Municipal Vulnerability Preparedness Program Action Grant Case Study: **Chelsea, Massachusetts**

Municipality: City of Chelsea
Project Title: Battery Energy Storage and Solar at Chelsea City Hall
Award Year (FY): 2022
Grant Award: $624,000.00
Match: $211,892.25
Match Source: $56,892.25 (In-Kind), $155,000.00 (Cash)
One or Two Year Project: Two Year
Municipal Department Leading Project: Housing & Community Development
Project Website URL: https://www.chelseama.gov/community/community_microgrid.php

Community Overview

The City of Chelsea, with a population of 40,787 residents, is an Environmental Justice[1], minority-majority community located north of the City of Boston. The Chelsea and East Boston are an energy distribution island, where the surrounding infrastructure is managed by National Grid, being more susceptible to electricity service interruptions in the event of a climate event. With major food produce and logistics facilities, road salt storage and distribution, as well as fuel storage for Boston Logan Airport, the City of Chelsea is uniquely in need of energy resiliency measures to mitigate its distribution grid vulnerabilities. As electrification to meet net zero by 2050 progresses and demand subsequently rises, homeowners, renters and small businesses are the primary groups that would be adversely affected by power outages or rolling blackouts.

Project Description and Goals

The project was located at Chelsea City Hall[2], addressing continuity of operations in the event of a blackout in the local distribution grid. The battery energy storage system (BESS) will provide the building with approximately 4 hours of electricity before engaging the buildings diesel generator. The original application included the purchase and installation of a BESS and solar PV for Chelsea City Hall. After selection of the general contractor through MGL c.25A, the cost for the BESS increased significantly while supply chain difficulties due to the COVID-19 pandemic made long lead time items available for installation unattainable.

The developments described above compelled the team to amend the original scope of work to not include installation of the BESS, while solar PV in the building was deemed not feasible due to the existing condition of the roof. With these changes, the goals of the project included (1) purchasing a BESS to provide backup power to Chelsea City Hall and 911 critical components; (2) conducting community education campaign around microgrid technology, its benefits and use case; (3) providing information to other municipalities on Chelsea's experience with developing a cloud-based microgrid; and (4) review of design and technical documentation from owner's agent prior to execution of contract. The following table lists the tasks involved in the project:

[1] The complete population of the City of Chelsea lives within an EJ census block group (November 2022 update). (https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts#environmental-justice-maps-update-2022-)
[2] 500 Broadway, Chelsea, MA 02150

Project Task	Subtask	2 Year Task	Status
Task 0: Project Kickoff	**Sub-task 0.1** Kickoff meeting with City, EEA and Consultant	No	Complete
Task 1: Program Management	**Sub-task 1.1** Project reporting, monthly progress meetings, executive and interdepartmental coordination	Yes	Complete
Task 2: Community Engagement & Regional Coordination	**Sub-task 2.1** On the ground engagement	Yes	Complete
	Sub-task 2.2 Graphics	No	Complete
	Sub-task 2.3 Regional Coordination	Yes	Complete
	Sub-task 2.4 Regional Energy Resilience Board	Yes	Complete
Task 3: Engineering Design	**Sub-task 3.1** General contractor completion of design detailing	No	Complete
	Sub-task 3.2 Owner's Agent Services by Project Team	No	Complete
Task 4: Procurement of Long Lead-time Components	**Sub-task 4.1** Analysis and approval of final specifications	No	Complete
Task 5: Wireless Communications, Controls, & Web Access	**Sub-task 5.1** Analysis of available BESS and microgrid display systems	No	Complete
	Sub-task 5.2 Preparation of performance specifications	No	Complete
Task 6: Solar Panel & Inverter Installation	**Sub-task 6.1** Performance Specifications	No	Complete
	Sub-task 6.2 Contract Format	No	Complete
Task 9: Solar Panel & Inverter Installation	**Sub-task 9.1** Project Team oversight of procurement	No	Complete
	Sub-task 9.2 GC Design, Permitting, and Purchasing of Solar in City of Chelsea DPW Yard	No	Complete
Task 10: Implementation of Remaining City Hall & 911 Center Installation	**Sub-task 4.2** Purchase, final design and shipping of BESS (G.C.)	No	Complete
	Sub-task 10.1 Project Team completion of design details	No	Complete
	Sub-task 10.2 Final Microgrid Components	No	Complete
Task 11: Optimization of System, Training, and Hand-Off	**Sub-task 11.2** Performance specifications	No	Complete
	Sub-task 11.4 Final Commissioning Guidance	No	Complete

The BESS project met the goals of fostering strong partnerships with GreenRoots, a community-based organization with focus on environmental and climate justice. The partnership between the City of Chelsea and GreenRoots has extended since its beginning, and collaboration has been present since the inception of the Chelsea Microgrid Project. The project included community engagement with residents of environmental justice and climate vulnerable areas within the City. Engagement included education sessions around microgrid technology, its benefits and challenges, while feedback was received to understand the community's preferences for equitable deployment in residential contexts.

The acquisition and future deployment of BESS in Chelsea City Hall is intended to provide continuity of operations for nearly 4 hours during peak electricity consumption to provide the community with a safe space during a given emergency. The BESS also reduces the need to use diesel generators to provide back up power to the building, mitigating air pollution in a region characterized by heavy freight traffic and overhead airplane traffic from Boston Logan Airport. Additionally, the cloud-based microgrid system allows for peak shaving during extreme heat events, where electricity demand reaches a critical point where the distribution grid could face rolling blackouts. Peak shaving and other services to the electricity grid by the BESS mitigates the need for Chelsea and East Boston to experience rolling blackout or other demand-reduction measures that would impact vulnerable residents, namely low-income renters without generators in their respective households.

