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The Quest for Public Purpose Microgrids for Resilience: Considerations for Regulatory Approval

Designing Resilient Communities: A Consequence-Based Approach for Grid Investment Report Series

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ABSTRACT

Interest in microgrids for resilience is growing with an increase in the frequency and severity of both natural and intentional threats and given the universal reliance on electricity for critical aspects of life and commerce. Some microgrid project proponents are coming before Public Utility Commissions to request electric ratepayer funding to cover part or all the costs. However, utility regulators are rarely approving ratepayer investments in microgrids, whether they are designed to improve resilience or not.

The purpose of this report is to identify the features of microgrids that can receive ratepayer funding. We start by identifying key regulatory objectives and defining and characterizing the term resilient public purpose microgrids to align with these objectives. We define resilient public purpose microgrids as those that serve public interests in island mode on extreme event days, in addition to interconnected mode on normal days. We then characterize five project types and provide a case study with findings for each. The project types are: (1) emergency response, (2) emergency shelters, (3) defense infrastructure, (4) essential public infrastructure, and (5) housing for immobile populations. Lastly, we summarize the findings across the case studies and propose next steps.

Our findings conclude that implementation of individual demonstration projects provides important insights public purpose microgrid service strategies, project design guidance, and funding sources and levels for development of utility system-wide resilient. There are many opportunities to advance resilient public purpose microgrid project development and regulatory review. We translate our findings to actions for regulators, utilities, communities, and other stakeholders.

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EXECUTIVE SUMMARY

In 2019, Sandia National Laboratories (Sandia) contracted Synapse Energy Economics (Synapse) to research the integration of community and electric utility resilience investment planning.[1] The research was funded by the U.S. Department of Energy (DOE) and conducted as part of the Grid Modernization Laboratory Consortium (GMLC), under the project named Designing Resilient Communities: A Consequence-Based Approach for Grid Investment (DRC).

The primary objective of the DRC project is to understand and provide guidance on the challenges and opportunities facing communities and electric utilities seeking to coordinate energy-related resilience efforts.[2] The project seeks to demonstrate an actionable path toward designing resilient communities through consequence-based approaches to grid planning and investment, and through field validation of technologies with partners that enable distributed and clean resources to improve community resilience. As part of the DRC project, Sandia is partnering with a variety of government, industry, and university partners to develop and test a framework for community resilience planning focused on modernization of the electric grid.

In support of DRC, Synapse produced a series of reports to explore challenges and opportunities in several key areas including benefit-cost analysis, performance metrics, microgrids, and regulatory mechanisms. This report focuses on microgrids, specifically resilient public purpose microgrids. We define resilient public purpose microgrids as those that serve public interests in island mode on extreme event days, in addition to interconnected mode on normal days.

Microgrid project proponents are coming before Public Utility Commissions to request electric ratepayer funding to cover part or all the costs. However, a 2019 report titled *The Value of Resilience for Distributed Energy Resources: An Overview of Current Analytical Practices* found that, "Microgrid investment proposals have met with mixed success in regulatory proceedings thus far."[3] Utility regulators are rarely approving ratepayer investments in microgrids, whether they are designed to improve resilience or not. Building on this insight, the purpose of this report is to identify the features of microgrids including potential resilience value that can receive ratepayer approval and funding.

This report:

- identifies key regulatory objectives for achieving resilience;
- uses these objectives to define the term resilient public purpose microgrid and characterize five project types;
- provides a case study and findings for each project type;
- summarizes findings across the case studies; and
- proposes next steps.

Implementation of individual demonstration projects provides important insights into the development of utility system-wide resilient public purpose microgrids in the areas of service

[1] In this research, municipal governments are considered communities due to their broad lens into local, public efforts and investments as well as their decision-making authority. Municipal governments include communities that are both urban and rural and both large and small.

[2] Department of Energy. *New GMLC Lab Call Awards for Resilient Distribution Systems*. September 4, 2017. Available at: https://www.energy.gov/articles/new-gmlc-lab-call-awards-resilient-distribution-systems.

[3] NARUC. *The Value of Resilience for Distributed Energy Resources: An Overview of Current Analytical Practices,* 2019. p. 15.

strategies, project design guidance, and funding sources and levels. We find several thematic strengths and weakness in the case studies, which we identify as 1) resilience as a specific, measurable goal, 2) alignment with utility system needs (addressing siting and sizing), 3) explicit provision of community needs, 4) application of ratepayer funding, and 5) multi-project assessment and prioritization. In summary, experience shows that resilience investments such as microgrids can be funded by ratepayers when one or more of the following are achieved: when the load to be served is critical, when needs beyond the host customer (such as utility and community needs) are met, when the normal day benefits of the project exceed the costs, and when other funding sources can be applied to cover all, or a portion of the additional costs related to resilience. Additionally, strategically directed and properly planned portfolios of resilience investments, rather than infrequent one-off projects, will likely be required to add resilience to the utility system.

Resilient public purpose microgrid project proposals could be stronger with direction from regulators, including utility system requirements related to siting and sizing of microgrids and the availability of ratepayer funds. Regulators can provide guidance for utilities and project proponents to refer to as they develop microgrid project proposals that are resilient and serve public interests. Defining replicable categories of projects, or project types, can help evolve proposals from individual projects to suites of solutions. The Next Steps section of the report includes questions regulators can use to reach out to utilities, communities, project developers, and other stakeholders for input as they develop this guidance. Building from the project examples identified in this report, regulators can use these inputs to define replicable, recognizable project types which can lead to development of more standardized regulatory processes and practices for ongoing project review.

Utilities, communities, and other stakeholders each have important roles and responsibilities to improve the project scope and understanding of the costs and benefits. Utilities can take the lead on BCA, performance metrics, screening and optimizing project ideas for utility system impacts, and proposing rate structures or riders to collect costs from ratepayers. Communities can assist with characterizing threats and quantifying consequences, providing data and input to regulators and utilities to avoid or minimize lost opportunities, and informing utilities and regulators of federal, state, and local legislation, policies, and funding sources relevant to these projects. Community leaders can also represent groups or demographics of people who are disproportionately favored or conspicuously absent from discussions. Other stakeholders can advocate for important outcomes such as community resilience, sustainability, customer rights and protections, equity, and environmental justice by working with utilities and others to conduct new research and analysis to fill gaps in current understanding.

There are many opportunities to advance resilient public purpose microgrid project development and regulatory review, to the benefit of regulators, utilities, communities, and other stakeholders. With explicit guidance from regulators, project proponent teams including utilities and communities can propose better projects, and more of them. Project types that are well defined and broadly replicable can streamline regulatory review. Projects that excel at achieving key regulatory objectives should be eligible for ratepayer contributions to cover a portion or all the costs. Regulatory proceedings including, but not limited to, integrated system planning, grid modernization, and non-wires alternatives can then focus on the level of ratepayer contribution and cost allocation to different beneficiaries through novel rate designs.

