required submissions by grantees in order to be distributed appropriated funds). The Federal Register entry specifically notes microgrids as potentially appropriate resiliency measures for use of these funds.[221]

Moving forward, especially as repairs are completed and microgrid policy develops further, unallocated federal funding seems likely, or at least possible, to be used for microgrid development in NYC.

b. New York State Support for Microgrids

Efforts at the state level have been more tangible and more focused on microgrid planning and policy. While many of these efforts are geared towards the state as a whole, given NYC's population and economic prominence in the state, as well as its significant vulnerability to extreme weather, it seems a likely target for planning and demonstration. For example, New York's Green Bank, established in 2013 and overseen by the New York State Energy Research and Development Authority (NYSERDA), recently noted that it is working to create a Resiliency Retrofit Fund that would use $30 million in federal Hurricane Sandy relief funding to encourage resiliency projects through credit enhancement.[222] It is also noted as being specifically coordinate with NYC.[223]

One of the most publicized microgrid efforts in New York State (NYS) has been the NY Prize competition. This program, stemming from Governor Cuomo's $16.75 billion "Reimagining New York for a New Reality" strategy,[224] is a $40 million competitive grant pool

221. Second Allocation, Waivers, and Alternative Requirements for Grantees Receiving Community Development Block Grant (CDBG) Disaster Recovery Funds in Response to Hurricane Sandy, 78 Fed. Reg. 69104, 69111 (Nov. 18, 2013).

222. *See* AGRION, STATE CLEAN ENERGY BANKS 16 (2013), *available at* http://www.nyceec.com/wp-content/pdf/State%20Clean%20Energy%20Banks.pdf.

223. *See id.* at 15–16; *see also* N.Y. STATE ENERGY RES. & DEV. AUTH., TOWARD A CLEAN ENERGY FUTURE: A THREE-YEAR STRATEGIC OUTLOOK 2013–2016, at 22 (2013).

224. *See* Press Release, Andrew M. Cuomo, Governor, N.Y., Governor Cuomo Announces Broad Series of Innovative Protections; Vice President Biden Credits Governor Cuomo's Storm Plan as A Model for Future Recovery Efforts (Jan. 7 2014), *available at* http://www.governor.ny.gov/press/01072013-cuomo-biden-future-recovery-efforts.

poised "to help build [at least ten] community-scale microgrids for areas with approximately 40,000 residents."[225] NY Prize is one of at least 1000 programs included in Reimagining New York for a New Reality that are aimed at extreme weather resiliency and response.[226] It was introduced in tandem with $1.37 billion in more traditional grid hardening efforts such tree trimming, new outage response systems, putting distribution wires underground, etc.[227] The Governor's Office Press Release notes that both "federal funds appropriated for Sandy . . . along with state funds" will support Reimagining New York for a New Reality,[228] and the NYS 2014–2015 Executive Budget references NYSERDA and the New York Power Authority (NYPA) as sources of the state backing.[229] NY Prize will support at least ten microgrids statewide and will be administered primarily by NYSERDA with support from NYPA.[230] The microgrids selected for funding must incorporate "decentralized, local, clean power sources" and serve "approximately 40,000 residents."[231] Program implementation details have not yet been announced. It should be noted that this model follows from another NYS microgrid competitive funding opportunity that began in October 2013, which will award $10 million in each Nassau and Suffolk counties to establish microgrids.[232]

Beyond microgrid funding, a number of state government and NGO entities that have been working on technical and regulatory planning, and even direct advocacy for microgrid implementation. In particular, the 2014 Draft State Energy Plan (SEP), NYS 2100 Commission recommendations, NYSERDA, the NYS SmartGrid Consortium (NYSSGC), and Pace Law School have been visibly

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225. ANDREW M. CUOMO & ROBERT L. MEGNA, 2014–15 EXECUTIVE BUDGET 36 (2014), *available at* http://publications.budget.ny.gov/eBudget1415/fy1415littlebook/BriefingBook.pdf.

226. *Reimagining New York for a New Reality*, SUSTAINABLEBUSINESS.COM NEWS (Jan. 9, 2014), http://www.sustainablebusiness.com/index.cfm/go/news.display/id/25430.

227. *See* Press Release, Andrew M. Cuomo, *supra* note 224.

228. *See id.*

229. *See* CUOMO & MEGNA, *supra* note 225, at 36.

230. Press Release, N.Y. Power Authority, N.Y. Power Authority President & CEO Gil C. Quiniones Highlights New York State's Efforts to Strengthen Electric Power System in Speech at Power Security Conference in Washington, D.C. (Mar. 4, 2014), *available at* http://www.nypa.gov/Press/2014/030414a.html.

231. *See* CUOMO & MEGNA *supra* note 225, at 17, 36.

232. Press Release, Andrew M. Cuomo, Governor, N.Y., Governor Cuomo Announces $815 Million for Next Phase of Long Island Recovery from Superstorm Sandy (Oct. 24, 2013), *available at* http://www.governor.ny.gov/press/10242013-long-island-recovery.

invested in exploring microgrids, and their reports and efforts have been crucial in spurring the microgrid discussion that led to the NY Prize. Each will be described in turn.

Starting with the recently released Draft 2014 SEP, NYS's State Energy Planning Board (SEPB) recently showed significant support for microgrids as part of NYS's energy future. This Draft SEP consists of two volumes, one which addresses various aspects of current energy use and production in NYS and future projections thereof, and another volume which presents fifteen "actionable policy recommendations" "to advance the State's energy future."[233] Notably, two of these fifteen initiatives, initiatives six and seven, commit the New York State Department of Public Service (DPS), NYPA, and NYSERDA to specific microgrid planning efforts.[234] DPS has the largest share of the responsibility, as it is charged with addressing obstacles to microgrids; considering stand-by rates (rates charged by electric corporations to backup microgrids), interconnection, maximum plant sizes, etc., and also with refining microgrid policies.[235] NYPA, on the other hand, is to "evaluate supporting microgrids in strategic locations," and NYSERDA and NYPA are to "develop programs, and authority if needed, to encourage new financing and ownership models to facilitate community grid projects."[236]

Another important point is that the Draft 2014 SEP specifically defines microgrids. Volume Two defines a microgrid 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 can connect and disconnect from such grid to enable it to operate in both grid-connected or island mode."[237] As will be discussed later, this definition is the only definition of "microgrid" that appears in legislative materials in NYS, and although it is not included in any public service statute or

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233. *See* N.Y. STATE ENERGY PLANNING BOARD, 2014 DRAFT NEW YORK STATE ENERGY PLAN: SHAPING THE FUTURE OF ENERGY 41 (2014), *available at* http://energyplan.ny.gov/-/media/nysenergyplan/2014stateenergyplan-documents/2014-draft-nysep-vol1.pdf.

234. *See id.* at 40–41.

235. *See id.*

236. *See id.* at 41.

237. See *NEW YORK STATE ENERGY PLAN* 2014 DRAFT: SHAPING THE FUTURE OF ENERGY VOL. 2 END-USE ENERGY 138 (2014), *available at* http://energyplan.ny.gov/-/media/nysenergyplan/2014stateenergyplan-documents/2014-draft-nysep-vol2-enduse.pdf.

regulations, defining microgrids is a necessary step in microgrid regulation.[238]

A second state microgrid planning document that has emerged in NYS is the NYS 2100 Commission's "Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure," released in 2013.[239] The 2100 Commission, established by Governor Cuomo in response to Hurricane Sandy, is composed of national interdisciplinary experts whose purpose is to aid law and policymakers in addressing future storm resilience.[240] Although this entity does not share the same level of legal authority as the SEPB, given the quality of experts, the public acclaim from the Governor's Office, and the subsequent adoption of related programs like Reimagining New York for a New Reality, their recommendations seem to have been quite influential.[241]

Specifically with regard to microgrids, the 2100 Commission's report provides a recommendation that endorses accelerated modernization and increased flexibility of the state electric system. This recommendation extensively details the basics of microgrids and a number of their flexibility benefits, and generally encourages their implementation in NYS.[242] More importantly, however, the recommendations note a number of barriers that microgrids face. The Commission points to the need for regulatory and statutory clarity and reform (as current structures almost exclusively limit microgrids to campus type settings), and it encourages the State and PSC to consider financial incentives (rate based cost recovery), interconnection and cost allocation problems, and how to ensure responsible maintenance and upkeep of such systems.[243]

One other NYS governmental entity that has been working on microgrid issues is NYSERDA. In 2010, NYSERDA released a report entitled *Microgrids: An Assessment of the Value, Opportunities and Barriers to Deployment in New York State*. This report provides in-depth technical detail on microgrids, considers

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238. *See* 2013 N.Y. Laws 468.

