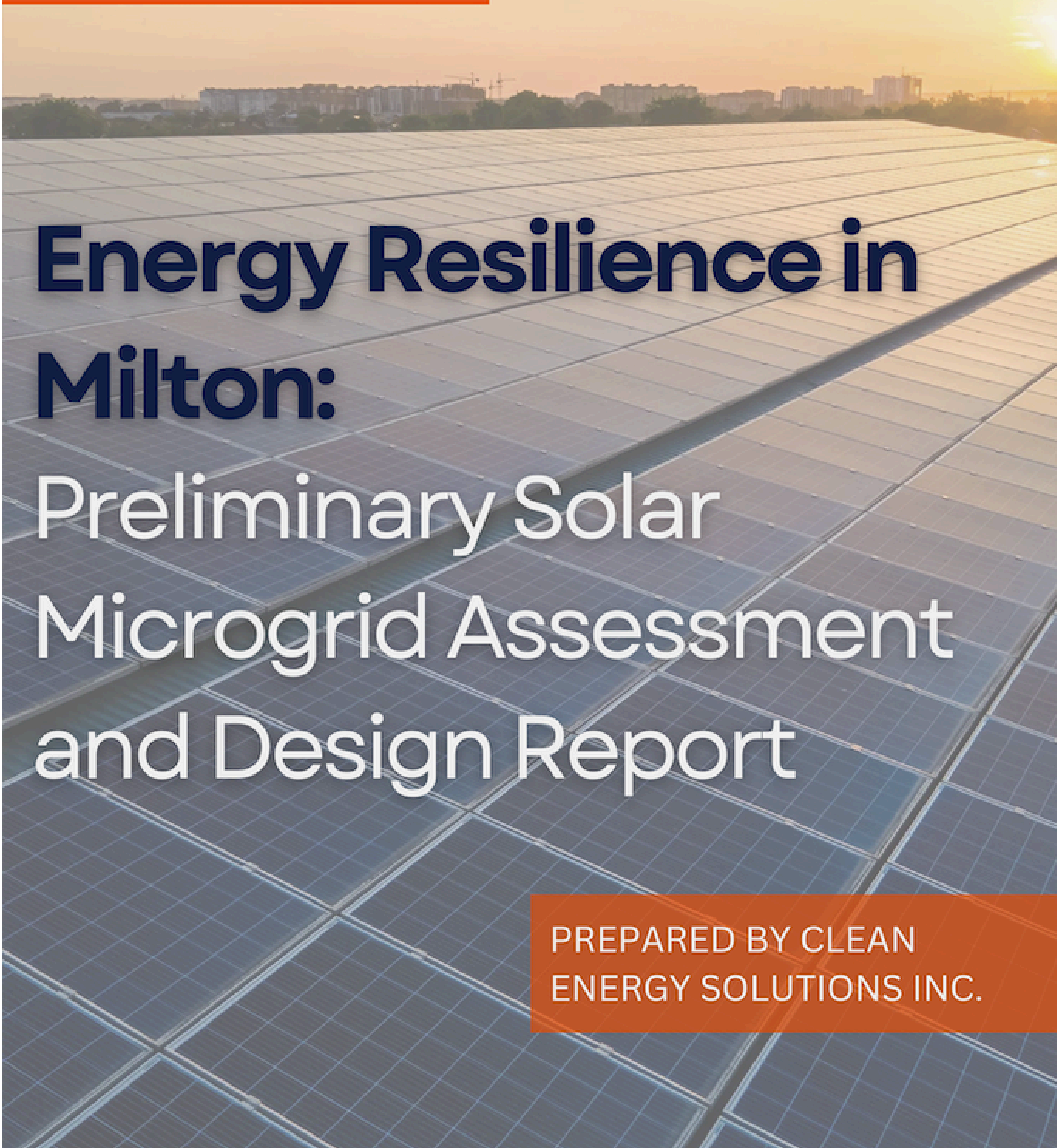
MARCH 25TH, 2024



# Energy Resilience in Milton:

## Preliminary Solar Microgrid Assessment and Design Report

PREPARED BY CLEAN ENERGY SOLUTIONS INC.

Prepared For
**THE TOWN OF MILTON & MRE INC.**

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## 1. Executive Summary

In this report, CESI will assess the feasibility and recommend design of a microgrid[1] for the Town of Milton and the Winter Valley Residences managed by MRE Inc. We will outline (1) the full range of benefits that a "microgrid without borders" can provide; (2) the innovative design elements CESI recommends and their applications to Milton, (3) the location and electric demand of the facilities that will be included in the microgrid, (4) opportunities for financial and environmental savings from energy efficiency (EE), electrification, solar and storage installations; (5) the costs and financing behind the microgrid, and (6) next steps recommended for the town and MRE.

Through its analysis, CESI has determined the potential sizing and location of a solar microgrid that would include the Town Hall, Police Department, and the six buildings at Winter Valley Residences Inc. To cover the total energy and resiliency needs of these locations CESI recommends a microgrid that will include 405 kWw of installed solar PV through a combination of rooftop, ground mount, and canopy solar, as well as 382kW of installed battery energy storage system (BESS) assets across the three facilities. The total cost of this project is estimated at $1,996,000 in total. However, with the existing incentive structures at both the federal and state levels for solar energy and storage, a significant majority of the project will pay for itself over the next 10 years. The gap in the total dollar value of the estimated up-front cost of an installation that cannot be amortized over this 10-year payback period is referred to as the "resiliency gap" for a given project. Using a parametric model developed by CESI, it has been determined that the resilience gap for this project is only 21% of the total project cost ($419,160). Given these findings, CESI is confident in the feasibility of a microgrid and the benefits that it will provide to the community.

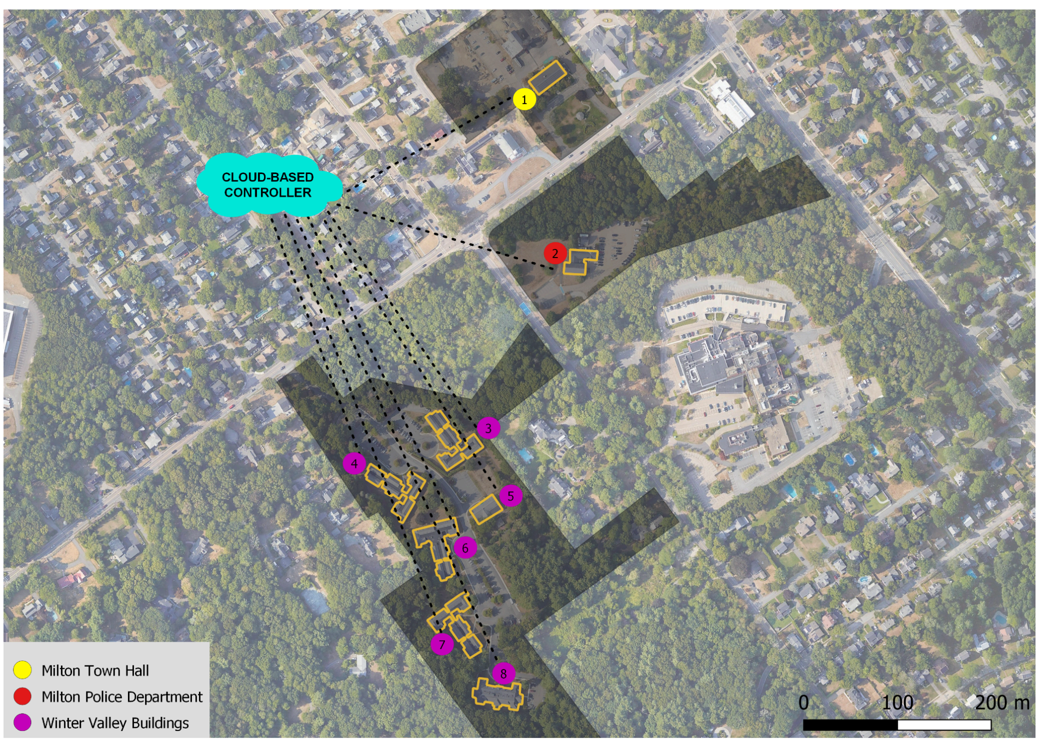
[1] The design recommended for Milton and Winter Valley is a "virtual microgrid" in the sense that the participating facilities are networked wirelessly via a cloud-based controller, rather than via wires connecting the facilities. This is called a "microgrid without borders" and its benefits are described in Section 4 of this report.

## 2. Introduction/Rationale

As extreme weather intensifies under climate change, it falls increasingly on municipalities to take preparedness measures to avoid future losses from these events. Through their hazard identification and planning processes, the Town of Milton has identified four major hazards associated with climate change that pose a potential threat to the town and its residents: intense storms, flooding, heat waves, and drought. As part of the town's intention to become an MVP community, listening sessions and workshops were held to identify priorities from the plan and discuss solutions. Out of these MVP workshops came a list of five priorities of which the desire to "complete a feasibility study of microgrid power and renewable energy options for the town" was tied as the third highest priority. In response to this momentum behind a microgrid, the Town solicited consulting assistance to make a community microgrid a reality. Clean Energy Solutions Inc. (CESI) was selected from this procurement process to author this study analyzing the potential for a microgrid. The study was funded by a $50,000 grant to the Town from the Metropolitan Area Planning Council (MAPC)'s Accelerating Climate Resilience Grant Program. The final deliverable from this initial round of funding, as identified in Milton's contract to CESI, is this report which outlines the potential, need, physical and financial feasibility, and location of a multi-building community microgrid in the Town of Milton.

The envisioned first phase for the Milton microgrid will begin in three locations: Town Hall, the Police Department, and the six buildings at the Winter Valley Senior affordable housing community, as visualized in Figure 1 below.

*Figure 1: Siting and Location of The Three Critical Facilities*



Each of these locations has distinct energy and resilience needs, varying loads and capacity, and feasibility for siting. Winter Valley, in particular, was chosen in fulfillment of Milton's commitment to serving environmental justice populations as Winter Valley is located in Block Group 4, Census Tract 4161.0, which is a designated environmental justice community based on the average household income being at 52% of the median in Massachusetts. By protecting seniors and emergency response teams from climate-related infrastructure failures, Milton seeks to be a resilient town for all its residents, in the face of climate change.