ACRONYMS AND DEFINITIONS

Acronym or Term	Definition
behind-the-meter	On the customer-owned portion of the grid
continuity	Providing uninterrupted electricity of sufficient quality to end-use customers
critical customer	A customer that is a higher priority for restoration in the event of an outage
customer equity	Balancing the interests, needs, and abilities of different constituencies
defense infrastructure	Includes military bases as well as other defense critical infrastructure not located on military bases
emergency response	Applies to emergency operation centers in the Town or City Hall or in police and fire department buildings
emergency shelters	Includes senior centers, gyms, community recreation buildings, arenas, convention centers, or schools, among other buildings
essential public infrastructure	Infrastructure that requires electricity to provide life-sustaining services and can include food, medical, communication, transportation, and water infrastructure
extreme event days	Days in which threats test the reliability and resilience of the electric grid resulting in a disruption.
fairness	A state in which no individual or group (*e.g.*, customers in total or in part, utility shareholders) unduly shoulders risks or retains the benefits of utility activities
front-of-meter	On the utility-owned portion of the grid
housing for immobile populations	Includes public housing, affordable multifamily housing, nursing homes, long term care facilities and group homes
islandable	Able to disconnect from the electric power grid, such that a facility or group of facilities retain power during an outage on the grid
just and reasonable rates	Considering the costs and benefits of investments
microgrid	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
normal days	Days in which the electric grid does not experience threats or does not experience any disruptions from threats
project proponents	Teams, including owners, that propose projects to regulators
project types	Replicable categories of projects
public purpose	Serves public interests
public interest	Promoting the well-being of the public generally, and utility customers more specifically
resilient public purpose microgrids	Microgrids that serve public interests in island mode on extreme event days, in addition to interconnected mode on normal days

Acronym or Term	Definition
resilience	The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions[4]
stakeholders	Companies, organizations, and individuals who are not project proponents but have important perspectives to share

[4] U.S. Office of the Press Secretary. 2013. *Presidential Policy Directive/PPD-21 -- Critical Infrastructure Security and Resilience*. February 12. Available at: https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil.

1. INTRODUCTION

1.1. Purpose

Interest in microgrids for resilience is growing with an increase in the frequency and severity of both natural and intentional threats, as well as the universal reliance on electricity for critical aspects of life and commerce. According to the U.S. Department of Energy, 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."[5]

Microgrid project proponents that propose projects to utilities and regulators are coming before Public Utility Commissions to request electric ratepayer funding to cover part or all the costs. However, a 2019 report titled *The Value of Resilience for Distributed Energy Resources: An Overview of Current Analytical Practices* found that, "Microgrid investment proposals have met with mixed success in regulatory proceedings thus far."[6] Utility regulators are rarely approving ratepayer investments in microgrids, whether they are designed to improve resilience or not. Building on this insight, the purpose of this report is to identify the features of microgrids that can receive ratepayer funding.

Microgrids can be configured in many ways. For example, microgrids can:

- serve one or multiple customers,
- serve critical and/or non-critical customers. Critical customers are higher priority for restoration in the event of an outage as they provide life-sustaining goods and services to a community,
- service public and/or private customers. Public customers can include government facilities and public housing. Private customers can include commercial businesses, apartment complexes, industrial facilities, and single-family homes,
- serve the full customer load, or a critical portion of the load,
- rely on one generation technology, such as a fossil fuel generator, or incorporate more technologies such as renewable generators, battery storage, combined heat and power solutions, and energy management systems and controls,
- operate in front of or behind the utility meter, and
- provide power on normal days and extreme event days. An important feature of resilient microgrids is the ability to connect and disconnect from the grid which enable them to operate in either grid-connected or islanded-mode, providing flexibility that can be useful during electrical outages. Extreme event days are days in which threats test the reliability and resilience of the electric grid resulting in a disruption.

Certain configurations may be more appealing to regulators and therefore, more likely to receive approval for ratepayer funding. In the Sandia National Laboratories report titled *Regulatory*

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[5] Definition developed by the Microgrid Exchange Group, which is comprised of an ad hoc group of individuals working on microgrid deployment and research. For more information on this effort, see: (2012) Ton, Dan T., and Merrill A. Smith, *The U.S. Department of Energy's Microgrid Initiative* at: https://www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy%27s%20Microgrid%20Initiative.pdf.

[6] NARUC. 2019. p. 15.

Mechanisms to Enable Investments in Electric Utility Resilience[7], we identify the following key regulatory objectives:

- *Continuity of electric service* is the ability of the electricity system to provide uninterrupted electricity of sufficient quality and quantity to end-use customers. Continuity includes restoring service as quickly as possible when disruptions occur.
- *Ensuring reasonable rates* requires consideration of the costs and benefits of investments. For rates to be reasonable, they must also be based on sound utility investment decision-making, which considers all information reasonably known or knowable at the time that decisions are made. In addition, reasonable rates ensure the utility remains solvent without reaping excess profits. This implies that utilities should consider all relevant risks and a comprehensive set of technologies and options to identify and prioritize solutions before commitments to invest are made.
- *Customer equity* requires balancing the interests of different constituencies. Fairness across customer classes generally calls for distribution of costs consistent with cost causation. Decisions about cost allocation across customer classes can be informed by cost-of-service studies and rate and bill impact analyses. Fairness across generations of customers requires that the cost of a capital investment is recovered over its useful life.
- *In the public interest* means that an investment promotes the well-being of the public generally, and utility customers more specifically. In some instances, the public interest includes environmental, public health issues, and job creation.

In this report, we define and characterize the term resilient public purpose microgrids to align with these key regulatory objectives. We define resilient public purpose microgrids as those that serve public interests in island mode on extreme event days, in addition to normal days. On normal days, the electric grid does not experience threats or does not experience any disruptions from threats. On extreme event days, threats test the reliability and resilience of the electric grid. The Sandia National Laboratories report titled *Application of a Standard Approach to Benefit-Cost Analysis for Electric Grid Resilience Investments* provides more detailed information on resilience benefits that can accrue to the utility system, communities, and society depending on the types of assets supported by microgrids.

Resilient public purpose microgrids serve public interests in island mode on extreme event days, in addition to interconnected mode on normal days.

We use these regulatory objectives to characterize five project types and provide a case study with findings for each. The project types are: (1) emergency response, (2) emergency shelters, (3) defense infrastructure, (4) essential public infrastructure, and (5) housing for immobile populations.

- Emergency response projects are those which enable emergency coordination and situational awareness by response agencies, for instance emergency operation centers in Town or City Hall, police and fire department buildings.