239. *See generally* NYS 2100 COMM'N, RECOMMENDATIONS TO IMPROVE THE STRENGTH AND RESILIENCE OF THE EMPIRE STATE'S INFRASTRUCTURE (2013), *available at* http://www.governor.ny.gov/assets/documents/NYS2100.pdf.

240. *Id.* at 10.

241. Press Release, Andrew M. Cuomo, Governor, N.Y., NYS2100 Commission Releases Preliminary Report on Improving the Strength and Resilience of New York State Infrastructure (Jan. 11, 2013), *available at* http://www.governor.ny.gov/press/01112013NYS2100-Commission.

242. NYS 2100 COMM'N, *supra* note 239, at 95–101.

243. *Id.* at 98–99.

various ownership and physical models for microgrids, and assesses their legal aspects in NYS and even their value.[244] Additionally, NYSERDA has been working on a new microgrid study for public release in 2014. The new study is in response to a legislative mandate included in a lengthy 2013 state budgeting bill which directs NYSERDA to consider the value of microgrids to emergency service entities, the locational value of microgrids within the state, possible regulatory structures for microgrids, funding models, and more.[245] Notably within this legislation, the NYS Senate used the same definition of microgrid as is used in the Draft 2014 SEP described above.[246]

Some of the open policy questions facing microgrids may be on the fast track for resolution. The New York Public Service Commission (NYPSC or PSC) on April 25, 2014, issued an order instituting a Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision.[247] In this proceeding the NYPSC is reevaluating the current regulated utility paradigm to examine whether changes must be made to better accommodate distributed energy resources under current market conditions.[248] In regards to microgrids, an accompanying staff report noted that:

> Although microgrids are only one form of DER, they warrant separate discussion here because there are several regulatory issues unique to microgrids that must be addressed. Tariffs for utility backup service need to be analyzed for their application in a multi-customer or campus setting; standards for interconnection need a similar analysis. Also, regulatory uncertainties are created where one person within a microgrid sells power to another, where existing utility lines within the microgrid are used, and where the lines of a microgrid cross public rights-of-way. In order to facilitate the development of microgrids, the Commission must adopt a consistent policy toward them so developers can better understand the regulatory environment.[249]

According to the NYPSC order, regulatory reform in this area could begin in early 2015.[250]

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244. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at iii.
245. S. 2608-D, 2013 Reg. Sess., Part T (N.Y. 2013).
246. *See id.*
247. Reforming the Energy Vision, 2014 WL 1713082 (N.Y.P.S.C. April 25, 2014).
248. *Id.*
249. *Id.* at *25.
250. *Id.* at *4.

An entity working alongside many of the aforementioned groups is the NYS Smart Grid Consortium (NYSSGC). The NYSSGC is a highly visible non-profit public-private partnership made up of state government entities such as the NYPSC, NYSERDA, and NYPA; utilities such as Con Edison and National Grid; educational institutions such as NYU, and the City University of New York; businesses such as GE and IBM; and, most importantly, the City of New York.[251] NYSSGC's microgrid efforts thus far have included presentations, webinars, and conferences addressing microgrid roadmaps and education for key authorities,[252] organizing studies on successful microgrids,[253] pooling resources for the public and its members,[254] and being active in the media.[255] Additionally, NYSSGC is action-oriented, and "is working with its utility members to establish microgrid projects both in New York City and in upstate New York."[256]

The aforementioned entities and projects are of course only a sampling of the major groups involved in microgrid discussions in NYC and NYS. Other relevant entities discussing and encouraging microgrid adoption include media outlets such as GreenTechMedia and EnergyBiz which have multiple influential articles on NY microgrid issues.[257] Regardless, it is clear that there is substantial

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251. *Members - NYS Smart Grid Consortium*, NYS SMARTGRID CONSORTIUM, http://nyssmartgrid.com/about-us/members (last visited Dec. 1, 2014).

252. *See* Microgrid Webinar, *supra* note 172; *Workshop on Microgrid Technology & Applications*, N.Y. ST. CENTER FOR FUTURE ENERGY SYS., http://www.rpi.edu/cfes/Workshop%20on%20Microgrid/index.html; *Next Generation Microgrids,* NYS SMARTGRID CONSORTIUM (2014), http://nyssmartgrid.com/ai1ec_event/next-generation-microgrids/?instance_id=.

253. *See* N.Y. STATE SMART GRID CONSORTIUM, 2014 MICROGRID INVENTORY 1–2 (2014), *available at* http://nyssmartgrid.com/wp-content/uploads/NYSSGC-RFP-Microgrid-Project-Inventory-1-6-14.pdf.

254. *See Microgrid - NYS SmartGrid Consortium*, NYS SMARTGRID CONSORTIUM, http://nyssmartgrid.com/microgrid/ (last visited Dec. 1, 2014).

255. *See New York State Smart Grid Consortium Applauds Gov. Cuomo's Vision for Community-Based Energy Solutions*, NYS SMARTGRID CONSORTIUM, (Jan. 8, 2014), http://nyssmartgrid.com/wp-content/uploads/NYS-Smart-Grid_State-of-the-State-Response_FINAL_010814.pdf.

256. Pyper, *supra* note 183.

257. *See, e.g.*, Jeff St. John, *New York Plans $40M in Prizes for Storm-Resilient Microgrids*, GREENTECH MEDIA (Jan. 9, 2014), http://www.greentechmedia.com/articles/read/new-york-plans-40m-in-prizes-for-storm-resilient-microgrids; Bobby Magill, *Microgrids: A New Kind of Power Struggle in New York and Connecticut*, GREENTECH MEDIA (Sept. 16, 2013), http://www.greentechmedia.com/articles/read/microgrids-a-new-kind-of-power-struggle; Jeff St. John, *Utilities at the Crossroads of the Grid Edge*, GREENTECH MEDIA (Nov. 13, 2013), http://www.greentechmedia.com/articles/read/utilities-at-the-crossroads-of-the-grid-edge; Darrell Delamaide*, Dawn of Micrgrogrids*, ENERGYBIZ MAG. (Sept./Oct. 2013), http://www.energybiz.com/

NYS government, academic, and non-profit focus on microgrid development, which is obviously crucial for NYC given its particular vulnerability to future storms and reliance on NYS law and policy for a number of microgrid issues.

c. NYC Microgrid Efforts

By far, the most important microgrid initiative in NYC has been former-Mayor Michael Bloomberg's Special Initiative for Rebuilding and Resiliency (SIRR) and the resulting 2013 PlaNYC report entitled *A Stronger, More Resilient New York* (PlaNYC). SIRR, a working group composed of more than thirty professionals and led by Seth Pinsky, President of the New York City Economic Corporation, was established by the Mayor's Office in December 2012 to address future storm resiliency planning in the wake of Hurricane Sandy.[258] The resulting PlaNYC report, released on June 11, 2013, details 250 initiatives, worth nearly $20 billion, and covers eleven different citywide sectors and five community plans focused on specific areas.[259]

With regard to microgrid planning, PlaNYC "called for public and private partners to scale up distributed generation systems and microgrids" in NYC.[260] This calling was the twenty-first of twenty-three initiatives suggested for increasing utility resiliency in NYC.[261] It first sets out four substantive actions to encourage distributed generation development, sticking to a previous PlaNYC goal of 800 MW of installed capacity by 2030, and then sets out four separate actions to encourage microgrid adoption.[262] These initiatives are to be implemented by key public and private entities.[263]

Focusing on the four microgrid actions, the first and perhaps most important action "call[s] on the PSC to clarify the rules governing the export of energy to multiple property owners and across roadways, so as to reduce uncertainty for private investors."[264] As will be described

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magazine/article/325109/dawn-microgrids; Terry Mohn, *Growing the Microgrid Market: Smart Grid Killer App*, ENERGYBIZ MAG., Sept./Oct. 2013, at 14, http://www.energybiz.com/magazine/article/296727/growing-microgrid-market.

258. *Seth Pinsky Biography*, AM. SOC'Y ENGINEERING EDUC., http://www.asee.org/conferences-and-events/conferences/edi/2013/program-schedule/Seth_Pinsky_bio.pdf (last visited Dec. 1, 2014).