As we look forward as a society towards rebuilding our energy systems in the face of climate change, there is an opportunity to create new energy designs that can respond to a myriad of challenges at once. There is a need now for energy that is not just renewable, but also resilient, and equitable. Above other system designs for renewable energy, microgrids are uniquely positioned to fill this gap. Defined by the Department of Energy as a "group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity concerning the grid"[2], microgrids are distinguished by their ability to both connect to the larger electrical grid and operate independently when the grid fails. This provides the locations included in the microgrid with power throughout the average duration of an outage, ensuring vital services such as wifi, cellular service, lighting, and more, are assured in the face of future challenges.

The generation method for a microgrid can vary from site to site, but the vision for Milton is to develop a solar microgrid with battery storage. The full design concept is outlined in Section 5. By operating on both the supply and demand side of energy production, microgrids provide and monetize several benefits that other forms of renewables are unable to. Oftentimes in climate resilience conversations, "silver buckshot" solutions are suggested- ideas that can address multiple issues at the same time. Microgrids are one of these ideas because they can fill gaps left by other forms of renewable energy. Rooftop solar, for example, is beneficial in that it reduces our reliance on fossil fuels, but it is largely inaccessible to renters and low-income customers and does not in itself confer resilience. Similarly, community solar, while more accessible and equitable, fails to meet the resiliency needs that climate change will impose on communities.

Microgrids are a solution that exists at the nexus of these challenges, providing a series of key benefits to environmental justice communities. Some of these benefits include (i1) Resilience; (2) Cost savings; (3) Job opportunities and training; (4) Energy ownership and democracy; (5) Energy efficiency/home improvement; and (6) an interest in addressing climate change. The financial and technical feasibility of Microgrid systems has been explored in depth, with white papers being produced as a part of the Department of Energy's Microgrid Research and Development Program[3] as well as regular Microgrid Knowledge reports[4]. With microgrids, we can

[2] https://www.energy.gov/eere/amo/articles/combined-heat-and-power-technology-fact-sheet-series-microgrids#:~:text=A%20microgrid%20is%20a%20group,with%20respect%20to%20the%20grid.

[3] https://www.energy.gov/oe/microgrid-program-strategy

[4] https://www.microgridknowledge.com/resources/reports

envision an energy revolution where communities own their energy and where this energy is renewable, resilient, and affordable to all.

## 3. Background

As the reliance on fossil fuels puts pressure on energy generation and distribution systems to become carbon-neutral, governments at every scale are increasingly searching for innovative ways to generate energy that is not only renewable but also resilient to future challenges. Further, federal, state, and local level governments are increasingly realizing the inequalities associated with how climate change is experienced. For decades it has been shown that environmental justice communities have borne the brunt of the damages associated with climate change. Massachusetts has made its own commitments to a carbon-neutral commonwealth by 2050 and has advanced policy solutions that heavily incentivize the development of solar energy to help service this goal. As a result, solar is the most heavily incentivized form of renewable energy in Massachusetts today making microgrids more feasible than ever before.

In October 2023, Milton was named in the top 20 best small cities in America alongside its comparable peers - Lexington, Melrose, Needham, and Arlington. As a town, Milton is akin to these towns which share similar developments across health, education, and safety but is underperforming by comparison in terms of sustainability[5]. In an urban analysis that studied 40 towns across 19 indicators such as - 'Reduced its municipal energy usage by 20 percent in five years', 'Conducted an emissions inventory', 'Adopted Massachusetts "Stretch" Code', 'Adopted a Building Energy Reporting and Disclosure Ordinance (BERDO)',' Committed to a specific climate goal by a specific year' amongst others, Milton scored 15 ranks behind its peers. Despite the town's momentum as a 'Green Community' since 2010 with celebratory work towards energy efficiency, there are still several environmentally friendly efforts aimed at improving the quality of life for all residents that Milton can pursue.

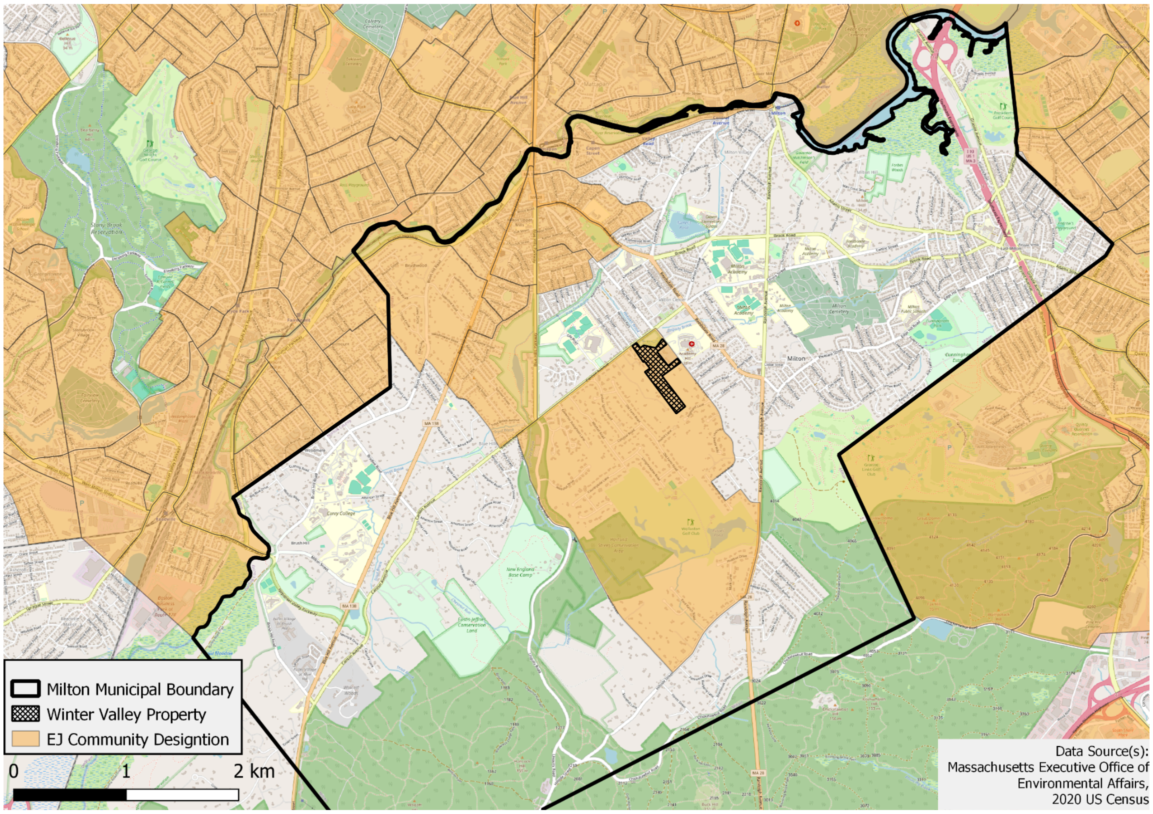
Environmental justice (EJ) is the equal protection and meaningful involvement of all people and communities concerning the development, implementation, and enforcement of energy, climate change, and environmental laws, regulations, and policies and the equitable distribution of energy and environmental benefits and burdens. There are a total of 1,838 EJ block groups in Massachusetts, accounting for nearly half of the state-wide population. Yet, even in Massachusetts, it has been shown that Black and Hispanic-majority census tracts have deployed less solar compared to other non-majority tracts. In the country, 47% of Black-majority census tracts have no existing solar installations at all, nearly double that of Hispanic-majority tracts (24%) and White-majority census tracts (21%)[6].

[5] Analysis by Mark Dellula (2021) - The Top 10 Greenest Towns in Massachusetts - Boston Magazine - https://www.bostonmagazine.com/news/2021/04/22/green-town-ranking/#indicators

[6] Sunter, D. A., Castellanos, S., & Kammen, D. M. (2019). Disparities in rooftop photovoltaics deployment in the United States by race and ethnicity. Nature Sustainability, 2(1), 71–76. https://doi.org/10.1038/s41893-018-0204-z

As visualized in Figure 1, there are 24 block groups in Milton, eight of which are identified as EJ block groups due to meeting either the income threshold, the minority population threshold, or both, which represents about 29% of Miltonians[7].

*Figure 2: Map of Milton's Environmental Justice Community Designations*




Municipalities have special opportunities to reach EJ neighborhoods with solar-related benefits, including cost savings, environmental stewardship, energy resilience, and a voice in their energy sources and delivery. Milton has been a designated Green Community since 2010 and has committed to reducing its carbon footprint by 50% by 2030. This commitment to environmental justice, a just energy transition, and addressing climate change are values that are deeply mirrored by CESI and played a significant role in the designing of this microgrid.