[7] Sandia National Laboratories report: *Regulatory Mechanisms to Enable Investments in Electric Utility Resilience* available at https://www.synapsenergy.com/sites/default/files/Regulatory_Mechanisms_to_Enable%20_Investments_in_Electric_Utility_Resilience_SAND2021-6781_19-007.pdf

- Emergency shelters can be senior centers, gyms, community recreation buildings, arenas, convention centers, or schools, among other buildings. Emergency shelters, sometimes municipally owned and operated and sometimes privately owned and operated, provide food, water, medicine, and shelter for the many people who are mobile in a community.
- Defense infrastructure can include military bases as well as other defense critical infrastructure not located on military bases.
- Essential public infrastructure is infrastructure that requires electricity to provide life-sustaining services and can include food, medical, communication, transportation, and water infrastructure. Municipal government facilities, such as water treatment plants and fire and police departments, ensure continuity of life-sustaining services for all.
- Housing for immobile populations can include public housing, affordable multifamily housing, nursing homes, long term care facilities and group homes. Microgrids for less mobile populations living in multifamily housing developments, group housing arrangements, or single-family homes provide a community benefit as municipal resources do not have to be deployed to each of these sites to address issues and the continuity of electricity services prevents health issues from occurring in residents who may also be more vulnerable to health issues.

It is important to note the following regarding the project types:

- Each project type is intended to be distinct from the others. No two project types overlap or are the same.
- The project types can be combined to form larger projects.
- These project types do not constitute an exhaustive list. The project types are intended to represent a sufficiently illustrative starting point for regulatory consideration of ratepayer investments in resilient public purpose microgrids.
- The project types are intended to be broadly replicable. Most, if not all communities should have one or more of these project types in order to have a robust provision of services during extreme events.
- All the project types involve publicly owned infrastructure. We acknowledge that some privately owned infrastructure can serve public interests by providing life-sustaining goods and services during an extreme event, such as grocery stores, banks, and pharmacies.[8] However, we did not identify microgrids combining multiple private owners that serve public interests, so this project type is not a focus for this report.
- The project types selected are intended to be informative but not overly prescriptive. Each communities', goals, threats, infrastructure, and services should inform identification of project types that meet its unique needs and interests.

1.2. Report Organization

The remainder of this report is organized as follows:

[8] Sandia National Laboratories' report titled *Performance Metrics to Evaluate Utility Resilience Investments* explicitly includes both public and private entities in the definition of customers who can provide critical community services.

- Section 2 reviews five resilient public purpose microgrid case studies and discusses key findings for each;
- Section 3 summarizes findings across the case studies; and
- Section 4 proposes next steps.

2. RESILIENT PUBLIC PURPOSE MICROGRID CASE STUDIES

2.1. Emergency Response

The City of Portland, Oregon initiated operation of the Fire and Rescue Microgrid in December 2019. The installation included a 30.24 kW solar array, 30 kW_{DC} lithium-ion battery providing 64.5 kWh of capacity or approximately two hours of backup for the facility. Critical loads were identified including computers and communications and configured to a panel to be served by the onsite generation. When grid power is interrupted, a reverse power flow relay will trip and eliminate the possibility that electricity generated onsite will flow to the grid.

The goals of the pilot project included showing proof of concept for future City-owned solar installations, increasing resilience of critical City infrastructure for emergency response in the event of an extended power outage and providing on-site renewable electricity generation and dispatchable stand-by generation to reduce energy and demand costs.

Key stakeholders included Fire Station 1 who was the system owner, the City's Bureau of Planning and Sustainability who assisted with project coordination, EC Electric who was the solar contractors, Portland General Electric (PGE) who provided technical assistance and monetary incentives for research and development and participation in the Energy Partner Demand Response Program, and Energy Trust of Oregon (ETO) who provided project development technical assistance and monetary incentives for a solar plus storage feasibility assessment.

The City of Portland contributed approximately 40 percent of the $200,000 cost for the project with utility ratepayers contributing most of the remainder. The utility contribution allows the energy from the battery to offset the site load during times of peak demand. ETO also contributed $2,500 for a feasibility assessment that summarized the system design scenarios, use case, financials, and benefits.[9]

[9] March 4, 2021 Synapse correspondence with Danny Grady, Sr. Energy Specialist at the City of Portland Bureau of Planning and Sustainability.

Photo credit: PGE.

Figure 1. City of Portland Fire and Rescue Microgrid

Key Findings

An important aspect of this project beyond load reduction during normal days is that it was designed to meet some limited resilience needs. The microgrid is designed to island from the grid during extreme event days and will be used to serve critical loads that were identified and isolated upfront as part of the design process. It is important to note though that the assessment of cost effectiveness did not include resilience-related benefits, as a standard process of quantifying these benefits was not available. Benefits exist in the form of continued operation of critical services during an outage, but no value was assigned.

Another noteworthy aspect is ratepayers and the community contributed to the project, in roughly equal shares. Since the project directly serves critical community needs, the community could substantiate providing significant financial support.

While the project provided utility system support on normal days in terms of load reduction, the project is explicitly precluded from feeding excess generation back to the utility system on extreme event days. Further, the location of the microgrid on this building may not be particularly advantageous from a utility system perspective. There is no indication that the utility performed a broader assessment of either blue sky or black sky benefits to inform the location of the project or prioritize this project against other investments, including other microgrids in this and nearby communities.

2.2. Emergency Shelters

Green Mountain Power (GMP) developed the Stafford Hill Solar Farm and Microgrid in Rutland, Vermont after Tropical Storm Irene hit in 2011. The storm caused flooding and wind damage and raised concerns about damages from future extreme storms driven by a changing climate. Shortly thereafter, ISO-NE identified a potential need for a transmission upgrade in central and northwestern Vermont. VELCO, Vermont's transmission operator, identified that distributed generation and energy efficiency located between Rutland and Burlington would help to alleviate this need.[10]

Using mostly ratepayer funding[11], GMP built a microgrid adjacent to the Rutland High School, which also serves as a Red Cross emergency shelter. The project is 100 percent renewable and consists of a 2.5 megawatt_{DC} ground-mounted solar installation and two, 2 megawatt_{DC} batteries with a combined energy capacity of 3.4 MWh. On normal days, energy generated by the project is injected into the utility grid, and the utility uses the batteries to provide regulation service and to shape the project's overall output to reduce costs of regional generation capacity and transmission. On extreme event days, the project is configured to power a portion of the load at the school which enables it to serve its purpose as an emergency shelter. The figure below shows the solar panels and batteries sited to the east of the school.

[10] Vermont Public Utilities Commission. Docket 7873. Working Group A. Utility Gap Analysis and Process Recommendations. Revised April 1, 2013. Available at: https://www.vermontspc.com/library/document/download/572/D7873_utilanalysis_04012013.pdf

[11] The state's utility regulator, the Vermont Public Service Board, reviewed the project in Docket 8098 and granted it a Certificate of Public Good on July 14, 2014.