259. *See* PLANYC, *supra* note 166, at "Table of Contents," "Foreword," 6.

260. Pyper, *supra* note 183.

261. *See* PLANYC, *supra* note 166, at 129.

262. *See id.*

263. *See id.*

264. *Id.*

below, exactly how microgrids will be regulated under public service law in New York is debatable and may vary based upon technical specifications of individual microgrid projects as well as regulatory interpretation. Accordingly, this action recognizes an important and necessary step to furthering microgrid implementation in the state.

PlaNYC's second, third, and fourth microgrid actions are to, respectively, (1) have the City "evaluate the potential for a micro-grid pilot in clusters of City-owned buildings," (2) work with DOE, NYSSGC, DG Collaborative, and NYSERDA to consider microgrid feasibility in Queens and the rest of the city, and (3) work with NYSERDA on technical and economic implications of increased microgrid penetration.[265] Furthermore, lack of other results directly from these actions does not mean that substantive microgrid projects are not going on NYC. In fact, NYPA has been working with Riker's Island prison since 2011 to install a 15 MW CHP microgrid, and this effort is projected to come online in fall 2014.[266]

The last of SIRR's recommendations for microgrids is that "utilities should incorporate micro-grid expansion into their planning."[267] For NYC's main utility, Con Edison, this recommendation has very much come to fruition. On February 21, 2014, the NYPSC issued a final order in a Con Edison rate case, which not only "approved . . . [a] four-year, $1 billion plan to strengthen its electric, gas and steam systems,"[268] but explicitly required Con Edison to "develop an implementation plan for a microgrid pilot project," and "develop 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."[269] Con Edison was given six months from the time that NYSERDA's microgrid study was completed to produce their implementation plan.[270] Both the required cost-benefit models as

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265. See *id.*

266. RIKERS ISLAND COGENERATION PLANT, N.Y.C. DEP'T OF CORR., FULL ENVIRONMENTAL ASSESSMENT FORM WITH SUPPLEMENTAL STUDIES (2011), *available at* http://www.nyc.gov/html/doc/downloads/misc/SEQRA_Environmental_Assessment_Form_Documents.pdf; Press Release, N.Y. Power Authority, *supra* note 230.

267. *See* PLANYC, *supra* note 166, at 129.

268. *See* RIKERS ISLAND COGENERATION PLANT, *supra* note 266, at A-2; Press Release, N.Y. Power Authority, *supra* note 230.

269. Proceeding on Motion of the Commission as to the Rates, Changes, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service (N.Y. 2014), 2014 WL 794789, at 3–4, 29.

270. *See id.* at 98.

well as the implementation plans should be important in understanding microgrid feasibility.

It should be noted that this PSC order is largely based on a joint proposal agreed upon by twelve of twenty parties involved in the rate case, including Con Edison, NYPA, Pace, and NYC, all of which have been involved in microgrid discussions.[271] NYC is particularly noted as having been active in presenting "scientific and engineering testimony on climate change and resiliency."[272] One other note is that the PSC not only applied this order to Con Edison, but "explicitly broadened the sweep of its order to address resiliency measures for all utilities in New York State."[273]

On a related note, while it is unclear whether there is a direct relationship, NYS recently granted Con Edison, NYU, and Smarter Grid Solutions $663,000 to study microgrid development in the New York metro area in February 2014.[274] The funding, announced by the Governor's Office, appears to be tied to the Reimagining New York for a New Reality Plan.[275]

Per the discussion above, NYC is clearly being considered for microgrid development, and for good reason. For such efforts to be successful however, it is important to understand how current statutory and regulatory requirements might aid, or more likely, hinder, microgrid implementation.

4. State Public Service Regulation

Perhaps the most substantial concern that arises in New York microgrid development is that microgrids are not defined under state public service law (PSL or NY PSL). PSL and implementing regulations provide the traditional legal framework for regulating electric and steam distribution utilities (known as electric and steam corporations in PSL) in NYS.[276] Neither a review of NY PSL nor of

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271. *See id.* at 5.

272. Christine A. Fazio & Ethan I. Strell, *New York State Leading on Utility Climate Change Adaptation*, N.Y. L.J., Feb 27, 2014, at 2 *available at* http://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/Fellows/2-27-14_nylj_-_new_york_state_leading_on_utility_climate_change_adaptation._clm_copy.pdf.

273. *Id.* at 1.

274. Press Release, Andrew M. Cuomo, Governor, N.Y., Governor Cuomo Announces Funding for Smart Grid Projects to Reimagine New York's Electric Grid for a New Reality (Feb. 3, 2014), *available at* http://www.governor.ny.gov/press/02032014-smart-grid-projects.

275. *Id.*

276. N.Y. PUB. SERV. LAW § 2 (McKinney 2013).

Department of Public Service regulations[277] reveal any mention of microgrids specifically. Many entities exploring microgrids in the city and state described above have reached the same conclusion.[278] This is particularly problematic because without explicit determination of what a microgrid is and what types of law apply, microgrid financiers and developers face a sizeable amount of uncertainty that may deter project development.

Given this lack of definitional clarity, the regulatory model applicable to microgrids turns on whether a microgrid can properly be classified as an electric corporation (or a steam corporation in the case of CHP microgrids) under section 2 of the NY PSL.[279] These definitions (electric and steam corporations) determine whether the PSC has various supervisory powers, such as those under NY PSL sections 65, 66, 68, and 69, (and NY PSL sections 79, 80, 81, and 82 for steam services), which will be discussed subsequently, or whether microgrids are free from such restraints. Under Section 2(13), an electric corporation is generally an entity "owning, operating or managing any electric plant,"[280] which includes not only the physical generation, but also all of the transmission, distribution, conduits, etc., tangential to the generation.[281] The definition provided for steam corporations is very similar.[282] Under these broad definitions, a microgrid very much seems to be an electric corporation as it necessarily entails generation and distribution. A 2010 NYSERDA study reached the same conclusion.[283]

There are, however, two exceptions provided under these definitions: one for privately produced and used electricity/steam, and one for specific types of generation.[284] Addressing the first exception, if the electricity or steam is generated and transmitted solely on private property and is not sold to anyone other than owners or tenants, then a facility is not treated as an electric or steam corporation.[285] This exception would therefore apply to private campuses and residential complexes that are not subdivided by public roads, and only provide service to themselves. This exception,

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277. *See generally* N.Y. COMP. CODES R & REG. tit. 16 (2013).
278. *See, e.g.*, Magill, *supra* note 44.
279. *See* N.Y. PUB. SERV. LAW § 2.
280. *Id.* § 2(13).
281. *Id.* § 2(12).
282. *See id.* §§ 2(21)–(22).
283. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 39.
284. N.Y. PUB. SERV. LAW § 2(13) (McKinney 2013).
285. *Id.* § 2(13), (22).

however, clearly does not apply to NYU's microgrid. Even though the NYU microgrid only supplies NYU's facilities, NYU's property is interspersed among non-university property and the microgrid must traverse public roads (thus is not solely on private property).[286]

However, NYU's microgrid would likely fall into the second exception for electricity or steam produced "solely from one or more co-generation, small hydro or alternate energy production facilities or distributed solely from one or more of such facilities to users located at or near a project site."[287] This section limits cogeneration, small hydro, and alternate energy to a maximum capacity of 80 MW, and defines alternative energy to include solar, wind, fuel cells, batteries, and stored energy systems, and other similar technologies.[288] Important aspects of this exemption are that it contemplates distribution to multiple users—not just a single private entity, would allow an otherwise regulated utility to own/operate such facility without regulation,[289] and does not preclude distribution across public property. However, as noted above, there is a requirement that distribution occurs "at or near a project site."[290] Unfortunately this phrase is also not defined in statute or regulation, but it is known that distribution around a 1000 acre campus has been held "at or near a project site," whereas a 3500 acre distribution area has been held to not be.[291] Additionally, the determination itself seems to be not only related to size, but is also based on particularized fact-finding and analysis in a given situation.[292]

Given these two exemptions, microgrids may or may not fall within PSC purview depending upon their generating capacity, whether they cross property lines, the type of generation used, the number of distinct customers served, and the scope of the distribution.[293] The next question is how this status impacts the oversight and regulatory requirements imposed on a microgrid. The remainder of this subsection will accordingly describe key aspects of PSL, and how it might apply to non-exempt microgrids, and will be relevant in

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286. *Washington Square Campus Map*, N.Y. UNIV. (May 20, 2014), *available at* http://www.nyu.edu/campusmedia/data/pdfs/NYU%20Campus%20Map.pdf.