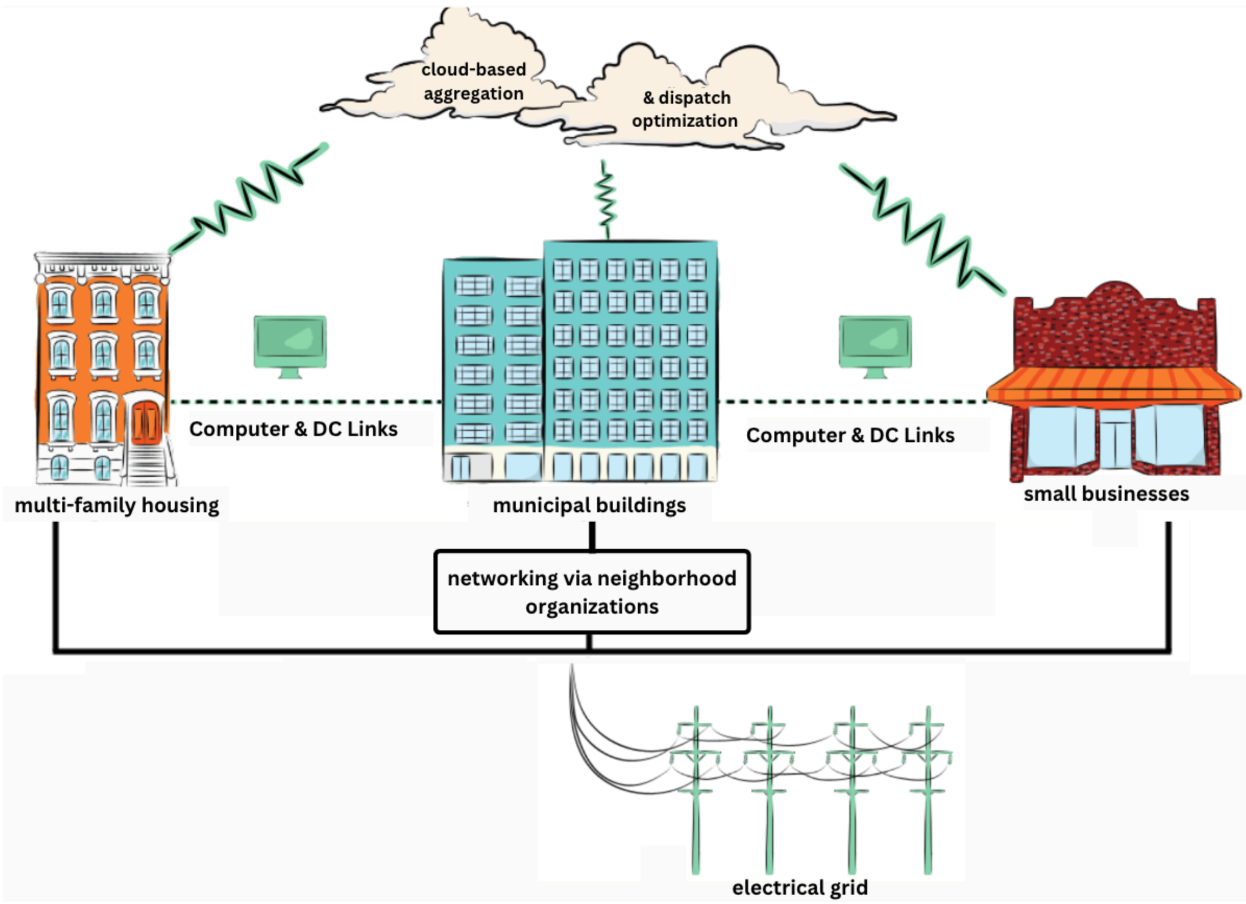
## 4. The Microgrid Without Borders Design: Original Concept

In a traditional microgrid, as would be typically seen on a college or hospital campus, the included buildings are electrically contiguous. The wires that connect them, usually owned and maintained by the local electric utility, allow the microgrid to share generated energy within its system while also connecting to the larger grid and its local storage capacity. While this design achieves the desired resiliency needs of the immediate area, it falls short in terms of its

[7] https://www.townofmilton.org/1088/Environmental-Justice

adaptability to urban areas, expansion potential, and applicability to individually metered tenants. Further, the microgrid's interconnection with the larger electric grid imposes burdensome bureaucratic barriers to the microgrid's development. In response to these challenges, CESI has designed an innovative microgrid structure that includes adaptable siting for urban areas, maximizes available state and federal incentives, and provides the desired resilience outcomes of a traditional microgrid. This design, a "Microgrid Without Borders™" (MWB), is a microgrid innovation in which buildings are virtually contiguous and "connected" only through cloud-based controllers, as pictured in Figure 2 below.

*Figure 3: Microgrid Without Borders Configuration Diagram*




In the Microgrid Without Borders design, energy is generated through photovoltaic arrays (PV) located on each building within the microgrid, sometimes shared among a collection of buildings on one site. An inverter converts the energy generated by the solar panels from direct current (DC) to alternating current (AC) energy that can be used by regular appliances. When energy generation from the solar exceeds the load of that building, the excess is either stored in on-site batteries or exported to the grid if "net metering" is enabled. The energy stored in these batteries can then be discharged to support the building's electric loads in the event of an outage.

The inverter and batteries may also be connected to the larger grid so that the microgrid can either remove electric load from the grid or inject renewable energy into the grid, depending on need. For this dance of load bearing and generation to take place, an automatic transfer switch (ATS) is installed to sense current and switch the local load between its stored solar generation and the grid's power as required.

In Massachusetts, there are incentive structures in place that reward both the load-bearing and generating capacity of a microgrid. To maximize capital return from these incentives, the ATS will automatically shift the building's load to local power when grid power fails. It also works to shift load from the grid to the microgrid batteries during "peak" hours when the load on the grid should be reduced. These priorities are coded into and managed by the microgrid's controller. The controller reads the available power and state of charge from each potential source: the solar panels, the grid- through utility meters– and the batteries. It then can make decisions about how to achieve resiliency while maximizing incentives for each site within the microgrid.

Within the MWB, instead of physically wiring the buildings included in the microgrid together, they are connected virtually through the controllers which communicate with each other through the cloud. In urban areas, the potential generation capacity of the microgrid is typically limited by the amount of space available but the MWB design alleviates this burden by removing the requirement that all the energy-generating assets be physically located at the site where that energy will be consumed. Further, the virtual nature of this microgrid design allows it to expand upon itself without being limited by physical wiring. To expand on the microgrid, an additional facility needs only to install an on-site controller and accompanying ATS that can connect virtually to the rest of the microgrid network, along with whatever capacity of energy generating and storage assets are required for that location. Drawing on lessons from a community-shared solar (CSS) design, the virtual microgrid can accommodate energy generation that occurs off-site while still providing resilience to facilities that require it through their installed battery storage.

In a typical CSS design, a solar garden is constructed by a solar developer, and customers can subscribe to a portion of its production. The energy generated by their share of the panels or production is not consumed directly. Rather, it is fed into the larger grid and recorded by a third party so the subscriber can claim their share. Subscribers receive credits on their utility bills in proportion to the production of the community solar project and their subscription size. These credits are priced so that subscribers see savings on their monthly bills from their subscriptions. The result is that solar energy and the savings that can result from its consumption are more accessible to low-income households which are typically more likely to be renters, experience high energy burdens, and be less able to install rooftop solar. Similarly, in the MWB design energy generating assets are sited wherever possible, given space and funding limitations. The production of multiple solar installations, on roofs or canopies, can be aggregated by the cloud-based controller and shared among low-income subscribers. In this sense, a virtual solar garden is constructed that functions in the same way as a typical CSS setup. It has the advantages of sitting within the community, ownership potential, and the addition of resilience assets where desired.

## 5. Incorporating Community Choice Aggregation and Community Shared Solar: The Proposed Milton Design

There are still some limitations to the original Microgrid Without Borders design. The design should be more adaptable and flexible to various regulatory contexts, particularly municipalities that participate in Community Choice Aggregation (CCA) and may already have access to community-shared solar. It should also be configured to provide resilience to individual apartments as well as master-metered buildings. Finally, it should arrange for payment of cash equivalents to residents who may not be able to take advantage of utility bill credits. Although the virtual nature of the Microgrid Without Borders design is an innovation in itself, an expansion upon this idea could introduce a new hybrid microgrid design, ideal for the case in Milton, that pushes the state-of-the-art in microgrid deployment and resilient energy.

Therefore, the proposal for Milton is an expansion of CESI's designs and follows the Microgrid Without Borders™ model that is in the implementation phase in several other municipalities including Chinatown, Cambridge, and Chelsea. This model, the Community Choice Aggregated Community Shared Solar (CCASS) model, is designed to provide several key benefits to the community in a way that is as customizable as possible with the possibility for expansion. The CCASS model is designed to maximize the revenue-generating capacity of the microgrid and reduce bureaucratic barriers while delivering the expected resilience and renewable energy aspects of a traditional microgrid. To achieve this, the CCASS model combines policy and innovations from four policies. Expanded explanations of these are included in Appendix B. They include:

1. The Solar Massachusetts Renewable Target (SMART) program: to lock in multi-year incentives for solar energy generation, including "adders" for low-income, CS, CCA, and storage inclusion.
2. Community Shared Solar (CSS): to provide solar-derived savings and clean-energy participation to those who cannot install solar panels on their property.
3. Community Choice Aggregation (CCA): to equip municipal sponsors with the purchasing power and market access necessary to group consumers on a city-wide or region-wide basis.
4. Hybrid neighborhood microgrids: to virtually aggregate non-contiguous sites when needed while wiring when possible.

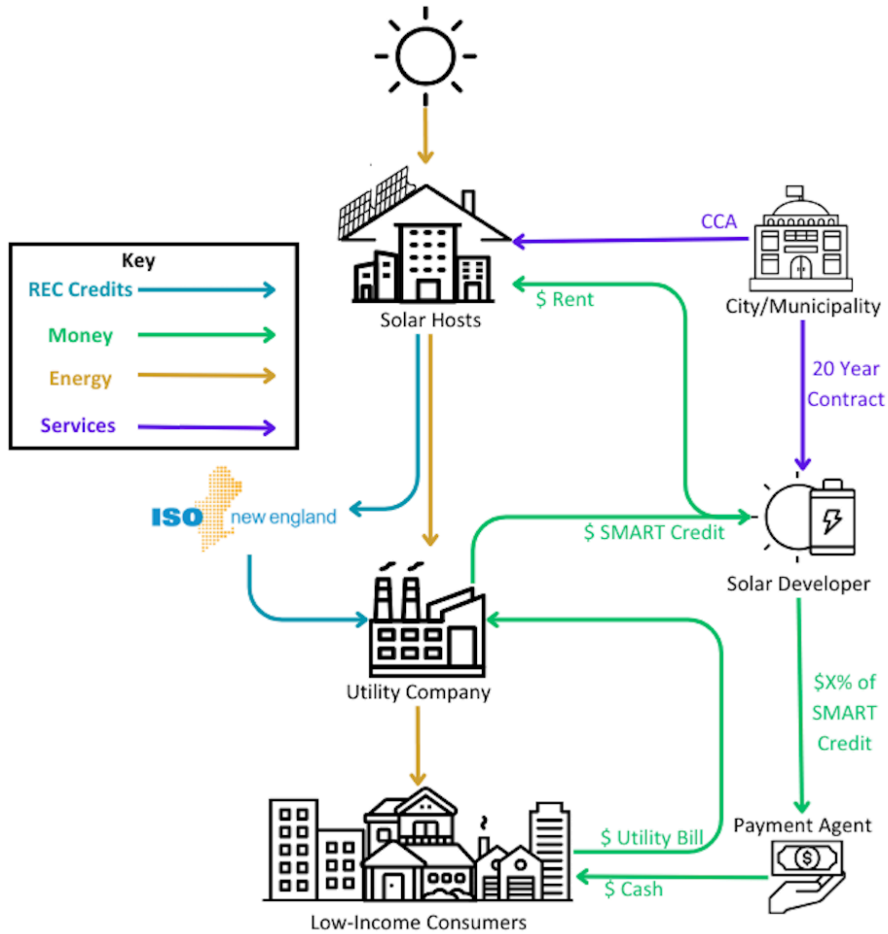
This design emerged from a recognized need to begin delivering not just energy and resilience to low-income customers, but also direct financial benefit when possible. Within existing microgrid models there arise three major challenges to delivering direct financial incentives to individually metered customers, like the residents of Winter Valley. They include: (1) the metering and wiring design of the residence's limits requires a community solar setup, (2) delivering direct financial benefit to tenants on low-income housing subsidies can potentially affect their HUD allowances, and (3) community solar bill credits do not directly affect tenants because of the complexity and credibility of their delivery. Therefore, the residents of Winter Valley may receive no direct financial benefit from installing solar panels in the facilities where they live. They can participate in “community solar” installations in Milton, however, if we name them as subscribers in that program.