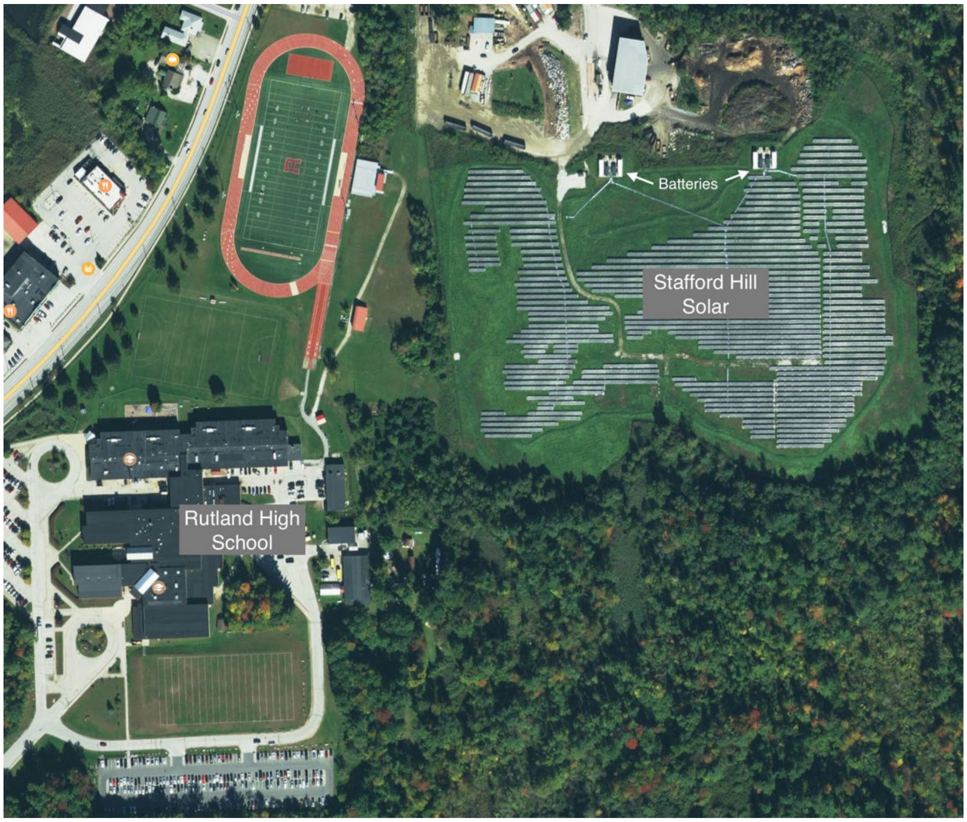

Photo credit: Apple Maps. Annotations by Synapse.

Figure 2. Stafford Hill Solar Farm and Microgrid in Rutland, Vermont

As part of its effort to purchase Rutland-based investor-owned utility Central Vermont Public Service, GMP committed to: (1) make Rutland the solar capital of New England and a center for energy innovation and (2) address community concerns that a large and stable employer would turn its attention away from the area. The project met both of GMP's goals.

Aside from GMP, the City of Rutland, the Vermont Clean Energy Development Fund, the U.S. DOE, and the Rutland Regional Planning Commission engaged in the design and proposal of the project. The City of Rutland owned the closed landfill on which the project is located, sought a productive and taxpaying use of a closed landfill and an innovative energy project the locality could showcase, and receives lease payments for the use of this land.[12] U.S. DOE and Vermont's Clean Energy Development Fund provided funding to support a technology demonstration of a 100 percent renewable microgrid.[13]

Only the normal day benefit-cost analysis of the project can be evaluated with the information available. Most of the project costs were provided by GMP ratepayers ($9.8 million), with a relatively small proportion of the costs covered by federal and state grants ($235,000 from U.S. DOE and

[12] State of Vermont Public Service Board. Docket 8098 Order. Petition of Green Mountain Power Corporation for a certificate of public good, pursuant to 30 V.S.A. § 248, authorizing the construction and operation of a 2.5 MW DC solar electric generation facility, known as the Stafford Hill Solar Farm, to be located on Gleason Road in the City of Rutland, Vermont. July 14, 2014.

[13] The project as part of a large portfolio of projects can helps Vermont meet its goal of 90 percent renewable energy economy-wide by 2050.

$5,000 from the Vermont Clean Energy Development Fund). From a ratepayer perspective, the solar portion of the project was projected to be cost-effective, costing $5.8 million (levelized cost of energy of 17.1 cents/kWh) while delivering $6.3 million in present value benefits (18.7 cents/kWh). The storage component is uncertain in net value. It cost ratepayers $4 million and was projected to deliver between $2.8 to $6 million in value.[14]

The range of monetized benefits in GMP's analysis ($9.1-$12.3 million) included many of the normal day, energy-related benefits such as the avoided costs of energy, capacity, transmission and ancillary services and the value of renewable energy credits.[15] GMP acknowledged, but did not quantify, the energy arbitrage value for the battery storage component of the project. Improved reliability, power quality and voltage regulation are benefits that were not mentioned or valued.

Key Findings

A key strength of this project is that it was sited in an area that could help offset the need for a transmission upgrade. As a result of public, adequate, and timely information, the microgrid was designed to help avoid the need for the utility and its ratepayers to invest in new grid transmission infrastructure. To date, the project has helped the utility achieve this goal.

Another noteworthy aspect of this project is the fact that the regulator approved the use of ratepayer funds to support it. The project was approved and received nearly all its funding from ratepayers based on a benefit-cost analysis which focused on normal day costs and benefits.[16]

Resilience was not the driving priority for this project. This microgrid project was proposed to primarily address grid issues; however, being located near a school provided resilience as a secondary and limited benefit. Although the project was clearly designed to perform on normal days, it provides the opportunity to examine how resilience can be paid for with blue sky benefits. For example there is an opportunity to:

- Analyze how many people the shelter can accommodate and how long these individuals can be accommodated given the amount of backup power that the installation provides for the site and include benefits such as avoided property damages to utility system and the school building, reduced medical and insurance costs due to avoided injuries and hospitalizations, and avoided loss of life.
- Identify resilience-related performance metrics and track and measure performance using metrics.
- Perform a threat analysis, including cataloguing and prioritizing all potential threats and assessing the probability or likelihood of experiencing the threats.

[14] State of Vermont Public Service Board. Docket 8098 Order. Petition of Green Mountain Power Corporation for a certificate of public good, pursuant to 30 V.S.A. § 248, authorizing the construction and operation of a 2.5 MW DC solar electric generation facility, known as the Stafford Hill Solar Farm, to be located on Gleason Road in the City of Rutland, Vermont. July 14, 2014.

[15] The low case did not include a value for avoided transmission cost.

[16] The low estimate of the benefits indicated the project was nearly cost-effective without including values for several benefits such as avoided transmission costs, improved reliability, power quality improvements, voltage regulation improvements, and the energy arbitrage value for the battery storage component of the project. The high estimate of the benefits indicated the project was cost-effective.