287. N.Y. PUB. SERV. LAW § 2(13), (22).

288. *Id.* § 2(2-a) to (2-c).

289. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 51.

290. *See* N.Y. PUB. SERV. LAW § 2(2-d); *see also* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 51.

291. *See* Order Making Findings on Regulation of Generation Facility and Approving Financing, N.Y. Pub. Serv. Comm'n, Case 09-M-0776 (Feb. 17, 2010).

292. *See generally id.*

293. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at S-10.

considering some of the more specific law and policy questions raised below.

If a microgrid, or any other entity, can properly be defined as an electric or steam corporation under section 2 of the NY PSL, this triggers a number of PSC and New York State Board on Electric Generation Siting and the Environment (Board) regulatory powers over the corporation.[294] These powers are fairly typical of state utility regulation, and the most important powers can generally be distilled into seven categories: general supervision; rates; quality of service; billing; administration and public reports; corporate finance and corporate structure; incorporation, franchise and certification; and residential service.[295]

For instance, section 65 of the NY PSL requires that electric corporations provide safe power, at just and reasonable rates and without undue discrimination, and also provide call centers, prepare emergency response plans, and comply with other regulatory requirements.[296] Section 66 of the NY PSL then gives the PSC oversight and approval powers over rates and expenditures, account and record keeping practices, emergency response plans, annual reporting, and investigatory and hearing authority of many aspects of electric corporation administration and operation.[297] Sections 79 and 80 largely mirror these provisions as they relate to steam corporations.[298] Section 68 of the NY PSL importantly goes on to give the PSC the authority to approve or deny Certificates of Public Convenience and Necessity (CPCN), which are required for construction and operation of electric plants and facilities that cross public rights-of-way (allowable per municipally delegated franchise rights described below).[299] The corporation's application is adjudged based upon the entity's ability to finance improvements, render safe, adequate and reliable service, charge just and reasonable rates, and whether the project is otherwise in the public interest.[300]

An electric corporation also triggers additional siting requirements under section 162 of the NY PSL (and various subsequent sections), including the need for a Certificate of Environmental Compatibility and Public Need from the Board if the system is over 25 MW in

294. *See id.* at 40–42.
295. *Id.* at 40–41.
296. *See* N.Y. PUB. SERV. LAW § 65 (McKinney 2013).
297. *See id.* § 66 .
298. *See generally id.* §§ 79, 80.
299. *See id.* § 68.
300. *Id.*

capacity (or 200 MW if the system is for industrial use and located on premises).[301] Other important powers and requirements come under NY PSL sections 69, 69-A, and 70, which give PSC oversight over debt, mergers, corporate organization and reorganization, and the right to transfer or lease franchise rights (NY PSL sections 82, 82-A, and 83 provide similar powers and requirements regarding steam corporations).[302]

The above statutory impositions are by no means a comprehensive listing, and the regulations promulgated by the DPS only get more technical and burdensome as they apply these and other requirements. However, these conditions are enough to provide context and show why NYSERDA reported that "[m]any potential projects would be unable to bear the administrative burden attendant of full regulatory treatment as a distribution utility under State law."[303]

5. NYC Municipal Authority—Public Property and Utility Service Territory Franchise Rights

NYS statutes do not reserve all authority over transmission and distribution for the state, and they generally allow local legislators and regulators to control public property in their jurisdiction. Particularly, section 20(10) of the NY General City Law provides cities with the power to "grant franchises or rights to use the streets, waters, water front, public ways and public places of the city."[304] This power is also the mechanism by which service territories are allocated among major utilities in the state.[305] The only clear exception is that major utility transmission facilities are removed from municipal jurisdiction and appear to come under the jurisdiction of the Board.[306] This exception generally should not apply to microgrids in NYC because major utility transmission facilities are large in scope (either greater than 125 kV capacity and more than one mile long, or between 100 kV and 125 kV and over ten miles), and do not include

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301. *See id.* § 162.

302. See generally *id.* §§ 69, 69-A, 70, 82, 82-A, 83.

303. N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 31; *see also* Magill, *supra* note 44. "If running a wire across a street subjects the developer to the same regulations Con Edison is required to comply with, the costs could be too high to secure financing." Bobby Magill, *Microgrids in NYC & Conn.—A New Kind of Struggle*, CLIMATE CENT. (Sept. 10, 2013), http://www.climatecentral.org/news/microgrids-in-nyc-connecticut-a-new-kind-of-power-struggle-16451.

304. N.Y. GEN. CITY LAW § 20(10) (Consol. 2014).

305. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 23.

306. *See* N.Y. PUB. SERV. LAW § 130 (McKinney 2013).

transmission that is wholly underground and in cities as large as NYC.[307] Accordingly, microgrids that need to cross public property will generally require NYC consent.

The New York City Charter provides the rules by which franchises can be granted in NYC. Under the Charter, a franchise grant requires a resolution of the City Council, and generally an appointed agency solicits public utilities to providing a necessary service.[308] This would be the method by which major electric, gas, water, and steam utilities obtain permission. However, the Charter also provides a more limited ability to use city property that merely requires agency authorization.[309] The Rules of the City of New York give the NYC Department of Transportation (NYCDOT) the authority, with approval of the Mayor,[310] to grant revocable consents for the grantee to make "improvements . . . on, over, or under City streets," including underground conduits and cables.[311] As described above, this is how NYU gained its authority to use underground conduits below City streets, and the 2010 NYSERDA microgrid study found that microgrids will generally be able to use this simpler method.[312] As will be discussed below, however, private microgrids that infringe on incumbent electric distribution utility financial interests are likely to face significant and potentially fatal opposition.

6. Remaining Law and Policy Issues

Having described the basic, albeit unclear, legal framework applicable to microgrid development, this last section on NYC microgrids will focus on important remaining law and policy questions in NYC. Important topics that this study considers include microgrid management and liability, utility franchise and business model concerns, privacy concerns, and several other requirements that might be imposed upon microgrids. Following from the previous legal overview, microgrids can fall within or outside of PSC jurisdiction based upon the type of generation used, how far power is distributed, and all of the other considerations noted above. Accordingly, most of the following issues are assessed from both regulated and unregulated perspectives.

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307. *See id.* at § 120.
308. *See* N.Y.C. CHARTER § 363 (2013).
309. *See generally id.* § 364.
310. *See id.* § 372.
311. 34 R.C.N.Y. § 7-04(a) (2013).
312. *See* N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 39.

A first important issue that any microgrid developer, owner, or interconnected party needs to be clear about is who is responsible for managing the microgrid, ensuring quality of service, and assuming liability in the event of system failure, malfunction, or other damaging event. These are all critical issues relating to the financial and operational success and benefits of any microgrid project to the relevant parties. They are also, however, legally unexplored topics, left uncertain by lack of statutory and regulatory specificity, leaving microgrid proponents unable to value the extent of these concerns from a regulatory perspective.

From a PSL perspective, these issues have been important since the inception of utility regulation and are therefore exhaustively covered by statute, regulation, and administrative rulings. Starting with management and quality, it is no surprise that electric corporations must comply with specific quality standards under PSL. As noted previously, section 65 of the NY PSL provides that every electric corporation must provide "safe and adequate" service (as do requirements under section 68 of the NY PSL for issuing and revoking a CPCN), which in itself implies an obligation to keep the system in working order.[313] This section goes further to specifically empower the PSC to undertake management and operations audits and impose "more stringent terms and conditions . . . as are necessary to ensure safe and adequate service . . . ."[314] Section 66 of the NY PSL bolsters this authority by giving the PSC general supervisory powers, the ability to "prescribe the safe, efficient and adequate property, equipment and appliances . . . to be used, maintained and operated," and power to "prescribe from time to time the efficiency of the electric supply system, [and] the current supplied . . . ."[315] Section 71 of the NY PSL also addresses this topic, allowing the PSC to investigate complaints regarding efficiency, voltage, and system outages.[316]

As for liability, this is not so directly defined in the relevant statutes. However, various court rulings shed light on how PSL regulation deals with this. As noted in *Lauer v. New York Telephone Co.*, "liability and rate making are inextricably intertwined, . . . once the tariff is accepted by the PSC, it 'takes on the force and effect of law and governs every aspect of the utility's rates and practices; neither party can depart from the measure of compensation or

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313. *See* N.Y. PUB. SERV. LAW §§ 65, 68 (McKinney 2013).
314. *Id.* § 65.
315. *Id.* § 66.
316. *Id.* § 71.

standard of liability contained therein.'"[317] Essentially, this case held that PSC rate orders can limit electric corporations' liability. However, it also noted that this authority conceptually rests on treating PSC rate orders as contracts between customers and the utility. Therefore, an order must specifically preclude actions against the utility, as would be required in any other contract.[318] Not all forms of liability can be waived, even if done so specifically. DPS regulations explicitly prohibit tariff limitations on liability for gross negligence or willful misconduct of employees, damages from negligence regarding a customer's property, or negligence regarding electric supply and related facilities.[319] Accounting regulations also contemplate utility liability for injuries and damages not covered by insurance.[320] Regardless, damages from interruption of service caused by ordinary negligence can be limited by tariff,[321] which is undoubtedly of substantial benefit to regulated utilities.