In Massachusetts, community-shared solar (CSS) is enabled as part of the SMART program, which includes various “adders” to the compensation available to solar generators (per kWh of solar energy that they feed into the grid). Unfortunately, the complexity of the incentive mechanisms built into CSS imposes several drawbacks from the viewpoint of those it would benefit. The Low-Income Community Shared Solar (LICSS) incentives paid out through 2022 are only in “Tranche” 3 out of 16 available blocks, whereas CSS generators are already in Tranche 13 of the 16 available to incentivize community solar in general. The reasons for the low LICSS uptake include several disadvantages to developers and the utility, but more importantly present barriers to residents’ receipt of real value:

1. The subscriber must pay two bills each month – their regular utility bill (net of their SMART Credit) and another to the CSS developer (typically 85% of the Credit) to recover the developer’s cost of building the solar generating unit
2. The value of a utility bill credit, deducted from an already complex monthly invoice and then offset in part by an additional payment to a developer, is hard to compute and to believe.

All this competes with many other offers that besiege consumers monthly. An alternative mechanism is depicted in Figure 3 below. This model advances a new application of CSS to allow LI subscribers to access affordable, renewable, and resilient energy from a localized, aggregated microgrid while receiving direct payments from Massachusetts Solar incentives.

*Figure 4: Community Choice Aggregated Community Solar Process Map © CESI 2023*



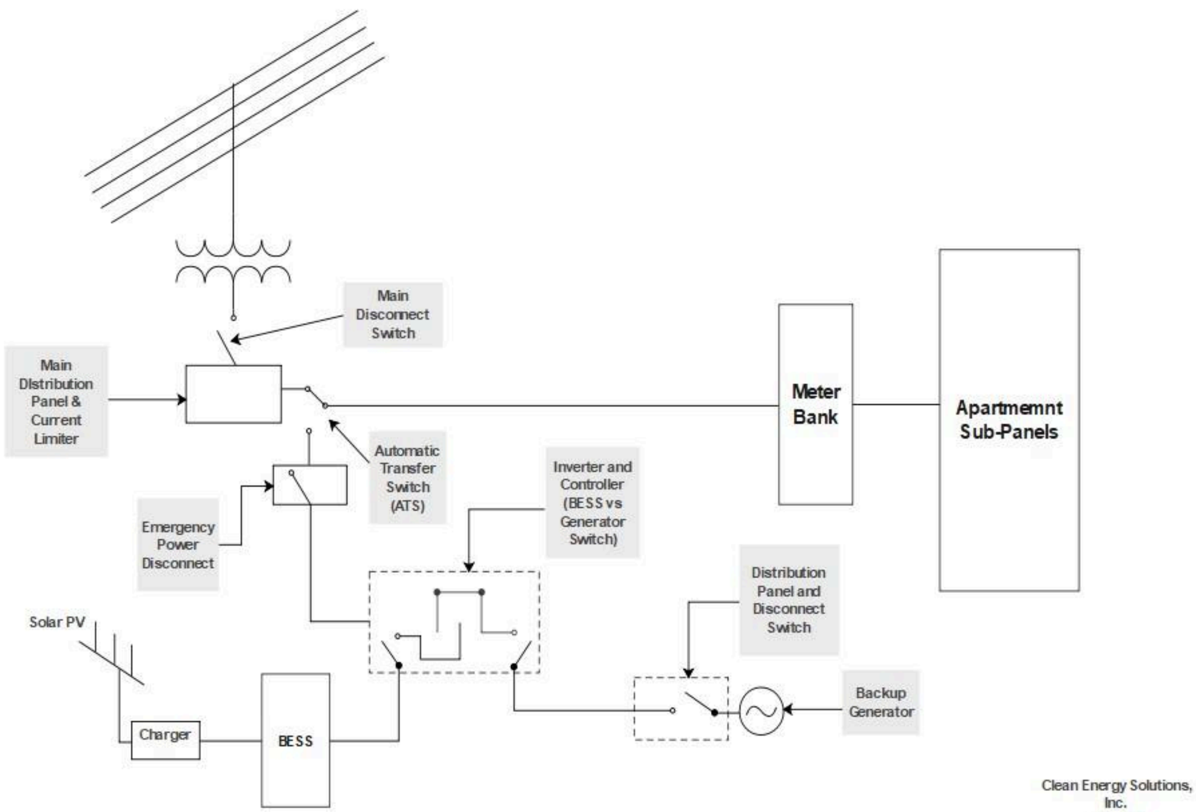

This arrangement pays actual cash (or cash equivalents, to be determined) to LI consumers, avoids double billing, and is offered by the Town and trusted developers. The developer needs only a single contract (with the Town and its Payment Agent), freeing them from marketing to multiple "off-takers." The utility need not arrange SMART credits to participants' accounts, but simply pays a monthly solar credit to the Developer and bills all customers as normal.

## Expanded Resilience: Reaching Individually-Metered Apartments

In Winter Valley, electricity consumption is metered directly to each apartment. A goal of this project is to allow all residents to "prosper in place" when grid power fails, remaining in their own homes with all power and communication functions unimpaired. This requires replacing the utility-supplied electric power with a local power supply in emergencies. When such power supplies, whether emergency generators or solar energy, are connected to the building, however, they provide resilience only to shared spaces and emergency circuits on separate "master" meter(s). Wiring backup power sources to each apartment individually is financially inefficient to the point of not being feasible given the cost and labor associated with this process. This means that residents' refrigeration, appliances, medical equipment, apartment heating and cooling, and lighting will not function in emergencies. In particular, medical equipment that residents rely on for their safety may also fail during power outages. For some residents, reaching an elevator and finding shelter in a shared space, leaving behind their support, may be very challenging.

To address this issue we propose to install, in each residential building, a special electrical connection that will supply solar power to the point where utility power normally feeds all the residents' meters. Every apartment will then continue to be powered when the utility grid fails for any reason. A schematic of this connection is shown below.

*Figure 5: Proposed Wiring For Individually-Metered Apartments*




An automatic transfer switch (ATS) senses when grid power is interrupted and when it is restored, switching all the apartments from grid power to local power and back again. Local power is supplied in such events by a battery, kept charged by the solar panels. In rare cases when the battery supply is exhausted, a generator is switched on and supplies emergency power until the solar panels can recharge the battery. A microgrid controller provides the logic for this switching. All participating buildings in Milton are networked to this controller so it can also shed the combined electrical loads during peak demand hours. That load shedding is very valuable to the utility and the environment, and so various incentives have been established by Massachusetts regulations, providing income to microgrid owners.

## Maximizing Solar Energy Deployment and Savings

The Town and Winter Valley have indicated an interest in maximizing the use of solar energy, displacing as much utility power as possible, for both environmental and economic reasons. Several limitations are standing in the way of this goal.

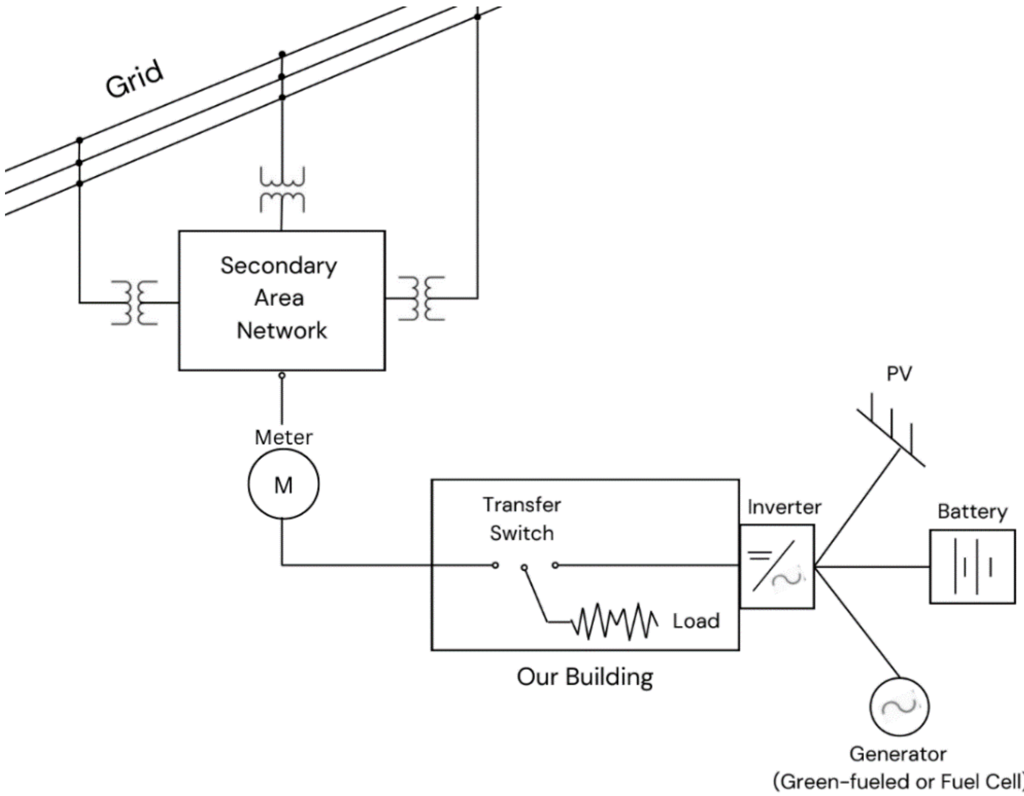
The first and most common limitation is space. Roof space is limited by shading, existing equipment on the roof, structural strength, local codes, and other restrictions. Available open space or parking appropriate for canopies is also limited at each site. In most cases, this prevents the generation of sufficient solar energy to carry all building loads and participate substantially in net metering. In Section 6 of this report, the maximum solar power that will fit on and around the initial buildings is estimated.