- This microgrid appears to be the only project proposed to address the combination of grid issues and some limited resilience concerns. There is no indication that the utility performed a broader assessment of either blue sky or black sky benefits to inform the location of the project or prioritize this project against other investments, including other microgrids in this and nearby communities.

2.3. Defense Infrastructure

Schofield Barracks, home to the 25th Infantry Division, was established in 1908 to provide a base for the Army's mobile defense of Pearl Harbor and the island of Oahu. Located at the foot of the Waianae Mountain Range, the base is inland, away from any coastal impacts from storms or tsunami. The U.S. Army was seeking to increase reliability at its Army bases in Central Oahu, including Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia. The Hawaii Electric Company (HECO) was seeking to strengthen the reliability of Oahu's electric grid and improve the integration of renewable energy resources such as solar and wind power.

Through a new partnership, the U.S. Army provided a 35-year lease for eight acres of land at the base to HECO to install and operate a new 50 MW biofuel and diesel generating plant in exchange for priority access to 100 percent of the electrical power needs for Schofield Barracks, Field Station Kunia, and Wheeler Army Airfield during extreme events.[17] The U.S. Army also agreed to provide physical security to the generating plant.

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[17] Scofield Generating Station Project Fact Sheet. May 22, 2018. Available at: https://www.asaie.army.mil/Public/ES/oei/docs/Schofield_Generating_Station_Project_Fact_Sheet_22May2018.pdf

Photo credit: HECO

Figure 3. Schofield Barracks Military Base Microgrid in Oahu, Hawaii

HECO ratepayers provided funding to install, own, and operate the project based on normal day grid benefits. On normal days, the energy generated by the plant will feed into the island's electric grid and serve customers on Oahu. The plant will feature modern, flexible, and efficient generators that will complement increasing levels of solar and wind power on the Oahu grid. The generators will be capable of quickly starting up, shutting down, or changing their output in response to sudden changes in solar and wind energy resources, which provide varying levels of energy depending on weather, time of day, cloud cover, and other factors.[18] In the event of an emergency, the plant will be able to isolate itself to serve facilities at Schofield Barracks Army bases to provide reliable power to the Army's facilities. The unit is black-start capable and able to operate on five-day fuel supply onsite and a 30-day fuel supply on the island.[19]

Key Findings

A unique feature of this project is the focus on resilience. U.S. DOD effectively swapped land and security resources for electric system resilience. U.S. DOE wanted resilience and HECO wanted the land to build the plant and physical security the Army could provide. HECO also sought the quick-start and ramping features of the generating units to supplement increasing levels of more variable

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[18] Hawaiian Electric. News Release. Hawaiian Electric, U.S. Army announce completion of Schofield Generating Station. May 1, 2018. Available at: https://www.hawaiianelectric.com/documents/about_us/news/2018/20180531_schofield_generating_station.pdf

[19] Presentation by Michael McGhee at 2019 NASEO Energy Policy Outlook. Army Energy Resilience: A Partnership Approach. February 6, 2019. Available at: https://www.asaie.army.mil/public/ES/oei/docs/NASEO_Feb2019.pdf

renewable generation on the island. The partnership enabled the realization of multiple benefits through creative application of electric ratepayer and taxpayer funds.

Another interesting aspect is the location of the plant. Resilience was a high priority in planning as evidenced by the fact that the plant was intentionally sited inland to avoid tsunami, storm, and rising sea level flood risk.

One drawback is the lack of availability of the backup generation to the communities on the island in the event of an extreme event. The structure of the agreement guarantees all the generation can be used by the base in the event of an emergency. Though the base can provide safety and security assistance to the surrounding communities during an extended outage, the communities will not benefit from access to electricity during these events.

2.4. Essential Public Infrastructure

Many parts of California suffer from reoccurring droughts and limited access to water resources.[20] In areas with scarce water resources, imports are high and the movement and recycling of water requires more energy. According to the California Energy Commission, "the transportation and treatment of water, treatment and disposal of wastewater and the energy used to heat and consume water account for nearly 20 percent of all the total electricity and 30 percent of non-power plant related natural gas consumed in California".[21]

Inland Empire Utilities Agency (IEUA), a municipal water district serving nine water agencies with 875,000 customers in Southern California, is a leader in energy efficiency and renewable energy. Since 2003, IEUA has constructed LEED platinum certified headquarters, reduced energy consumption by nearly 25 percent with aggressive energy efficiency, and installed 5 MW of solar, 1 MW of wind, and 3 MW of biogas internal combustion engines across four facilities.[22]

Since 2000, the California Public Utility Commission's Self Generation Incentive Program (SGIP) supported installation of distributed energy resources including wind, waste heat to power, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems. Advanced energy storage systems emerged around 2014 with approximately 50 MW in the queue.[23]

Around this time, Advanced Microgrid Solutions (AMS) reached out to IEUA regarding advanced energy storage opportunities at their facilities with renewable energy installations.[24] By pairing the renewable energy generation with batteries, AMS estimated that IEUA could reduce its peak

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[20] Advanced Microgrid Solutions. "Inland Empire Utilities Agency and Advanced Microgrid Solutions Launch First-of-its-Kind Energy Storage Project". PR News Wire. October 2016. Available at: https://www.prnewswire.com/news-releases/inland-empire-utilities-agency-and-advanced-microgrid-solutions-launch-first-of-its-kind-energy-storage-project-300348764.html

[21] Id.

[22] March 9, 2021 Synapse correspondence on updates to the case study with Pietro Cambiaso and Sarah Recinto at IEUA

[23] Itron. *2013 SGIP Impact Evaluation*. April 2015. Figure 3-8. Page 3-10. Available at: https://www.cpuc.ca.gov/sgip/

[24] Conversation with Pietro Cambiaso, Deputy Manager of Strategic Planning and Resources at IEUA on December 21, 2020.

demand charges and generate energy savings of five to ten percent annually.[25] It is important to note that this case study did not address resilience as a specific goal.

AMS sized the batteries at each site from 500 to 1,500 kW to maximize these savings by accounting for the load, load shape, and the peak demand at the sites.[26] IEUA's Board of Directors reviewed and approved the 4.08 MW project proposal and contracting agreement, which leveraged SGIP incentives to reduce AMS upfront costs and was structured to spread the costs to align with the savings such that cost savings accrued to ratepayers begin in the first year after installation.[27] As there was no upfront capital investment and savings were realized immediately, the project was attractive to IEUA and the first installation occurred in 2016. [28,29]

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[25] Grindstaff, Joseph. Project Profile: Energy Storage Integration – Inland Empire Utilities Agency implements battery energy storage at wastewater facilities. Distributed Energy. Accessed June 2020. Available at: http://digital.businessenergy.net/publication/?m=4119&i=415309&view=articleBrowser&article_id=2811937&ver=html5

[26] March 9, 2021 Synapse correspondence on updates to the case study with Pietro Cambiaso and Sarah Recinto at IEUA

[27] Id.