Outside of the PSL regulatory model, parties to a microgrid system generally should be able to draft contracts and limit liability in way that they can agree to. As noted above, limitation on utility liability is premised on contractual limitation of liability. Generally contract law allows parties to absolve their own negligence via contract, with the caveat again that liability cannot be limited for intentional wrongdoing, willful or gross negligence, or reckless indifference.[322] There may also be limitations per contract law where there is great disparity in bargaining power, where important state interests are compromised, and courts often otherwise minimize restrictions of liability by using strict construction of the clauses as restrictions are not judicially favored.[323] Additionally, New York statutes and regulations invalidate limitations on liability in certain situations such as landlord negligence in operation and maintenance of demised premises, certain real property owner and contractor negligence, and maintenance contractor negligence, among others.[324] Accordingly, if

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317. Lauer v. N.Y. Tel. Co., 231 A.D.2d 126, 129 (N.Y. App. Div. 1997) (citing Lee v. Consol. Edison Co. of N.Y., 98 Misc. 2d 304, 305–06 (N.Y. App. Term 1978)).

318. *See id.* at 129 (citing Krasner v. N.Y. State Elec. & Gas Corp., 90 A.D.2d 921, 921–22 (N.Y. App. Div. 1982)).

319. *See* 16 N.Y. COMP. CODES R & REG. tit. 16, § 218.1 (2014).

320. *See id.*

321. LoVico v. Consol. Edison Co., 420 N.Y.S.2d 825, 825–26 (N.Y. App. Term 1979).

322. 79 N.Y. JUR. 2D *Negligence* § 6 (2014).

323. *See id.* § 7.

324. *See id.* § 8.

a microgrid were to fall into one of these situations, contractual limitations on liability may not apply.

Several interrelated concerns exist in NYC regarding the implications of microgrids for traditional utility franchise rights and their ability to earn income. Specifically, entities have worried that microgrids will take customers away from the traditional utility,[325] and that "those least able to afford it will be left behind to bear the costs of maintaining the system."[326] Accordingly, it is important to understand what financial threats microgrids actually pose to the traditional utility model, and what threat an incumbent utility might pose to microgrid implementation.

First of all, it is quite clear that under the NYU and Co-op City CHP microgrid models, Con Edison electric sales are lower because the customer is generating their own electricity rather than purchasing it. Con Edison therefore seemingly loses revenue flows when microgrids operate as primary, as opposed to backup, generation.

However, as described above, 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.

However, as more customers turn to distributed generation, and sales to these customers are reduced, the problems noted above may arise, namely that the utility loses revenue and that customers who remain on the system could be allocated larger portions of fixed utility costs if cost allocation and rate design issues are not monitored closely. To some extent this challenge already exists today; influential figures in NYC energy policy have called for backup power rates that are "fair and equitable to microgrid customers . . . reflect[ing] the benefits microgrids can offer by reducing demand on congested grid systems, like in New York City where there's an energy crunch during peak hours."[327] While utilities already have a statutory obligation to provide backup services to alternate energy, small hydro, and CHP facilities at "just and reasonable rates,"[328] the argument is that benefits of microgrids to the grid/utility justify decreased revenue,

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325. Pyper, *supra* note 183.
326. Press Release, N.Y. Power Authority, *supra* note 230.
327. *See* Pyper, *supra* note 183.
328. *See* N.Y. PUB. SERV. LAW § 66 (McKinney 2013).

and that attempting to charge microgrid users for standby power in a way that allows full recuperation of value lost from regular sales is excessive.[329] Under either view, at a certain point the benefits to the utility may not justify the reduction in revenues, and other customers will likely be harmed if rates for back up service are not designed appropriately.[330]

In looking at a variety of state regulatory frameworks, NYSERDA's 2010 microgrid research concluded that "[f]ranchise violations when selling electricity to customers within a utility's existing service territory, and when running wires across public right-of-ways, were . . . primary barriers" to microgrids.[331] In states such as Maryland, Illinois, and Minnesota, at least in 2010, franchise territory rights are often either exclusive, or the regulatory regime is limiting of new entrants, by specifically defining those who can bypass franchise rights, or by placing significant burdens of proof on new entrants.[332]

NYS however is less stringent on defending service territories, although it still leaves significant room for an incumbent utility to combat threatening microgrids. First of all, according to a number of court cases extending back into the 1800s, New York has firmly held that unless a municipality explicitly grants an exclusive franchise, the franchise is not exclusive and the municipality can allow another entity to provide service in that territory.[333] This doctrine was most recently applied to allow New York City, in its capacity as a municipal water utility, to supply water to a housing developer otherwise within the service territory of Jamaica Water Supply Co. This was allowed because Jamaica's franchise grant was not found to be explicitly exclusive.[334] At the same time, however, the revocable grant that a microgrid would need to obtain in NYC is subject to approval of the NYCDOT and the Mayor, and requires a public hearing,[335] under

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329. *See* Pyper, *supra* note 183.

330. N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 46. "A microgrid that was either never connected or disconnects from the utility distribution system, may be able to avoid [standby] charges . . . ." *Id.*

331. *Id.* at 66.

332. *Id.*

333. *See, e.g.*, *In re* City of Brooklyn, 143 N.Y. 596, 609–10 (1894) ("A charter, secured by compliance with its terms, does not grant to the company an exclusive privilege or franchise to supply water to the town, or village; nor preclude the grant of another charter for a similar franchise. The grantee of the charter takes nothing by implication and the state is not further bound, nor restricted, than can be read in the act.").

334. *See* Jamaica Water Supply Co. v. City of New York, 236 N.Y.S.2d 816, 818 (1962).

335. *See* 34 R.C.N.Y. § 7-09(c) (2013); N.Y.C. CHARTER § 371 (2013).

which the application can be challenged by any "[o]ther private part[y] that already occup[ies] space in the street . . . ."[336] In the case of NYU, Con Edison did not object to their application, but if private microgrids became problematic from the utility's perspective, it could undoubtedly have attempted to block an application by arguing that it "interfere[s] with use of inalienable property of the city for public purposes,"[337] or by petitioning the Mayor.[338] Accordingly, even if an incumbent utility does not have an exclusive franchise with which to estop microgrid development, "the mere threat of tying up a potentially small enterprise such as a microgrid, in litigation over franchise rights[,] could stop a project."[339]

Privacy concerns regularly arise in the electronic industry, and with regular customer apprehension being voiced around smart grids,[340] privacy on microgrids deserves discussion. Under the PSL regulatory model, there are very few statutory privacy mechanisms that apply to electric corporations in terms of protecting customers. The only statutory provision is section 65(7) of the NY PSL, mandating that no "electric corporation shall sell or offer for sale any list of names of its customers."[341] The only other somewhat related provision is that a utility cannot share any proprietary information of its customers with a subsidiary of the utility.[342] There are also statutory privacy mechanisms that protect confidential information of the utility from disclosure by the PSC and DPS.[343]

As a result of the limited statutory requirements, the PSC appears to have broad latitude in how it regulates utilities and utility programs that use customer information. Due to the leniency of section 65(7) of the NY PSL, the PSC has allowed utilities in certain circumstances to divulge customer information when not for the purpose of a sale.[344] The PSC, however, does take privacy very seriously and has held that "[p]rotection of consumer information is a basic tenet of the Public

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336. N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at A-37.

337. N.Y.C. CHARTER § 364.

338. *See id.* at § 372.