The potential capacity of the existing grid is another key consideration in sizing due to the potential for local grid overloading. Recent publicity has been given to the limitations of utility distribution capacity, where solar energy interconnections have been proposed. Electric utilities publish “heat maps” to indicate lines nearing capacity. Some solar developers have had to cut back on their plans, at least until the ability of the grid to accommodate their power export or demand is clarified.

Finally, expenses and delays in utility interconnection approvals can also limit the potential of a developing microgrid. When any new solar installation intends to supply its on-site load “in parallel” with grid supply, or when it intends to export power to the grid for economic reasons, an interconnection service application (ISA) must be submitted and approved by the utility before the grid connection is allowed. This always takes significant time and can in some cases delay approval beyond the developer’s tolerance. In addition, if the interconnection seems likely to require additional grid capacity, protection devices, or other accommodations, the utility may impose a substantial charge for studying the design and cost.

The key to overcoming these limitations is what CESI proposes in the CCASS model, which is the integration of CSS with CESI’s original MWB design. When space and/or local interconnection are limited, a community solar installation can allow increased solar energy to be used. In Milton, the Team intends to identify sites for CSS deployment and to consider the aggregation of multiple sites rather than the usual remote “solar garden.” This may allow increased CSS development on Town properties, and open the possibility of ownership by low-income residents. We also propose innovations in the CCASS model to overcome expensive delays related to achieving interconnection by avoiding both parallel operation and power export to the grid through no-contiguous design. That compromise loses the income from net metering and various utility incentives, but it does support demand-charge savings and some income from certain environmental credits and capacity markets. It also may make solar energy installations possible where utility approvals would prevent them. The key design element to make this possible is an automatic transfer switch, which ensures that neither parallel operation nor power export can ever occur. This allows installations anywhere on the utility grid, even on secondary area networks in dense urban settings, as illustrated below in Figure 5.

*Figure 6: Non-Contiguous Wiring Potential Design*




A third solution to solar deployment limitations is to allow their sharing among contiguous buildings. This is the design of conventional microgrids but the connection among users is via the utility grid. Connecting separately metered facilities with private wiring is considered unsafe and in violation of utility "franchise" rights.

In Milton, we have an opportunity to pilot a safe and legal design, by sharing solar and battery resources among buildings that are all on Town property. This would allow making use of space where it is available for solar and battery systems, taking advantage of economies of scale, and carrying their energy to other sites that are more limited. Municipalities have this right, but it has not been codified. CESI has supported pending legislation (S 2100 and H 3159) to do this and drafted an amendment to address utility concerns. Following is the relevant passage in the House bill as drafted by the Committees on Telecommunications, Utilities, and Energy.

"Section 1L. Distributed energy services; Microgrid operations"

For climate resiliency and mitigation, reliability, and encouragement of installation of distributed electricity generation and storage capacity, no right to exclusive service or franchise established within Section 1B or elsewhere in this chapter shall prevent a municipality, or agencies of the Commonwealth or private electric customers in coordination with a municipality, within an electric or gas company's service territory, from: (a) establishing an energy microgrid or district energy system; (b) sharing electric generation or storage resources among facilities that are contiguous and owned by the same utility customer, irrespective of the number of electric meters installed at such facilities; or (c) using public rights of way to conduct electrical conduit or other energy resources point to point where the municipality deems there is benefit from sharing energy resources."

The CESI amendment adds: "provided, however, that electrical microgrids shall not sell energy to retail customers, shall not distribute energy across property owned by others than the municipality, and shall limit any new electrical connection between utility-metered facilities to cases when such facilities have been disconnected from the utility supply of electrical energy."

There is no challenge to utility franchise rights in this legislation. Milton would not generate power for sale; would not distribute power to other customers; would not cross public ways or any other property that it does not own; and would not interconnect separately metered facilities except when they have been disconnected from the grid. The proposed design in this report will be piloted with full transparency for utilities to demonstrate the obvious right of towns to share DERs on their property.

## 6. Energy Efficiency and Demand Findings

To construct a vision for the Milton microgrid we first needed to understand the demand needs of the participating facilities. This process included visits to each location where an analysis was conducted of the energy efficiency and demands of each site. These visits and the subsequent analysis constitute what is known as an energy audit. The findings justify the financial and technical feasibility of siting energy resiliency and generation assets at Town Hall, the Police Department, and Winter Valley. Below is a summary of those findings with the full energy audit materials available in Appendix D.

Assessing the energy efficiency of a facility begins with an accurate understanding of the facility's construction, energy-consuming systems, operations, and equipment age, condition, and maintenance. An accurate picture of the historical energy consumption by month as obtained from historic utility company data is also necessary. Once understood, appropriate improvement specifications and savings estimates can be generated for various energy-conserving and renewable energy-producing upgrades, such as would be included in a microgrid. In addition, reduced greenhouse gas emissions (GHG), improved living/occupancy conditions, and the ability to minimize the electric demand that solar must serve can be accomplished. During the summer and fall of 2023, CESI staff studied the three facilities and evaluated the potential for energy efficiency (EE) and renewable energy (RE) improvements. CESI performed on-site inspections, documented, and photographed relevant existing facility conditions, and interviewed facility and Town Staff. Complete billing histories including consumption, cost, tariff, and metering type for all utilities including electricity, natural gas, fuel oil, propane, and water/sewer, were compiled for each facility. A month-to-month heating degree day and daily use comparison of utility consumption to known facility equipment efficiencies, operation profiles, and occupancy patterns was used to disaggregate likely current electricity energy and demand profiles. From that exercise, estimates of electric energy usage in kilowatt hours (kWh) and demand in kilowatt (kW) savings from both EE and RE improvements, including appropriately sized photovoltaic (PV) systems and a battery energy storage systems (BESS) at each facility were made.

To evaluate the financial feasibility of various microgrid configurations, CESI has developed a parametric model for each facility summarizing the underlying economics and assumptions behind various incentives and savings inputs (see Appendix C). The model's purpose is threefold: (1) To evaluate the initial financial feasibility and sustainability of a Milton Community Microgrid, as well as to assess the sensitivity of all relevant state and federal kWh-based incentives, (2) to support Town of Milton personnel in gaining authority to proceed with a Pilot Project for the Milton Community Microgrid, and (3) to help educate any individuals, organizations, or government administrations aspiring to create or join a community microgrid on the underlying financial structure and justification for its construction.

The models in this report are based on inputs derived from CESI's facility energy audits and energy use and cost analysis. These inputs are located and described in the Inputs tab of the attached parametric model. Cost estimates are based on NREL's current annual[8] estimate of solar PV and battery storage systems and CESI's review of the current pricing of recent projects. Inputs are available for estimated savings from EE and RE improvements, their estimated installation cost, and potential estimated annual RE revenue from various incentive sources such as DOER's Solar Massachusetts Renewable Target Program (SMART), Clean Peak Energy Standard Program (CPS), Eversource's ConnectedSolutions Demand Response Program, ISO New England's Installed Capacity (ICAP) forward capacity market credits, Eversource tariff demand reduction due to optimum use of battery storage, solar PV energy (kWh) production, and the Investment Tax Credit now available to municipalities under the federal Inflation Reduction Act (IRA). Annual expense inputs include debt service rate and term, equipment maintenance, and third-party fees necessary to recoup some of the available revenue streams mentioned above.

The model is structured to analyze one building at a time. It will solve for a simple 10-year payback and calculate any funding gap necessary to achieve it, if any, which is referred to as the "Resiliency Gap" in the Model and this report. It is defined as the dollar value of the estimated up-front cost of an installation that cannot be amortized over 10 years given all the financial assumptions inputted into the Model. Critical inputs include the: (1) estimated total project cost – as in the Summary Table below and each of the facility ProFormas, (2) loan interest rate –set at 4% in this report, (3) availability and magnitude of the federal Investment Tax Credit (ITC) – set at 30% in this report, (4) annual energy savings/revenues - as displayed in the first seven columns of each ProForma, and (5) annual project expenses - as displayed in the columns in each ProForma. Identifying the resiliency gap is a crucial step in determining the project's need for debt-free

[8] https://atb.nrel.gov/electricity/2023/commercial_pv

financial assistance from various utility, state, and federal programs. The individual model results are additive as summarized in Tables 1 and 2, below[9].

*Table 1: Parametric Model Summary, All Three Facilities*

| Milton, MA | Measure | PV kW | BESS kW | Total Cost | Amount Financed (prior to 30% ITC) | Resilience Gap Payment Required for 10 Yr Payback | Resilience Gap as Percent of Total Cost | Approximate Amount Financed (net of 30% ITC) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Town Hall** | Solar PV + BESS | 89 | 54 | $ 403,000 | $ 306,200 | $ 96,800 | 24% | $ 214,340 |
| | | | | | | | | $ - |
| **Police Department** | Solar PV + BESS | 177 | 40 | $ 484,000 | $ 411,500 | $ 72,500 | 15% | $ 288,050 |
| | | | | | | | | $ - |
| **Winter Valley** | Solar PV + BESS | 139 | 288 | $1,109,000 | $ 854,000 | $ 255,000 | 23% | $ 597,800 |
| | | | | | | | | |
| **Totals** | | 405 | 382 | $1,996,000 | $ 1,571,700 | $ 424,300 | 21% | $ 1,100,190 |

*Table 2: Cost By measures, PV and BESS*

| Milton, MA | Measure | PV kW | BESS kW | Cost |
|---|---|---|---|---|
| | | | | |
| **Town Hall** | Solar PV | 89 | | $ 225,000 |
| | BESS | | 54 | $ 178,000 |
| | | | Sub Total | $ 403,000 |
| **Police Department** | Solar PV | 177 | | $ 354,300 |
| | BESS | | 40 | $ 129,700 |
| | | | Sub Total | $ 484,000 |
| **Winter Valley** | Solar PV | 139 | | $ 347,500 |
| | BESS | | 288 | $ 761,500 |
| | | | Sub Total | $ 1,109,000 |
| **Totals** | All Measures | 405 | 382 | $ 1,996,000 |

A summary of energy audit and load assessment findings and recommendations follow. Complete Energy Audits of each facility are included in Appendix D. If there is a discrepancy in any values in this report and those in the Audits, the values in this report shall take precedence.