[28] Conversation with Pietro Cambiaso, Deputy Manager of Strategic Planning and Resources at IEUA on December 21, 2020.

[29] Utility Dive. AMS installs 3.65 MW of battery storage at California water agency. October 24, 2016. Available at: https://www.utilitydive.com/news/ams-installs-365-mw-of-battery-storage-at-california-water-agency/428830/

Photo credit: IEUA

Figure 4. One of Four IEUA Facilities with Renewable Energy and Batteries in San Bernardino County, California

Key Findings

This project was structured so the normal day savings offset the upfront costs. The primary goal of this project was to reduce power demand resulting in utility bill savings. Cost effectiveness was assessed to ensure the savings outweighed the costs. As a result, ratepayers experienced net savings immediately.

A significant benefit of the project is the grid stability and flexibility it offers. Governor Newsom recently issued an executive order to free up additional energy capacity during the hours of 3 P.M and 10 P.M due to the heat wave in August 2020. IEUA modified its recycled water pumping schedule and shut down the dewatering operation, reducing the facility load by more than 2 MW during the heat wave. Onsite energy storage was also deployed to reduce the facility energy demand from the electric grid by an additional 1 MW. IEUA action provided support to the electric grid and Southern California Edison, reducing the need to implement further rolling blackouts.

Resilience was not a specific goal of this project since IEUA experienced several shorter-duration outages each year and has yet to experience a longer-duration outage. Since the project was installed, interest in resilience has increased with the threat of wildfires and associated risks of electricity outages meaning resilience may be a goal moving forward. Regarding resilience,. IEUA maintains backup diesel generators at each site that can provide power for critical uses. However, air quality regulations limit IEUA's use of its fossil fuel generators due to issues with air quality and pollution in the region.[30]

Furthermore, the interconnection agreement with SCE requires IEUA to shut down all on-site power generation and energy storage in the event of a power outage, precluding IEUA from using its renewables and batteries during any outages. It may be possible for IEUA to change some equipment at the site and the interconnection agreement with SCE to allow its cleaner, on-site generation to operate during outages and IEUA is in conversation with the electric utility to determine whether to pursue these updates. SCE has cited the process of implementing a microgrid to be complex with safety as a key priority in discussions to date. Additionally, SCE may potentially require IEUA to bear any additional costs to upgrade grid infrastructure in support of this functionality. IEUA is working closely with SCE to gather necessary details about the potential costs and possible incentives to determine whether they would be reasonable given the frequency and duration of both recently experienced outages and possible future outages.[31]

2.5. Housing for more Vulnerable Populations

L+M Development Partners acquired the Marcus Garvey Apartments in the Brownsville neighborhood of Brooklyn, New York in December 2014. The 32 low-rise apartment buildings on nine city blocks contain 625 affordable residential units. The apartments were also due for major renovation in 2014. An evaluation determined that new wiring and transformers were needed. The buildings had electric heat and were master-metered which made them good candidates for grid-connected solutions such as a microgrid, as this type of project could help L+M save on operating costs.

Severe grid constraints also increased the appeal of a microgrid, along with other solutions. The substation serving Brownsville had an "energy demand 69 megawatts beyond what it [could] safely provide."[32] The area was prone to frequent rolling blackouts. To defer the need for a new $1.2 billion substation, local utility ConEd developed the Brooklyn Queens Demand Management (BQDM) program allowing a portfolio of non-wires solutions to apply for incentives. The New York Public Service Commission (PSC) set aside $200 million for BQDM projects and allowed costs for approved projects to be recovered in rate base. For BQDM to work, many projects would need to enroll in the program.

The 1.1 megawatts of rooftop solar, 300-kilowatt (1.2-megawatt hour) lithium-ion storage, and 400-kilowatt natural gas-powered fuel cell microgrid at Brownsville has been operational since spring of 2017. On blue sky days, the microgrid provides demand charge savings while increasing the utilities' renewable power generation. On black sky days, the project powers a small base location for providing services with heating and cooling, cooking, and phone and computer charging capabilities. The project also provides 12 hours of supply for the main offices and the site's security system.

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[30] South Coast AQMD Rule 1110.2

[31] Conversation with Pietro Cambiaso, Deputy Manager of Strategic Planning and Resources at IEUA on December 21, 2020.

[32] Anzilotti, Eillie. Fast Company. July 25, 2018. *"These apartments' microgrid is a lesson in urban resilience."* https://www.fastcompany.com/90202972/this-apartment-complexs-microgrid-is-a-lesson-in-urban-resilience

Photo credit: Google Earth

Figure 5. Microgrid at Marcus Garvey Apartments in Brooklyn, New York

To make the project economically viable, the many project funders coordinated diverse value streams to cover their costs. This coordination was a complicated process. Because the project did not initially start as a microgrid, separate ownership and financing arrangements were ultimately made for the solar panels, the batteries, and the fuel cell. L+M purchased the roughly $1.6 million in solar panels and received a $460,000 grant and approximately $504,000 in federal tax incentive credits.

Later, and part way through the solar panel installation, L+M engaged GridMarket's service to search for a battery expert, which it found in Demand Energy.[33] For the resulting 20-year storage-as-a-service agreement, Demand Energy formed a special purpose entity and L+M created Marcus Garvey Partners LLC (Partners) to take advantage of a shared savings model. Demand Energy was able to purchase the $1.25 million energy storage system with a 10-year loan from a green bank. The shared savings arrangement involved using energy savings to pay down the loan, the Partners paying a monthly service fee, and an end-of-year reconciliation where any demand response revenues and demand charge savings were split 45/55 between the Partners and Demand Energy's special purpose entity. Bloom Energy installed the fuel cell under a 20-year Power Purchase Agreement.[34]

The project successfully applied to the BQDM program and received a $540,000 incentive that ConEd disbursed over three installments. Notably, BQDM does not allow for grid export of energy, so the solar panels cannot garner net-metering credits.[35] The project also qualified for two ConEd

[33] Demand Energy has since been acquired by Enel.
[34] Subsequently sold to Terraform Power, which is the current owner.
[35] Per a conversation with Elan Blum of L+M Development Partners on June 4, 2020, solar production is consumed by residents on site and is curtailed about 5% of the time as a result of the net-metering restriction.

demand response programs (Commercial System Relief Program CSRP and Distribution Load Relief Program or DLRP) and two NY-ISO demand response programs (Installed Capacity-Special Case Resource or SCR, Summer and Winter programs). The Partners and special purpose entity receive payments for performance from both, although they were not allowed to participate in the ConEd programs for the first two years since they were already receiving revenue from BQDM.