339. N.Y. STATE ENERGY RES. & DEV. AUTH., *supra* note 184, at 23.

340. *See generally The Smart Grid and Privacy*, ELECTRONIC PRIVACY INFO. CENTER, http://epic.org/privacy/smartgrid/smartgrid.html (last visited Dec. 1, 2014).

341. N.Y. PUB. SERV. LAW § 65(7) (McKinney 2013).

342. See *id.* § 66-c(4)(b)(2).

343. *See, e.g.*, *id.* § 15.

344. Order on Rehearing Granting Petition for Rehearing, N.Y. Pub. Serv. Comm'n, Case 07-M-0548, 18 (Nov. 18 2010) ("[T]ransferring customer data to OPower solely to administer and analyze the behavioral modification program is not a prohibited sale of customer information under Public Service Law § 65(7).").

Service Law and our policies."[345] In situations where electric utilities (and other telecommunication and other utilities) have sought to use customer data, including names, account numbers, usage history, and similar personal information, the PSC has balanced privacy and usefulness. Particularly, the PSC has considered factors such as customers' reasonable expectations of privacy; the importance of public perception and relationship with the utilit; and, at the same time, the importance of utility goals with respect to such information and cost effectiveness, efficiency, and value to ratepayer.[346] Accordingly, the PSC has allowed utilities to transmit personal customer information to third parties where the purpose of the transmission was a permissible and possibly important utility function, the disclosure was necessary to such function, and there are sufficient privacy safeguards imposed by the PSC.[347]

An issue remains as to whether microgrid users would be treated as customers, or as part of the electrical corporation under the regulatory model. This is important because protection for a customer from its utility is quite different than protection for a utility from the regulator. One important factor here is whether the end users jointly own the microgrid or whether a single regulated entity owns the microgrid. If a microgrid were regulated as an electric corporation, it would have various reporting requirements to the PSC, for example under section 5(1)(h) of the NY PSL.[348] In some cases, courts have held that the PSC does not have the authority to require filed reports to be deemed confidential and withheld from the public.[349] At the same time, Personal Privacy Protection Law in NYS does emplace fairly strict requirements on state entities with regard to how they can disclose personal, identifying information of natural persons, so individuals may have greater legal privacy protection in this context.[350]

If a given microgrid does not fall within the definition of electric corporation and thus the ambit of PSL, the situation is presumably a contractual matter for the customers and the microgrid operators to determine. Like with privacy statements that come along with user agreements for a host of products and services that we use today, users can presumably either accept, reject, or haggle regarding the

345. *Id.* at 17.
346. *Id.* at 18–19.
347. *Id.* at 18.
348. N.Y. PUB. SERV. LAW § 5(1)(h) (McKinney 2013).
349. *See, e.g.*, Zuppa v. Maltbie, 76 N.Y.S.2d 577, 780–81 (N.Y. Sup. Ct. 1947).
350. *See* N.Y. PUB. OFF. LAW § 96-a (McKinney 2010).

terms and conditions of their contractual relationship, of which privacy is a part.

C. Connecticut's Microgrid Pilot Project

Some states are pursuing microgrid-based responsive infrastructure to modernize their grid and improve electric reliability. For example, Connecticut's state legislature, energy administrator,[351] and regulatory authority[352] are pursuing grid modernization efforts. The Connecticut General Assembly passed a statute authorizing financial grants for community-based microgrid pilot projects, subject to legislatively defined parameters.[353] The state grants fund microgrids that connect a municipality's "critical facilities," to create a back-up power source in the event of a citywide power outage. City, state, and federal entities were allowed to connect facilities that crossed public rights of way.[354] The City of Hartford, a grant recipient, is creating a network to "power a school, a senior center, a library, a gas station, and a supermarket in the event of a blackout."[355] This self-sufficient mini-grid is connected to the centralized power grid, but has the ability to disconnect and operate independently for four weeks.[356]

In response to the infrastructure damage and power outages caused by Hurricane Irene and Hurricane Sandy, the Connecticut General Assembly passed a comprehensive statute that requires utilities to establish resilience standards.[357] Resilience is determined by measuring both the functionality of the system during an event that could disrupt service and the ability of the system to recover if service is interrupted.[358] The statute requires utilities and municipalities to

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351. Connecticut Department of Energy and Environmental Protection (DEEP).

352. Connecticut Public Utilities Regulatory Authority (PURA).

353. *See* CONN. GEN. STAT. ANN. § 16-243y (West 2013).

354. *See id.*

355. Press Release, Pedro E. Segarra, Mayor, City of Hartford, Mayor Segarra Joins White House Official Nancy Sutley, Governor Malloy, Senator Blumenthal at White House Climate Change Event in Hartford (Aug. 13, 2013), *available at* http://www.hartford.gov/pressroom/989-wednesday-mayor-segarra-joins-white-house-official-nancy-sutley-governor-malloy-senator-blumenthal-at-white-house-climate-change-event-in-hartford.

356. CONN. DEP'T ENERGY & ENVTL. PROT., REQUEST FOR PROPOSALS: MICROGRID GRANT AND LOAN PILOT PROGRAM, NOTICE OF AVAILABLE FUNDS 2 (2013).

357. *See* CONN. GEN. STAT. ANN. § 16-32h (West 2014).

358. *See* THERESE MCALLISTER, NAT'L INST. OF STANDARDS AND TECH., U.S. DEP'T OF COMMERCE, DEVELOPING GUIDELINES AND STANDARDS FOR DISASTER RESILIENCE OF THE BUILT ENVIRONMENT: A RESEARCH NEEDS ASSESSMENT 16, 18

evaluate their performance in past emergencies and identify areas for institutional improvement.[359] In addition to this evaluative approach, the state legislature acted proactively by authorizing funds for localized infrastructure upgrades.[360] These statutes lay the foundation for Connecticut's response to the damaging impact of extreme weather events: system hardening.[361]

The heart of the legislation lies in the microgrid pilot program.[362] "Sandy-shaken Connecticut is the first state in the country to roll out a statewide microgrid program aiming to maintain power for some businesses and public services when a storm roars through the state, or a blackout disrupts the power grid."[363] When adequately financed, microgrids have the ability to spur grid modernization, which promises demand-side management and increased reliability.[364] Additionally, they serve as installed infrastructure insurance.[365]

States have been hesitant to implement aggressive grid updates, as doing so changes the way the grid is operated and is capital intensive.[366] Once installed, microgrids change the way power flows. Difficulty arises when operators have to change the balance of supply and demand to accommodate new sources of generation. Additionally, the required upfront investment is substantial. Connecticut officials anticipate paying a premium for the microgrid systems, but they justify the substantial cost as an investment in

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(2013) (describing the impact of codes and standards on the performance of infrastructure).

359. CONN. GEN. STAT. ANN. § 16-32h(b).

360. CONN. GEN. STAT. ANN. § 16-243y (West 2013).

361. CONN. GEN. STAT. ANN. § 16-32h.

362. H.R. Conn. Gen. Assemb., Transcript, at 315 (May 9, 2012) ("After weathering a state emergency, the Governor's office, the House and the Senate . . . realized that the reliability of our system needed help. We rolled up our sleeves, put our party status aside, and we came up with a solution.").

363. *See* Magill, *supra* note 44.

364. *See* FEREIDOON P. SIOSHANSI, SMART GRID: INTEGRATING RENEWABLE, DISTRIBUTED, & EFFICIENT ENERGY 22–23 (2012).

365. Julija Vasiljevsea et al., *Evaluating the Interest in Installing Microgrid Solutions*, ELECTRICITY J., Oct. 2012, at 61–62 (2012) ("[M]icrogrid solutions can be viewed as hedging tools for the DSO [distribution system operators].").

366. *See* Martin Rosenberg, *Here Comes Microgrids! Connecticut Leads the Way*, ENERGYBIZ (Sept. 29, 2013), http://www.energybiz.com/article/13/09/here-come-microgrids; Ralph Masiello & S.S. (Mani) Venkata, Editorial, *Microgrids: There May Be One in Your Future*, IEEE POWER & ENERGY MAG., July/Aug. 2013, at 14 *available at* http://www.dnvkema.com/Images/Microgrids%20-%20there%20may%20be%20one%20in%20your%20future.pdf ("Storms such as Katrina, Irene, and Sandy have heightened the need for local back-up power to withstand multiday outages, especially for any load that is critical to public safety, health, and welfare.").

electricity quality.[367] Fortunately, installation costs are known and measurable. When viewed from the perspective of a public without power, the increased costs may be justified. Connecticut's microgrid program requires that the municipal microgrid be able to connect to and operate with the centralized grid.