[9] Advantages – includes all the critical MG variables, prompts the user to estimate each, and provides guidance in finding the correct values to use in the various programs. Limitations – does require some level of knowledge of a facility's energy systems, consumption, and cost, and how available incentives are valued. Further, installation costs are estimated and can change over time due to inflation, equipment shortages, and the advent of improved technologies.

## Milton Town Hall Findings

Our audit efforts have not revealed the need to currently recommend any significant EE improvements in Milton's Town Hall. Select installations of air-source heat pumps (ASHPs) in certain areas and the conversion of the remaining stairwell fluorescent lighting to LEDs may be possible. Detailed engineering and financial analyses are recommended early in the Design Phase. Our primary recommendation is to install a 54-kW, battery energy storage system (BESS), which is sized to meet the current monthly maximum coincident electricity demand of the Town Hall for four hours.

We also recommend the installation of ground-mount, parking lot solar PV canopies to complement the existing 28.3 kilowatt (kW) roof-mounted array and have determined that an 89-kW parking lot array would be feasible in the lot to the northwest of the newly constructed fire department headquarters. The array would be located and sized as follows: parking lot Canopy (40 parking spaces to the rear (northeast) of the Town Hall and adjacent to the new Fire Station – 89 kW, 225 modules. As currently sized, the canopy module production would satisfy 87% of the current facility's annual energy (kWh) consumption. With the inclusion of the existing roof mount PV production, slightly more than the current annual energy needs of the Town Hall will be satisfied.

Table 3 below displays the estimated 10-year Cash Flow resulting from the installation of the recommended solar PV parking lot array, BESS, and new controls. The installation would cost approximately $403,000, of which a loan of $214,500 (net of the 30% investment tax credit) would be amortized with savings/revenues over a period of 10 years. First-year savings/revenues would be approximately $57,000 against expenses of $34,900. A Resiliency Gap of $96,800 would have to be filled with grants or other financial inputs.

*Table 3: Town Hall Parametric Model ProForma Cash Flow*

| Total Investment Estimate: | Output value | Units | Questions? |
|---|---|---|---|
| Total investment estimate in EE | $0 | *Dollars ($)* | i |
| Total investment estimate in BESS and microgrid controller | $178,200 | *Dollars ($)* | i |
| Total investment estimate in Solar | $225,000 | *Dollars ($)* | i |
| Total investment | $403,200 | *Dollars ($)* | i |
| Investment Tax Credit available in IRA | 30% | *Percent (%)* | |
| Upfront or Imputed Present Value of Annual Resilience Gap or Cash Flow Shortfall | $96,768 | *Dollars ($)* | |

| Annual Emissions Reduction Calculation | Output value | Units |
|---|---|---|
| EE savings, electric | 0 | *kWh per year* |
| Emission reduction from electric EE | 0 | *metric tons per year* |
| Solar savings, electric | 108,000 | *kWh* |
| Emission reduction from solar displ. | 57 | *metric tons per year* |

MILTON TOWN HALL

| | Annual Energy Savings from EE Improvements | Annual energy savings from solar energy produ[illegible] | T&D Demand Savings | Connected Solutions "Active Demand" Response Savings | ICAP Savings | Clean Peak Standard Certificate (CPS) Revenue [[illegible] | SMART Revenue PV + BESS | Less: Annual System Maintenance (2% est.) | Less: Curtailment Service Provider (CSP) charge | Less: Debt Service | Annual Cash Flow [2] | Cumulative Cash Flow | Carbon reduction (metric tons/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Total investment: | | $ (214,502) | $ (214,502) | |
| Year 1 | $ - | $ 14,040 | $ 14,208 | $ 12,150 | $ 2,187 | $ 1,535 | $ 12,960 | $ (4,290) | $ (4,106) | $ (26,446) | $ 22,239 | $ (192,264) | 57 |
| Year 2 | $ - | $ 14,321 | $ 14,493 | $ 11,786 | $ 2,187 | $ 1,489 | $ 12,571 | $ (4,376) | $ (3,982) | $ (26,446) | $ 22,042 | $ (170,222) | 57 |
| Year 3 | $ - | $ 14,607 | $ 14,783 | $ 11,432 | $ 2,187 | $ 1,444 | $ 12,194 | $ (4,463) | $ (3,863) | $ (26,446) | $ 21,875 | $ (148,347) | 57 |
| Year 4 | $ - | $ 14,899 | $ 15,078 | $ 11,089 | $ 2,187 | $ 1,401 | $ 11,828 | $ (4,553) | $ (3,747) | $ (26,446) | $ 21,737 | $ (126,610) | 57 |
| Year 5 | $ - | $ 15,197 | $ 15,380 | $ 10,756 | $ 2,187 | $ 1,359 | $ 11,473 | $ (4,644) | $ (3,635) | $ (26,446) | $ 21,628 | $ (104,982) | 57 |
| Year 6 | $ - | $ 15,501 | $ 15,687 | $ 10,434 | $ 2,187 | $ 1,318 | $ 11,129 | $ (4,737) | $ (3,526) | $ (26,446) | $ 21,548 | $ (83,434) | 57 |
| Year 7 | $ - | $ 15,811 | $ 16,001 | $ 10,121 | $ 2,187 | $ 1,279 | $ 10,795 | $ (4,831) | $ (3,420) | $ (26,446) | $ 21,497 | $ (61,937) | 57 |
| Year 8 | $ - | $ 16,128 | $ 16,321 | $ 9,817 | $ 2,187 | $ 1,240 | $ 10,471 | $ (4,928) | $ (3,317) | $ (26,446) | $ 21,473 | $ (40,464) | 57 |
| Year 9 | $ - | $ 16,450 | $ 16,647 | $ 9,522 | $ 2,187 | $ 1,203 | $ 10,157 | $ (5,026) | $ (3,218) | $ (26,446) | $ 21,477 | $ (18,987) | 57 |
| Year 10 | $ - | $ 16,779 | $ 16,980 | $ 9,237 | $ 2,187 | $ 1,167 | $ 9,853 | $ (5,127) | $ (3,121) | $ (26,446) | $ 21,509 | $ 2,522 | 57 |
| Total | $ - | $ 153,734 | $ 155,579 | $ 106,343 | $ 21,870 | $ 13,436 | $ 113,433 | $ (46,975) | $ (35,934) | $ (264,462) | $ 217,024 | | 572 |

| Results | Output value | Units |
|---|---|---|
| Total Savings Year 11 (no debt payment) | $ 48,914 | *Dollars ($)* |
| Approximate total years to $0 cumulative cash flow | 9.9 | *Years* |
| Cumulative cash flow over 15 years | $ 461,594 | *Dollars ($)* |

## Milton Police Department

Our audit efforts have not revealed the need to currently recommend any significant energy efficiency (EE) improvements. Select installations of air-source heat pumps (ASHPs) to replace the split and mini-split air conditioners in certain areas may be feasible. Given the very generous subsidies and tax credits available in the federal IRA legislation, the capital expenditure would be substantially discounted. New windows, and more efficient replacement toilets and aerators in all restrooms may also be feasible.

These and other possibilities are listed under "Other Potential Recommended ECMs" at the end of this final report. Although they are unlikely to have short paybacks, they may be advisable if an applicable funding source is identified and/or for climate and safety-related reasons. Detailed engineering and financial analyses are recommended early in the Design Phase.

Our primary recommendation is to install a total of approximately 177 kW of solar PV in several arrays: three rooftop arrays, two parking lot canopies, and one ground mount array as well as a 40-kW "battery energy storage system" (BESS), which is sized to meet the current peak monthly maximum coincident electricity demand of the Police Department for four hours (as historically recorded on the two master electric meters).

The arrays would be located and sized as follows: Rooftops (several) – 15 kW, 42 modules; parking Lot Canopy (eight parking spaces to left at facility entrance) – 20 kW, 58 modules; ground Mount (in an approximately 140 x 50-foot area in the existing open field to the left of the facility as shown below) - 142 kW, 406 modules. As currently sized, the combined module production would satisfy 145% of the current facility's annual energy (kWh) consumption. The system is deliberately oversized to accommodate a potential community-shared solar program for which 52kW, or about 68,000 kWh would be available annually. That is also equivalent to roughly 37% of the ground mount system's annual kWh production.

The table below displays the estimated 10-year Cash Flow resulting from the installation of the recommended solar PV parking lot array, BESS, and new controls. The installation would cost approximately $484,000, of which a loan of $288,000 (net of the 30% investment tax credit) would be amortized with savings/revenues over 10 years. First-year savings/revenues would be approximately $74,500 against expenses of $44,300. A funding shortfall (or Resiliency Gap) of $72,500 would have to be filled with grants or other financial sources. It should be noted that cost estimates are also based on the assumption that the existing trussed roof structures will not require modification to support the weight of the PV arrays.