The monetized benefits include reduced operating costs, revenue from participating in four demand response programs, and reliable electricity for the apartments' main offices, emergency shelter, and security system. The system is designed to earn revenue from ancillary services and transactive energy revenue, which is not included in the monetized benefits. Other non-monetized benefits include improved occupant comfort due to energy efficiency and equipment upgrades, improved safety from upgraded electrical infrastructure and new lighting, community resilience, and avoided emissions and greenhouse gas reduction from pursuing a clean-fueled microgrid instead of building a new substation. This project did not prevent the building of a new substation by itself but was one of many projects that led to this result. The project also helps the state meet its policy goals and the utility meet its goals related to demand reduction, decarbonization, and grid optimization.

Key Findings

This project is one of the first to establish the viability of microgrids for affordable multi-family housing and has proven to be financially feasible with multiple value streams. The project at Marcus Garvey Apartments came together due to several timely factors; namely, the massive upgrades required at all units when L+M assumed ownership and the ability to leverage the non-wires solution options offered through BQDM. Given that the building is master metered with electric heat and utilities included in residents' monthly rent, L+M was able to realize significant savings in operating costs which can be passed along to residents through lower rents and other benefits. The microgrid has helped the property lower its monthly operational costs by 15 to 20 percent through energy efficiency upgrades and demand charge savings. A year into the microgrid's operations L+M released plans for partnering with a nonprofit to create an after-school program, funded by savings from the microgrid.

The project also demonstrates the application of ratepayer funding through non wires alternative program incentives. Utility ratepayer funds provided through BQDM were an important source of funding for the project along with incentives from taxpayers.

This microgrid is helping to address grid constraints, though it is a small portion of the solution. Current estimates have the microgrid reducing ConEd's peak demand by 207 kW.[36,37,38]

While one of the project goals was to reduce grid reliance, resilience was not the priority. The power provided by the microgrid provides a small portion of the power needed for the site, and the emergency shelter that will receive the power cannot serve all residents.

The development of the project as separate components rather than a complete system resulted in some drawbacks. L+M did not initially set out to build a microgrid. Instead, the solar, batteries, and fuel cell were all undertaken at different junctures. Sometimes project partners did not know the new

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36 NYCEEC. *Deal Spotlight: Marcus Garvey Apartments.* https://nyceec.com/deal-spotlight/marcus-garvey-apartments/
37 A conversation with Elan Blum of L+M Development Partners on June 4, 2020 indicated that 500kW of grid congestion has been relieved.
38 State of New York Public Service Commission. July 13, 2017. *Order Extending Brooklyn/Queens Demand Management Program.* (Case 14-E-0302)

components were added. This resulted in balancing issues and poses limitations on the scalability and replicability of the project.[39] For example, L+M has plans to add three new buildings to the Marcus Garvey complex, providing 348 additional housing units in 13,400 square feet. These new buildings – located across the avenue from the existing units - will have geothermal heating and cooling and highly efficient appliances, but L+M does not plan to expand the microgrid to them.[40]

[39] Per a conversation with Nick Lombardi of Enel X on June 9, 2020.

[40] Per a conversation with Elan Blum of L+M Development Partners on June 4, 2020, the complex ownership of the multiple assets involved at the existing microgrid were cited as one reason for not expanding upon them to bring the new buildings into the microgrid. L+M has considered microgrids as an option for other LMI buildings in its portfolio.

3. FINDINGS

In this section, we summarize several core areas of strength and weakness in the case studies. We identify these areas as 1) resilience as a specific, measurable goal, 2) alignment with utility system needs (addressing siting and sizing), 3) explicit provision of community needs, 4) application of ratepayer funding, and 5) multi-project assessment and prioritization.

3.1. Resilience as a specific, measurable goal

Though resilience is commonly cited as a goal of microgrid projects, resilience was not the primary goal of several of these projects. The projects where resilience featured prominently as a goal included the City of Portland's Fire and Rescue microgrid and HECO's microgrid at Schofield Barracks. The City of Portland's microgrid was the only one that mentioned identifying and isolating critical loads upfront. IEUA's advanced energy storage project was not islandable from the grid, which is required functionality to be called a microgrid and for meeting resilience needs. In cases where islanding was enabled, the islanding capability has not been tested to ensure it will work in the event of an emergency, as is the case with GMP's Stafford Hill Solar Farm and Microgrid. Further, resilience benefits were not captured in cost-effectiveness analyses for any of these projects. Lastly, project proponents generally did not plan to measure or report resilience performance after the projects were built. Thus, even when resilience benefits exist, they are not represented in the accounting.

3.2. Alignment with utility system needs

Projects were often, but not always, sited in areas to maximize the benefits of avoiding or deferring alternative investments for the utility system and its ratepayers. The BQDM incentive program in New York is an example of a utility and its regulator providing strong guidance and direction on siting in their service territories and helping project proponents and regulators prioritize project locations based on an assessment of grid impacts or the opportunity to provide grid benefits at those locations. GMP also received some insight into regional transmission constraints that its project was designed to help alleviate. Though IEUA has responded to state orders to free up capacity to avoid more rolling black outs, the project was not sited or designed to meet this need and IEUA did not coordinate with the utility to achieve this goal during site selection. The location of the City of Portland microgrid also did not seem to be particularly advantageous from a utility system perspective.

It seems that many projects were not of sufficient scale to properly address grid constraints and resilience needs. For example, it is unclear how the project scale was determined for the Stafford Hill Solar Farm and Microgrid and Schofield Barracks and whether additional capacity can be added at these sites.

3.3. Explicit provision of community needs

While all the case studies were selected because they could be considered critical facilities and offer some community benefit, many projects were not well designed to meet community needs in the event of an extended grid outage. For example, project proponents did not consider the potential for the Marcus Garvey Apartments to serve as a community resource in the event of an outage. Communal spaces and parking areas in large housing complexes can serve as distribution centers for food, water, clothing and medicine, and a charging center for phones, computers, and vehicles for those in the surrounding neighborhoods. Also, Schofield Barracks signed a contract with HECO to receive 100 percent of the output of its microgrid during an extended outage. While the communities' needs for safety and security were considered and provided for, the economic and public health impacts to communities in the event of an outage were not addressed by this project. On the other hand, the City of Portland's microgrid was designed to meet specific community needs and the City contributed substantial funds to the project to support implementation.

3.4. Application of ratepayer funding

Utility ratepayer funding was used in all these cases we focused on in this report to support benefits provided on normal days, and often in combination with other sources such as taxpayer funding. This report identifies several models that can be used to replicate microgrid deployment at scale including: 1) electric utility-owned and operated microgrids as shown in the HECO and GMP examples, 2) water utility-owned and operated microgrids as shown in the IEUA example, 3) electric utility non-wire alternative incentive programs to support ownership by third-party project developers as shown by the Marcus Garvey Apartments example, and 4) community-owned microgrids receiving ratepayer support as shown by the City of Portland example.