1. Project Funding and Administration

The Connecticut General Assembly tasked the Department of Energy and Environmental Protection (DEEP) with establishing a grant and loan program for microgrid development.[368] The central purpose of the pilot project was to "support local distributed energy generation for critical facilities."[369] The state senate approved up to $15 million "for the cost of design, engineering services and interconnection infrastructure."[370] Just over one year later, Governor Malloy recommended increasing the initial funding by $30 million.[371] The legislature responded by authorizing the additional funding, which renewed the program for a second round of proposals.[372] In addition to the state legislative and executive branches, the relevant regulatory body has also supported microgrid development. Before approving a utility merger, the Connecticut PURA required the surviving utility to agree to spend $300 million on incremental development of microgrids and increased system resiliency.[373]

In carrying out its statutory directive, DEEP launched the pilot program with a formal request for proposals.[374] Proposals had to specify how the project would provide power to critical facilities

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367. *See* Rosenberg, *supra* note 366.

368. *See* CONN. GEN. STAT. ANN. § 16-243y(b) (West 2013).

369. *Id.*

370. 2012 Conn. Pub. Acts 12-148 § 62(c).

371. Press Release, Dannel P. Malloy, Governor, Conn., Gov. Malloy Announces Nation's First Statewide Microgrid Pilot (July 24, 2013) *available at* http://www.ct.gov/malloy/cwp/view.asp?A=4010&Q=528770 (listing the nine communities that received pilot project funding: Bridgeport, Fairfield, Groton, Hartford, Middletown, Storrs, Windham, and Woodbridge).

372. *See* 2013 Conn. Pub. Acts 13-239, § 62 (describing the grant and loan aspect of the pilot program); *Climate Goals & Legislation*, DEP'T ENERGY & ENVTL. PROTECTION, *available at* http://www.cga.ct.gov/2013/act/pa/pdf/2013PA-00239-R00SB-00842-PA.pdf (last visited Dec. 1, 2014) ("[Connecticut c]ommits an additional $30 million for the build-out of microgrids across the state.").

373. *See* EDISON ELEC. INST., BEFORE AND AFTER THE STORM: A COMPILATION OF RECENT STUDIES, PROGRAMS, AND POLICIES RELATED TO STORM HARDENING AND RESILIENCY 32 (March 2014 ed.) (citing Connecticut PURA Docket No. 12-01-07 (Apr. 2, 2012)).

374. *See generally* CONN. DEP'T ENERGY & ENVTL. PROT., *supra* note 356.

"continuously . . . for a minimum of four weeks."[375] The proposal had to include two weeks' worth of "uninterruptable" access to energy resources, which could be generated locally or delivered to the microgrid generation facility.[376] It had to have a plan for procuring additional resources for the remaining two weeks.[377]

The statutory definition of "critical facilities" begins narrowly, with an explicit list of entities that provide core public services: "hospital, police station, fire station, water treatment plant, sewage treatment plant, public shelter, [and] correctional facility."[378] The definition then broadens to include regulated market actors, specifically television and radio facilities licensed by the Federal Communications Commission.[379] Finally, the statute opens the definition up to the Chief Municipal Officer and DEEP's use of discretion to identify "any other facility or area."[380] The legislature's guidance is most detailed in respect to fundamental community entities, those that involve public health and safety.[381] The statutory reference to telecommunications actors and other private parties expresses a legislative willingness to expand participation in the local electricity market, but only to regulated actors. The language establishes a limited market for public and private actors to convert the state's initial investment into a modernized electric distribution system.

Along with defining the type of actors allowed to participate in the pilot program, the state legislature focused on the size of the actor. The statute requires DEEP to award funding evenly among all sizes of communities.[382] In recognizing the temporary nature of pilot projects, the statute set up a reporting and review process for future project development. The statute is dedicated to continual microgrid development. It exhibits this by requiring loan recipients to submit status reports after five years, calling for DEEP to identify additional funding sources, and asking for statutory recommendations that support future funding.[383] Moreover, the statute calls for a collaborative research and development effort between DEEP and

375. *Id.* at 2.
376. *See id.*
377. *See id.*
378. *See* CONN. GEN. STAT. ANN. § 16-243y(a)(2) (West 2013).
379. See *id.*
380. *See id.*
381. *See id.*
382. *Id.* § 16-243y(c).
383. *Id.* § 16-243y(d), (e).

the Connecticut Academy of Science and Engineering that focuses on identifying electric infrastructure that is cost-effective and reliable.[384]

2. The City of Hartford—Parkville Microgrid Proposal

One of the approved projects from the first round of proposals is the City of Hartford's Parkville Microgrid that proposes to link critical city and community services in a neighborhood with a population of 5100.[385] This project plans to create a standalone microgrid at the Parkville School and Parkville Senior Center and Library in Hartford, CT.[386] In addition to the Parkville School and Senior Center, the microgrid will interconnect two neighboring facilities. One facility is the C-Town Supermarket located directly across Park Street from the school, and the other facility is the Hartford Shell Gas station located diagonally across Park Street from the school.[387]

Currently these public and private facilities are served radially through an overhead line connected to a 23 kV underground primary feeder along Park Street.[388] The proposal is to disconnect the facilities from their existing electric distribution lines and tap into the existing primary feeder to connect each of the facilities through a new underground parallel feeder.[389] At the connection with the existing primary feeder a new motorized switchgear will be installed, allowing the new microgrid to disconnect and operate as a separate power island served by its own distributed energy generation when necessary.[390] The system design includes a 600 kW natural gas-fired generator whose waste heat will be recovered for CHP operations to support existing boiler heating and electric chilling at the school.[391] The system is rated to provide continuous generation of power and heat requirements and existing loads at the facilities will be easily supplied while in island mode.[392] The total capital budget for the

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384. *Id.* § 16-243y(f).
385. *See* CITY OF HARTFORD—PARKVILLE MICROGRID, CONN. DEP'T OF ENERGY AND ENVTL. PROT., MICROGRID GRANT AND LOAN PILOT PROGRAM: NOTICE OF AVAILABLE FUNDS § 1 (2013) *available at* http://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/8525797c00471adb85257b8e006adeaf/$FILE/City%20of%20Hartford%20Parkville%20Proposal%20061813.pdf.
386. *See id.*
387. *See id.*
388. *Id.*
389. *Id.*
390. *Id.*
391. *Id.* § 2.
392. *Id.*

project is $2.9 million, with $2.1 million covered by the grant funds and the remainder provided as matching funds.[393] The project narrative notes that this microgrid project "appears more suited to municipal, state, or utility ownership," since the "estimated financial returns will preclude consideration from private investors."[394] When complete, the City of Parkville microgrid will provide access to food and gasoline for the neighborhood during extended power outages and also provide a center of refuge for the community at the public facilities. These services will be made more resilient at no small cost as efficient new generation must be constructed, as well as a new micro-distribution system. In addition, substantial engineering and technical support is necessary for planning for the microgrid design and ongoing staff support will be necessary to operate the microgrid facilities, which are not centrally dispatched by the utility.

3. *Beyond the Pilot Project*

Energy regulation is a field characterized by overlapping local, state, and federal jurisdiction. The complex regulatory regime makes policy innovation difficult, yet a changing climate and a vulnerable grid necessitate action. "The post-Sandy environment is viewed by policymakers, regulators, utilities and utility stakeholders as providing an opportunity to look more comprehensively and strategically at reliability and storm hardening and resiliency programs, as well as underlying regulatory frameworks in the states."[395] Connecticut, among other states, amended its regulatory framework and disaster plan through the lens of past emergency response.[396]

The post-Sandy Amendments were targeted at infrastructure because structural changes can improve the grid's resiliency. Microgrids give the utility the power to accurately balance supply and demand by "precisely controlling interconnected loads and managing customer voltage profiles . . . [to] reduce the cost of providing reactive power and voltage control."[397] The utility is automatically implicated in any modernization effort because it owns the preexisting grid

393. *Id.* § 3.

394. *Id.* § 3, at 3.

395. EDISON ELEC. INST., BEFORE AND AFTER THE STORM: A COMPILATION OF RECENT STUDIES, PROGRAMS, AND POLICIES RELATED TO STORM HARDENING AND RESILIENCY 24 (2013 ed.).

396. *See id.* (including New York and New Jersey among states that are open to modifying their utility response and disaster plans).