## *Table 4: Police Department Parametric Model ProForma Cash Flow*

| Total Investment Estimate: | Output value | Units | Questions? |
|---|---|---|---|
| Total investment estimate in EE | $0 | *Dollars ($)* | i |
| Total investment estimate in BESS and microgrid controller | $129,600 | *Dollars ($)* | i |
| Total investment estimate in Solar | $354,000 | *Dollars ($)* | i |
| Total investment | $483,600 | *Dollars ($)* | i |
| Investment Tax Credit available in IRA | 30% | *Percent (%)* | |
| Upfront or Imputed Present Value of Annual Resilience Gap or Cash Flow Shortfall | $72,540 | *Dollars ($)* | |

| Annual Emissions Reduction Calculation | Output value | Units |
|---|---|---|
| EE savings, electric | 0 | *kWh per year* |
| Emission reduction from electric EE | 0 | *metric tons per year* |
| Solar savings, electric | 212,400 | *kWh* |
| Emission reduction from solar displ. | 113 | *metric tons per year* |

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| | Annual Energy Savings from EE Improvements | Annual energy savings from solar energy production [3] | T&D Demand Savings | Connected Solutions "Active Demand" Response Savings | ICAP Savings | Clean Peak Standard Certificate (CPS) Revenue [1] | SMART Revenue PV + BESS | Less: Annual System Maintenance (2% est.) | Less: Curtailment Service Provider (CSP) charge | Less: Debt Service | Annual Cash Flow [2] | Cumulative Cash Flow | Carbon reduction (metric tons/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Total investment: | | $ (287,742) | $ (287,742) | |
| Year 1 | $ - | $ 27,612 | $ 9,688 | $ 9,000 | $ 1,620 | $ 1,096 | $ 25,488 | $ (5,755) | $ (3,029) | $ (35,476) | $ 30,244 | $ (257,498) | 113 |
| Year 2 | $ - | $ 28,164 | $ 9,881 | $ 8,730 | $ 1,620 | $ 1,064 | $ 24,723 | $ (5,870) | $ (2,938) | $ (35,476) | $ 29,899 | $ (227,599) | 113 |
| Year 3 | $ - | $ 28,728 | $ 10,079 | $ 8,468 | $ 1,620 | $ 1,032 | $ 23,982 | $ (5,987) | $ (2,850) | $ (35,476) | $ 29,595 | $ (198,004) | 113 |
| Year 4 | $ - | $ 29,302 | $ 10,281 | $ 8,214 | $ 1,620 | $ 1,001 | $ 23,262 | $ (6,107) | $ (2,764) | $ (35,476) | $ 29,332 | $ (168,672) | 113 |
| Year 5 | $ - | $ 29,888 | $ 10,486 | $ 7,968 | $ 1,620 | $ 971 | $ 22,564 | $ (6,229) | $ (2,682) | $ (35,476) | $ 29,110 | $ (139,562) | 113 |
| Year 6 | $ - | $ 30,486 | $ 10,696 | $ 7,729 | $ 1,620 | $ 942 | $ 21,887 | $ (6,354) | $ (2,601) | $ (35,476) | $ 28,929 | $ (110,634) | 113 |
| Year 7 | $ - | $ 31,096 | $ 10,910 | $ 7,497 | $ 1,620 | $ 913 | $ 21,231 | $ (6,481) | $ (2,523) | $ (35,476) | $ 28,786 | $ (81,847) | 113 |
| Year 8 | $ - | $ 31,718 | $ 11,128 | $ 7,272 | $ 1,620 | $ 886 | $ 20,594 | $ (6,611) | $ (2,447) | $ (35,476) | $ 28,683 | $ (53,164) | 113 |
| Year 9 | $ - | $ 32,352 | $ 11,351 | $ 7,054 | $ 1,620 | $ 859 | $ 19,976 | $ (6,743) | $ (2,374) | $ (35,476) | $ 28,619 | $ (24,545) | 113 |
| Year 10 | $ - | $ 32,999 | $ 11,578 | $ 6,842 | $ 1,620 | $ 834 | $ 19,377 | $ (6,878) | $ (2,303) | $ (35,476) | $ 28,593 | $ 4,048 | 113 |
| Total | $ - | $ 302,344 | $ 106,077 | $ 78,773 | $ 16,200 | $ 9,597 | $ 223,084 | $ (63,014) | $ (26,511) | $ (354,760) | $ 291,790 | | 1,126 |

| Results | Output value | Units |
|---|---|---|
| Total Savings Year 11 (no debt payment) | $ 65,350 | *Dollars ($)* |
| Approximate total years to $0 cumulative cash flow | 9.9 | *Years* |
| Cumulative cash flow over 15 years | $ 618,540 | *Dollars ($)* |

## Winter Valley Findings

To date, our efforts have not revealed the need to currently recommend any significant energy efficiency (EE) improvements at any of the buildings. Winter Valley is to be commended for installing more energy-efficient equipment over time, especially when financial assistance in the form of grants is available. An exception may be replacing several electric-resistance baseboard heating and through-wall air conditioners with air-source heat pumps (ASHPs) in each electrically heated apartment. Given the very generous subsidies and tax credits available in the federal IRA legislation, the capital expenditure would be substantially discounted. This would reduce the total electric load in both heating and cooling seasons. It would be disruptive, however, and the possible tight federal timelines may make it difficult to phase changeovers with occupancy changes. Detailed engineering and financial analysis are recommended early in the Design Phase.

Additionally, as this feasibility analysis evolves, we may recommend additional EE improvements such as more efficient common area air conditioners, additional wall insulation, and perhaps replacement toilets and aerators in all common area restrooms, including those at the Office/Community building. Our major recommendations at Winter Valley are to install a total of 139 kW of rooftop solar PV arrays that would be owned by the Town of Milton (or perhaps Winter Valley) placed on all buildings except for building #5 (which does not have sufficient roof space) and to install a lithium "battery energy storage system" (BESS) at the exterior of all six buildings, sized to meet the current monthly maximum coincident demand of each building (from 36 kW to 54 kW, as historically recorded on each building's master electric meter). The rooftop arrays would be located and sized as outlined in Table 5.

*Table 5: Sizing and Location of Winter Valley PV Installations*

| Building Number | Solar kW/Building | Panels/Building | Battery KW Installed |
|---|---|---|---|
| 1 | 42 | 119 | 54 |
| 2 | 28 | 79 | 54 |
| 3 | 28 | 79 | 54 |
| 4 | 28 | 79 | 54 |
| 5 | - | - | 36 |
| Office | 14 | 40 | 36 |
| Total | 139 | 396 | 288 |

As sized, the combined module production would satisfy 41% of the combined current facility common area annual energy (kWh) consumption. The PV and BESS recommendations in this report satisfy only non-apartment, common area loads at Winter Valley to start. When we refer to "the current average monthly demand of each building (as historically recorded on each building's master electric meter" we are not including the residential electricity loads that are recorded on each resident's electric meter. The rationale is that residents will likely not see individual bill savings given that their unit's electricity allowance will be adjusted as the consumption is reduced and their monthly rent will increase by a commensurate amount.

The table below displays the estimated 10-year Cash Flow per the average Winter Valley building's savings and cost resulting from the installation of the recommended solar PV rooftop arrays, a BESS at each building, and new controls. The aggregate total for all six buildings is displayed in the yellow highlighted box at the top of the table. The total installation cost for all six buildings would be approximately $1,109,000, of which a total loan of $598,000 (net of the 30% investment tax credit) would be amortized with savings/revenues over 10 years. First-year savings/revenues for all six buildings would be approximately $165,000 against expenses of $103,000. A total funding shortfall (or Resiliency Gap) of $255,000 would have to be filled with grants or other financial sources. It should be noted that cost estimates are also based on the assumption that the existing trussed roof structures will not require modification to support the weight of the PV arrays.

*Table 6: Winter Valley Parametric Model ProForma Cash Flow*

| Total Investment Estimate: | Output value | Units | Questions? | TOTAL PROJECT (ALL 6 BUILDINGS) | | |
|---|---|---|---|---|---|---|
| | AVG/BLDG | | | | | |
| Total investment estimate in EE | $0 | *Dollars ($)* | i | $ - | | $ 597,805 Total Debt |
| Total investment estimate in BESS and microgrid controller | $126,933 | *Dollars ($)* | i | $ 761,600 | | |
| Total investment estimate in Solar | $57,917 | *Dollars ($)* | i | $ 347,500 | | |
| Total investment | $184,850 | *Dollars ($)* | i | $ 1,109,100 | | |
| Investment Tax Credit available in IRA | 30% | *Percent (%)* | | | | |
| Upfront or Imputed Present Value of Annual Resilience Gap or Cash Flow Shortfall | $42,516 | *Dollars ($)* | | $ 255,093 | 23% | |

| Annual Emissions Reduction Calculation | Output value | Units |
|---|---|---|
| EE savings, electric | 0 | *kWh per year* |
| Emission reduction from electric EE | 0 | *metric tons per year* |
| Solar savings, electric | 27,800 | *kWh* |
| Emission reduction from solar displ. | 15 | *metric tons per year* |

THIS IS THE AVERAGE CASH FLOW FOR EACH OF THE 6 BUILDINGS AT WINTER VALUE - ENTIRE PROJECT WOULD BE 6 TIMES GREATER THAN SHOWN

| | Annual Energy Savings from EE Improvements | Annual energy savings from solar energy production [3] | T&D Demand Savings | Connected Solutions "Active Demand" Response Savings | ICAP Savings | Clean Peak Standard Certificate (CPS) Revenue [1] | SMART Revenue PV + BESS | Less: Annual System Maintenance (2% est.) | Less: Curtailment Service Provider (CSP) charge | Less: Debt Service | Annual Cash Flow [2] | Cumulative Cash Flow | Carbon reduction (metric tons/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Total investment: | | $ (99,634) | $ (99,634) | |
| Year 1 | $ - | $ 3,614 | $ 9,580 | $ 8,925 | $ 1,607 | $ 544 | $ 3,336 | $ (1,993) | $ (2,841) | $ (12,284) | $ 10,488 | $ (89,146) | 15 |
| Year 2 | $ - | $ 3,686 | $ 9,772 | $ 8,657 | $ 1,607 | $ 527 | $ 3,236 | $ (2,033) | $ (2,755) | $ (12,284) | $ 10,413 | $ (78,733) | 15 |
| Year 3 | $ - | $ 3,760 | $ 9,967 | $ 8,398 | $ 1,607 | $ 512 | $ 3,139 | $ (2,073) | $ (2,673) | $ (12,284) | $ 10,352 | $ (68,382) | 15 |
| Year 4 | $ - | $ 3,835 | $ 10,166 | $ 8,146 | $ 1,607 | $ 496 | $ 3,045 | $ (2,115) | $ (2,593) | $ (12,284) | $ 10,303 | $ (58,078) | 15 |
| Year 5 | $ - | $ 3,912 | $ 10,370 | $ 7,901 | $ 1,607 | $ 481 | $ 2,953 | $ (2,157) | $ (2,515) | $ (12,284) | $ 10,268 | $ (47,810) | 15 |
| Year 6 | $ - | $ 3,990 | $ 10,577 | $ 7,664 | $ 1,607 | $ 467 | $ 2,865 | $ (2,200) | $ (2,439) | $ (12,284) | $ 10,246 | $ (37,564) | 15 |
| Year 7 | $ - | $ 4,070 | $ 10,789 | $ 7,434 | $ 1,607 | $ 453 | $ 2,779 | $ (2,244) | $ (2,366) | $ (12,284) | $ 10,237 | $ (27,327) | 15 |
| Year 8 | $ - | $ 4,151 | $ 11,004 | $ 7,211 | $ 1,607 | $ 439 | $ 2,695 | $ (2,289) | $ (2,295) | $ (12,284) | $ 10,240 | $ (17,087) | 15 |
| Year 9 | $ - | $ 4,234 | $ 11,224 | $ 6,995 | $ 1,607 | $ 426 | $ 2,615 | $ (2,335) | $ (2,226) | $ (12,284) | $ 10,256 | $ (6,831) | 15 |
| Year 10 | $ - | $ 4,319 | $ 11,449 | $ 6,785 | $ 1,607 | $ 413 | $ 2,536 | $ (2,381) | $ (2,160) | $ (12,284) | $ 10,284 | $ 3,453 | 15 |
| Total | $ - | $ 39,572 | $ 104,898 | $ 78,116 | $ 16,065 | $ 4,758 | $ 29,198 | $ (21,819) | $ (24,862) | $ (122,840) | $ 103,087 | | 147 |

| Results | Output value | Units | | | | |
|---|---|---|---|---|---|---|
| | | Total Yr 1 Savings | $ 165,630.76 | | Total Yr. 1 Exper | $ 102,703.63 |
| Total Savings Year 11 (no debt payment) | $ 23,019 | *Dollars ($)* | | | | |
| Approximate total years to $0 cumulative cash flow | 9.9 | *Years* | | | | |
| Cumulative cash flow over 15 years | $ 218,184 | *Dollars ($)* | | | | |