3.5. Multi-project assessment and prioritization

Though an important starting point, all the case studies represent one-time, single microgrid projects. There is no evidence that a portfolio of project proposals, including alternatives to microgrids such as grid hardening, were examined and prioritized for implementation. Utility service territory-wide assessments of the probability and potential consequences of various threats for communities and facilities were not made publicly available if they were conducted at all.

In summary, experience shows that resilience investments such as microgrids can be funded by ratepayers when the load to be served is critical, needs beyond the host customer (such as utility and community needs) are met, the normal day benefits of the project exceed the costs, and other funding sources can be applied to cover all, or a portion of the additional costs related to resilience. Additionally, strategically directed and properly planned portfolios of resilience-improving investments, rather than infrequent one-off projects, will likely be required to add resilience to the utility system.

4. NEXT STEPS

Implementation of individual demonstration projects provides important insights for development of utility system-wide resilient public purpose microgrid service strategies, project design guidance, and funding sources and levels. In this section, we translate these findings to actions for regulators, utilities, communities, and other stakeholders.

4.1. Regulators

Resilient public purpose microgrid project proposals could be stronger with direction from regulators, including utility system requirements related to siting and sizing and availability of ratepayer funds. Regulators can provide guidance for utilities and project proponents to refer to as they develop microgrid project proposals that are resilient and serve a public purpose. The taxonomy of project types that we outline herein can help evolve proposals from individual projects to suites of solutions. Regulators can reach out to utilities, communities, project developers, and other stakeholders for input as they develop this guidance.

Regulations can ask the following questions of these parties:

- How much of a priority is resilience for this jurisdiction? On what data/information/logic, can we base this prioritization?
- How can project proponents prove that the solution they are advocating for is the best solution?
- How many projects are needed/desirable? How much funding should be made available to support these investments? What is the rationale for these estimates?
- Where should the projects be sited to best support the utility system?
- What project scales are most advantageous for the utility system? What project types and uses provide opportunities at these scales? What duration of outage relief should projects at these scales provide for?
- How do we define eligible project designs? To what extent will the project be able to serve the needs when the needs arise?
- What communities are most impacted or have the greatest need for assistance? What is the best way to define who they are and how they are impacted/what their needs are?
- How often and how soon will communities be impacted? What is the best way to define the frequency and immediacy of impacts?
- Are there certain types and combinations of community services that when supported with resilient power, provide a greater community benefit?
- What building and locations provide the best community support?
- What should be considered when defining the proportion of total costs that can be supported by electric utility ratepayer funds? By other utility ratepayer funds? By taxpayer funds?
- Should other funding sources beyond ratepayer funds be required? Why or why not?

Building on the taxonomy of project types that we outline herein can help evolve proposals from individual projects to suites of solutions. Regulators can build on these inputs to define replicable, recognizable project types which can lead to development of more standardized regulatory processes and practices for ongoing project review.

4.2. Utilities

Utilities can act as project owners or support third-party project owners. We provide suggestions on both roles below.

> As project owners, utilities should take the lead on developing a complete BCA and performance metrics, including resilience as appropriate. Guidance on developing complete BCA is available in Sandia National Laboratories' report titled *Application of a Standard Approach to Benefit-Cost Analysis for Electric Grid Resilience Investments*.[41] Sandia National Laboratories' report titled *Performance Metrics to Evaluate Utility Resilience Investments* includes a menu of performance metrics for grid resilience and an Excel-based tool visualizing these performance metrics in the form of reporting templates for regulators, utilities, and stakeholders to consider.[42] Utilities should also take the lead on screening and optimizing project ideas for utility system impacts.
>
> To support third-party project owners, utilities should provide information on grid functions and challenges with communities and regulators, offer input to other project team members who can support the development of a complete BCA for new microgrid tariff structures. and share performance metrics that they use for projects they develop in their jurisdiction. Utilities should assist team members with screening and optimizing project ideas for utility system impacts. Utilities should also inform project teams about state and local legislation and policies and relevant electric utility regulations.

Utilities can also take the lead in proposing rate structures or riders to collect costs from ratepayers. Rate structures can leverage benefits in the BCA to substantiate ratepayer contributions and allocation of costs to different parties.

4.3. Communities

Community leaders should be included as members of project teams. These representatives can help to characterize threats and quantify consequences, clarify interests and priorities, provide project funding support, and assist with project screening, prioritization, and design. Communities can inform the questions around what are the critical service categories that are hardest to obtain during the next outage. Communities can also provide data and input to regulators and utilities to avoid or minimize lost opportunities, including supporting complete BCA calculations and performance metric development, informing regulatory guidance by advocating for project ideas relevant to their jurisdictions, and maximizing resilience investments within reasonable bounds for cost-effectiveness.

Communities can provide data as well. Sandia National Laboratories' report titled *Performance Metrics to Evaluate Utility Resilience Investments* includes a discussion of roles and responsibilities in developing

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[41] Sandia National Laboratories. 2021. *Application of a Standard Approach to Benefit-Cost Analysis for Electric Grid Resilience Investments. https://www.synapse-energy.com/sites/default/files/Standard_Approach_to_Benefit-Cost_Analysis_for__Electric_Grid_Resilience_Investments_19-007.pdf*

[42] Sandia National Laboratories. 2021. *Performance Metrics to Evaluate Utility Resilience Investments.*

performance metrics for grid resilience, including for communities and other stakeholders.[43] Projects seeking some ratepayer funding for resilience should be able to demonstrate benefits to one or more communities and that the benefits flow to many members of these communities. Regulators should know the proportion of ratepayers in the community that are expected to benefit from the solution and how much they are expected to benefit; communities are well-positioned to help with this important task. Community leaders can also represent groups or demographics of people who are disproportionately favored or conspicuously absent from discussions.

Lastly, communities can inform utilities and regulators of federal, state, and local legislation, policies, and funding sources relevant to these projects. For example, project designs in states with renewable portfolio standards should demonstrate consideration of qualifying resources. Grant funding for economic development, resilience, or equity initiatives may also be available to communities.

4.4. Other Stakeholders

Other stakeholders include companies, organizations, experts, and individuals who are not project proponents but have important perspectives to share. These participants can advocate for important outcomes such as resilience, sustainability, customer rights and protections, equity, and or environmental justice. These participants can also be research institutions who can work with utilities and others to conduct new research and analysis to fill gaps in current understanding.

There are many opportunities to advance resilient public purpose microgrid project development and regulatory review, to the benefit of regulators, utilities, communities, and other stakeholders. With explicit guidance from regulators, project proponent teams including utilities and communities can propose better projects, and more of them. Project types that are well defined and broadly replicable can streamline regulatory review. Projects that excel at achieving key regulatory objectives should be eligible for ratepayer contributions to cover a portion or all the costs. Regulatory proceedings including, but not limited to, integrated system planning, grid modernization, and non-wires alternatives can then focus on the level of ratepayer contribution and cost allocation to different beneficiaries through novel rate designs.

[43] Id.

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