397. *Id.* at 9.

infrastructure. Any modifications to that infrastructure impact the utility's property rights and its ability to profit from its assets.

III. ADVANCING URBAN MICROGRID POLICY

These case studies clearly demonstrate that urban microgrids, rather than an abstract electric grid fantasy, are well established today. The UCSD microgrid is a shining example of how today's smart grid technology can make urban America's energy more reliable, clean, and cost-effective. Similarly, during Hurricane Sandy the NYU microgrid demonstrated the benefits of distributed energy resources and grid redundancy even for one of the world's most reliable electric networks. In addition, the NYU microgrid, similar to UCSD's system, demonstrates that CHP technology brings both carbon reduction and cost reduction benefits to the end-user, compared to conventional grid technology. These success stories also highlight the challenges further microgrid development faces. It is important to note that these two case studies feature large university campuses with compact, well-integrated, central infrastructure. Meanwhile, Connecticut's leading microgrid grant program and the Philadelphia Navy Yard's infrastructure retrofit suggest that, while microgrids have well established models, modernizing the distribution system with highly-controlled islanded systems faces significant capital infrastructure and policy hurdles.

Previous smart grid technology research recommends clear public policy to speed smart grid results.[398] Unfortunately, consistent across all of our case studies is evidence that microgrid policy is anything but clear. In order to advance the policy discussion, the following legal and regulatory issues, which arise in our case study research, will be discussed:

(1) The legal definition of the microgrid;

(2) The granting of franchises across public streets;

(3) Liability for service quality issues;

(4) Tariff issues for energy buyback and supplemental service; and

(5) Other customer service issues.

One option to resolving these policy issues would be to apply the current public utility regulatory paradigm to the provision of microgrid services: the state regulatory authority directs the electric distribution utility to develop microgrid services through a utility

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398. JONES & ZOPPO, *supra* note 5, at 152.

tariff. While a public utility microgrid model may require a reevaluation of certain goals and incentives within state public service law,[399] it is well within the expertise of the existing utility sector. While this alternative is certainly a workable model and one that may be particularly attractive in regions of the country where vertically integrated utilities[400] remain the norm, the following policy discussion assumes that third-party provision of microgrid services will at least be an available option.

Front and center to the legal and regulatory challenges facing microgrids is their unclear legal definition. Case study examples lack a cohesive legal definition of what a microgrid is, or, possibly more importantly, is not. Developing a clear statutory and regulatory definition of a "microgrid" would significantly refine public policy and incent a market reaction. Central to this definition is clarifying whether a microgrid is or is not an electric corporation similar to a standard distribution utility, and, if it is not, in what ways does the microgrid legally differ from the electric corporation. It is noteworthy that in California, Pennsylvania, New York, and Connecticut microgrid development has occurred when customers or other third parties have been able to elude the definition of an electric corporation.[401] In these states, exemptions from the definition of an electric corporation have often limited a microgrid to only distribute electricity for its own use or, potentially, to multiple customers who do not require microgrid facilities to cross a public street.[402] Subjecting a microgrid owner to the same rules and regulations as an electric distribution utility that is subject to rate and service quality regulation by the state regulatory commission could likely stifle microgrid development given the significant costs and overheads that public utility regulation creates. On the other hand, not being subject to the same regulatory scheme as an electric corporation suggests that microgrid owners will have significantly reduced scope and authority compared to a fully regulated distribution utility given that the

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399. For example, public utility microgrids may require a clarification of what are appropriate levels of service reliability so that microgrid investments do not lead to claims of utility "gold plating" during rate cases.

400. A vertically integrated utility is a utility that still provides regulated monopoly service for generation, transmission, and distribution functions.

401. *See* CAL. PUB. UTIL. CODE § 218(a) (West 2009); CONN. GEN. STAT. ANN. § 16-243y (West 2013); N.Y. PUB. SERV. LAW § 2 (McKinney 2013); 66 PA. CONS. STAT. ANN. § 102 (West 2004).

402. *See* CAL. PUB. UTIL. CODE § 218(a) (West 2009); CONN. GEN. STAT. ANN. § 16-243y (West 2013); N.Y. PUB. SERV. LAW § 2 (McKinney 2013); 66 PA. CONS. STAT. ANN. § 102 (West 2004).

current regulatory regime exists for established policy reasons. Clearly resolving the legal definition of a microgrid is a necessary starting point.

Another big picture legal issue involves opening access to public rights of ways. As our research has demonstrated, a municipality or the state typically has the authority to define a public utility franchise's boundaries. Some states grant utilities exclusive franchises while other states, such as New York, tilt toward nonexclusive franchises. Exclusive utility franchises are consistent with the economic theory that least cost service is achieved by economies of scale combined with public rate regulation. Overcoming franchise limitations and allowing a single campus or base microgrid to interconnect neighboring customers will appeal to microgrid advocates and perhaps support the goal of increased electric grid resiliency. Connecticut overcame the question of franchise exclusivity by expanding the franchise right in a limited manner to governmental authorities during the unique circumstance of a pilot project. Can proposals to have critical community facilities such as hospitals tap into existing private microgrids be far away? On the other hand, increasing the footprint of single site microgrids will accelerate concerns over utility revenue adequacy embodied in the expansion of distributed energy resources, and possibly lead to redundant or stranded utility distribution system resources. Defining clear public policies around the definition and authority of microgrids, as well as the related utility franchise rights, in a holistic manner that considers all utility customers, is a vital first step in microgrid policy development.

Finally, a looming microgrid policy issue is liability for power and service quality from microgrid facilities. Currently, statutes and regulatory tariffs define the liability limitations for power and service quality issues. As discussed in the New York case study, one common state policy approach is to limit the public utilities liability to those situations where there is gross negligence. Absent gross negligence on the part of the distribution utility, customers would be responsible for insuring their own equipment from power and service quality issues. Critical to state laws limiting utility liability is a demonstrated ability for electric utilities and other central grid operators to maintain power and service quality. As other third-party actors become involved in managing grid service quality, there should be clear guidance provided in regards to whether similar liability limitations are expected for microgrid operators and whether a lack of liability limitations would create barriers to microgrid development.

While a key feature of an urban microgrid is its ability to island during outages caused by severe weather events, an equally important feature is for microgrid customers to share the benefits of the utility network. Critical to sharing utility network benefits is the ability to increase microgrid efficiency by selling excess energy from the microgrid back to the utility or wholesale market and at other times purchasing network energy services for peak and back-up service when microgrid resources are physically or economically unavailable to serve load within the microgrid. Balancing the microgrid's contribution to network benefits is another challenging issue that must be resolved in a manner that is just and reasonable for all customers. Developing buyback and standby rates for distributed resources is a longstanding utility rate design issue. The issue, highlighted by interest in microgrids, remains controversial and difficult to navigate. Stakeholder interest in incenting microgrid development must be balanced by adherence to rate design principles that benefit customers and the grid as a whole. Poorly developed rate designs will only present future problems with even more problematic public policy choices.

As microgrids expand to more complex configurations serving multiple customers, policymakers will also have to grapple with a multitude of consumer protection issues such as service quality and customer data privacy. In addition, in states where retail competition for electric service exists, such as Pennsylvania, Connecticut, and New York, expansion of microgrids will raise questions about their impact on the provision of default electric service. Today's regulatory compact between the public utility and state regulatory authority has developed with rather sophisticated (some might say burdensome) processes for measuring and incenting service quality. Meanwhile, today's smart grid technologies are capable of collection, storage, and analysis of large amounts of customer data. When non-utility parties have access to detailed customer data, and likely in a more lightly-regulated environment, customer data privacy issues will grow in significance. When a microgrid serves a single customer on a campus the issues of service quality and data privacy will be self-regulating, but as pressures increase to expand microgrids beyond a single customer footprint, the need for new thinking about these consumer protections will grow. As the rollout of smart grid technologies across the country has demonstrated, consumers demand that these policies be considered in advance.

CONCLUSION

A resilient and efficient electric grid is critically important to urban America. The challenges brought on by climate change demand that urban planners embrace smart technologies to help cities both mitigate and adapt to these impending outcomes. Urban microgrids offer important opportunities for our cities to become smarter, cleaner, and more efficient. History has demonstrated that one of the greatest challenges for technological adoption is often not the technology itself, but rather the public policies that guide its implementation. Urban microgrids and smart energy technologies once again highlight the importance of a well-developed legal and regulatory framework for achieving the broad societal goals embodied within the technological promise.