Results and Deliverables

The "Battery Energy Storage and Solar at Chelsea City Hall" project ensured the acquisition and deployment of a 250 kW/510 kWh battery to provide power at peak building consumption for approximately 4 hours. The BESS will provide $75,099 in savings the first year from the commercial operation date, by The project included drafting, submitting and receiving approval for interconnection of the BESS with Eversource through an Interconnection Service Agreement (ISA). The project, along other grant funding sources, provided the necessary resources to develop and review an Investment-Grade Audit (IGA) with all associated costs and benefits consolidated into a proforma developed by Ameresco. The project also resulted in design documents for battery placement, conduit and wiring, while Synapse Energy Economics and rest of the microgrid partners providing performance specification and commissioning documentation for construction and implementation of the technology.

Lessons Learned

The Chelsea Microgrid Project is an innovative initiative that has not been implemented in other municipalities of Massachusetts, making the implementation of this technology within an Environmental Justice community extremely important to develop a proof-of-concept for future deployment.

- ***Appropriate procurement method***: Procurement of a general contractor with expertise in microgrid technology will largely depend on the scope of the project. Some municipalities may want to institute a microgrid in only a few buildings and not interested in expansion of a cloud-based network. For scenarios with limited deployment, MGL c. 30B would be sufficient to evaluate various proposals from qualified vendors to acquire equipment, construct, commission, and operate the systems if desired. Alternatively, municipalities may use MGL c. 25A to procure a qualified general contractor for the scope of work, especially if the intention is not to simply procure an arrangement in the likes of a power purchase agreement or "energy-as-a-service". Where municipalities would either like to expand the network, incorporate solar PV in addition to BESS, and hold ownership over the assets, MGL c.25A provides advantages due to the requirement of an Investment-Grade Audit and review by DOER along the process.

- ***Investment-Grade Audits as planning tools***: Understanding the capital expenditures for the scope of work, their subsequent energy savings, potential revenue streams, financing gaps and resulting cashflow of a project is an essential exercise to gauge implementation feasibility. The inclusion of a proforma that incorporates these items in addition to amortization throughout the useful life of a project's assets is key to making an informed decision. Municipalities can leverage IGAs for each facility they are interested in deploying BESS and/or solar PV, giving a clear picture of the most feasible projects and enabling the development of a timeline for the creation of a network. Alongside community input to create a scope of work that also meets community needs, IGAs and their respective proformas can be combined to identify if a combination of projects encompassing a variety of facilities ultimately provide a positive or breakeven cashflow in addition to resiliency.
- ***Incorporate risk into the equation:*** BESS and solar PV usually come with a manufacturer's warranty, this may include both performance and replacement. Warranties may not extend throughout the useful life of the asset, being a potential source of risk if there are no additional guarantees from another party. One mitigating action would include measurement and verification throughout the useful life of the project's assets, where if the equipment fails to provide the energy savings from the IGA, the general contractor will compensate the municipality accordingly. A second mitigating action would include ensuring replacement of the equipment, either through insurance or by incorporating the capital cost of replacement after any warranties expire as a sinking fund. Careful consideration should be given between insurance costs and capital costs in relation to the project's cashflow to select the most beneficial option.
- ***Maximize solar PV ownership:*** The current state of battery technology, demand response programs[3], distribution grid hosting capacity, and facility consumption profile may make BESS deployment financially non-competitive at the moment. In order to curtail or eliminate negative financial outcomes, solar PV should be deployed alongside BESS to defray any gaps not covered by energy savings and demand response. Ownership of solar PV systems may increase the total capital costs of the project but do provide additional revenues through programs such as SMART incentives in contrast to traditional power purchase agreements. Operations, maintenance, measurement and verification should be taken into account where ownership is retained by the municipality.
- ***Prioritize energy efficiency and electrification:*** Decarbonization is a key goal in order to achieve the Commonwealth's climate mitigation goals through 2050. Energy efficiency measures and electrification of current fossil-fuel-powered equipment should be prioritized before proceeding to deploy BESS and solar PV. Not only does these actions aide in reducing costs and increasing energy savings, but they allow to size the BESS in a manner that could avoid costly infrastructure upgrades and increase the number of hours of resiliency.
- ***Consolidate meters where possible:*** Massachusetts law makes it difficult for microgrids to expand taking advantage of economies of scale, primarily due to the franchise clause found in MGL c.164, where connecting various facilities with separate meters may prompt legal challenges from utilities. Due to this challenge, connecting a whole city block with a single BESS becomes unattainable, thus increasing capital costs by having to acquire multiple BESS for the same purpose. A solution to this hurdle is to consolidate meters into a "master meter" for multiple facilities not unlike a university campus. Where these consolidation can occur, especially if facilities are held by the same entity and contiguous, a single BESS may be deployed and reduce costs by kilowatt-hour of production. Reducing these costs may increase the amount of resiliency hours a project can achieve for continuity of operations.

[3] The ConnectedSolutions and Clean Peaks program are major sources for BESS demand response participation.

- *Evaluate financing options:* Municipalities should evaluate how to finance any gaps for their respective projects. Traditionally, bonds have been used to finance large capital projects and is a familiar procedure for municipal employees. An alternative are tax-exempt lease/purchase agreements (TELP), where a bank provides the financing at a fixed rate, usually encompassing part of the useful life of the project. Careful consideration on how interest rates and debt service impacts the overall cashflow of the project should be taken into account when deciding which financing method to select.

The best way for municipalities to know more about the Chelsea Microgrid Project is to meet with municipal staff and partners. The team looks forward to provide information and insights on the project for interested stakeholders. Documentation related to the project is also available for review and discussion to provide clarity and

Partners and Other Support

- GreenRoots
- Synapse Energy Economics
- Clean Energy Solutions
- Climable
- GDT Engineering