## Savings Allocation Barriers and Potential Solutions

As mentioned above, each apartment's electricity use at Winter Valley is recorded on an individual electric meter where the resident is responsible for paying the monthly bill. Winter Valley assigns each unit a dollar value monthly "allowance" toward the electricity bill. The allowance value is subtracted from the resident's rent obligation equal to 30% of their annual income. HUD allows for several different methods of determining the allowance value. Winter Valley uses a statistical sample of actual resident bills organized by apartment size (number of bedrooms). Since the resident's total payment is capped at 30% of income, a reduction in the electric bill does not translate into dollar savings for the resident. Any on-site solar PV electricity production would be fed to the master meters at each building with none of the savings accruing to the residents.

## Greenhouse Gas (GHG) Reduction Potential

Each parametric model also calculates estimated CO2 reductions due to the performance of our EE and RE recommendations for each of the first ten years of service. Reductions in emission totals are primarily due to the solar PV with a smaller amount coming from assumed EE measures. Reductions would continue over the 20-year useful life of the PV systems, with annual decreases due to equipment efficiency degradation and the likely greener grid power over time as more and more RE is fed into the grid. The last column of each Model's ProForma displays the estimated CO2 emissions avoidance due to the PV production over a ten-year term for each facility. The 10-year total for all three facilities is 2,580 metric tons.

The estimate is based on eGrid's 530 Lb./MWh baseload CO2 emissions factor for 2021 in the New England grid sector which is similar to the value Milton uses in its municipal GHG CO2 reduction progress analyses. It is not discounted for possible grid reductions (cleaner grid power avoided) over the ten years. While the reduction is, compared to the inventory, a small percentage of Milton's current annual emissions, it is only limited by the EE and RE potential evident in the three facilities in this report. As the MG evolves, it will have a significant impact on overall CO2 emissions.

## Potential For Facility Upgrades and Improved Living Conditions

Beyond the financial and environmental benefits, a resulting major improvement in working or living conditions would be a reliable, clean source of emergency energy over an extended period, especially at Winter Valley where most of the buildings do not currently have emergency power for anything other than corridor lighting. The possible cold sequencing of PV-supplied BESS power to the Winter Valley units via an automatic transfer switch during a grid outage would allow residents to shelter in place.

Other potential facility upgrades under consideration that would improve working/living conditions are:

1. At Town Hall, select installations of ASHPs in certain areas, and the conversion of the remaining stairwell fluorescent lighting to LEDs.
2. At the Police Department, select installations of ASHPs to replace the split and mini-split air conditioners in certain areas. Also, new windows, and more efficient toilets and sink aerators in all restrooms.
3. At Winter Valley, more efficient common area air conditioners, additional wall insulation, and replacement toilets and aerators in all common area restrooms, including those at the Office/Community building.

## Electric Demand Profiles for Each Facility; Probable Apartment Loads and Coincident Demand

Each Energy Audit contains detailed spreadsheet summaries of facility energy and water use and costs from March 2022 through March 2023. For electricity, the Eversource meters record the actual monthly kW demand for each meter, but the tariff under which all the accounts are billed subtracts 10 kW from the amount to be billed. Inspection of each use record reveals the peak demand month. Knowing the systems and operations of each facility allows an understanding of which systems are creating the actual annual peaks and if they occur in summer or winter. Realizing the annual peak kW is an important step in appropriately sizing the BESS to meet the most severe grid outage situation at each facility. The recommended BESS sizes may vary slightly from the values recorded on the meters as storage batteries typically come in standard, not customizable, kW increments.

The individually metered apartment electric use at Winter Valley is on a residential tariff that does not include a demand component and the meter does not record demand, only energy (kWh) use. Again, knowing the energy systems and operations has allowed CESI to estimate the likely demand profile for groups of apartments that may be supplied emergency power from a BESS (or fuel-powered generator) during a grid outage. When estimating potential aggregated apartment demand to be satisfied by a BESS, consideration must be given to the coincidental use of apartment-based equipment. For instance, not all of the apartment air conditioners or heating-related loads will be drawing power at any given moment. As indicated elsewhere in this report, the currently recommended BESS size and cost at Winter Valley do not include the apartment loads.

Dimensionally, on average, each BESS listed below would be housed in a painted metal enclosure and measure approximately 3 x 4 x 8 feet. At each facility, the BESS would be installed outside on a concrete pad, at a fire code-required distance or greater from each building. Considerations for exact placement would include aesthetics, juxtaposition to utility connection points (to minimize installation costs), and to any pre-existing above- or below-ground infrastructure such as paved areas, landscaping, and water, electricity, and gas lines. Following is a summary table of monthly peak demands for each facility:

*Table 7: Peak Facility Electricity (kW) Demands and Month They Occur In*

| Eversource | Account # or Building # | Peak kW | Month | BESS kW |
|---|---|---|---|---|
| | | | | |
| **Town Hall** | 2673-772-1006 | 56 | August | 54 |
| | | | | |
| **Police Department** | 2673-768-1002 | 40 | December | 40 |
| | | | | |
| **Winter Valley** | Building #1 | 50 | December | 54 |
| | Building #2 | 46 | January | 54 |
| | Building #3 | 38 | February | 54 |
| | Building #4 | 40 | February | 54 |
| | Building #5 | 17 | August | 36 |
| | Office | 48 | February | 36 |

## 7. Conclusion & Next Steps

The Town and Winter Valley present an opportunity to extend the state of the art in community-based microgrids that are focused on benefits to EJ residents. The recent EmPower grant supports that opportunity with funding for designing the more challenging elements in delivering such benefits. The grant application describes the next steps in that process and is included in Appendix E.

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## Appendix A: Original Project Scoping and Timeline

**Task 1- Kickoff Meeting:** This meeting will be the first step in the project and provide an opportunity for consultants to meet with staff and the community, for us to learn some baseline information from the consultant's experience, and for all involved to share their knowledge, expertise, expectations, and intentions.

**Task 2- -Energy Audit –** Consultants will conduct comprehensive energy audits to at least ASHRAE Level II standards energy audits of the three locations in the project area (Milton Town Hall, Winter Valley, and the Milton Police Department) and share their findings with stakeholders.

**Task 3: Energy Load Assessment –** Consultants will use the results of the energy audits to determine the base load and energy needs within the project area and will use those to guide the feasibility analysis of a microgrid project.

**Task 5: Initial Feasibility Study –** Consultants will prepare an initial report on the feasibility of the project, including the expected energy needs of the project areas, installation costs, and timeline for action. This report will be reviewed by Staff and stakeholders and then be discussed at a public forum to maximize community engagement throughout the process. This is expected to take place between the sixth and tenth months of the project and cost $10,000.

**Task 6: Final Feasibility Study –** A final report on the feasibility of the project will be completed, including the expected energy needs of the project areas, installation costs, timeline for action, and a report on the feedback received from residents. That feasibility report will be used to guide the Town's process for the implementation and creation of our microgrid system. This will be completed in the final two months of the project and cost $4,000.

**Proposed Timeline**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Task 1: Kickoff Meeting | | | | | | | | | | | | |
| Task 2: Energy Audit | | | | | | | | | | | | |
| Task 3: Energy Load Assessment | | | | | | | | | | | | |
| Task 4: Community Meetings | | | | | | | | | | | | |
| Task 5: Initial Feasibility Study | | | | | | | | | | | | |
| Task 6: Final Feasibility Study | | | | | | | | | | | | |

## Appendix B: Expanded Policy Explanations

### Solar Massachusetts Renewable Target (SMART) Program

The Solar Massachusetts Renewable Target Program (SMART) is a declining block incentives program that came into effect in November of 2018 and is designed to encourage the development of solar energy to help the Commonwealth meet its emissions targets. The program was designed to replace SREC trading (additional information on this in the CCA section), which imposed too many uncertainties for efficient financing, and to make solar more cost-effective for utility companies and other solar developers to build in Massachusetts. Under the program, owners of solar units can apply to the Program Administrator (Clear Result) and MA DOER to receive payment directly from utility companies for their solar generation (Hacker, 2023). Participation is currently capped statewide at 3,200 megawatts of total incentivized solar. The program requires that 5% of qualifying energy under the program serves low-income customers per 200-megawatt capacity block[10] identified by the utility. Municipalities may aggregate customers into a single load under the "community choice aggregation" program, and invite bids to supply that aggregated load with solar energy (see section (c), CCA below). The program outlines special provisions for community-shared solar installations to participate, so long as each customer enrolled consents to participate (see section (b), CSS below). Finally, the program outlines ways qualifying installations can increase their payment amounts, through compensation rate adders (simplified to be called "adders").

Under the program, utility companies break their solar purchase obligations into 16 successive capacity blocks. The declining block incentive means that after the first capacity block is filled, every subsequent block will receive a 4% lower credit and 4% lower adders than the block that came before it. Solar projects must qualify through an application and be selected for participation in the program. The SMART program specifically incentivizes community-shared solar by allocating higher base rate compensation levels (the lowest amount a project will receive per kWh through the program before adders) for CSS projects. Further, there are adders for kWh that serve low-income customers, maximize solar tracking, are pollinator-friendly, for projects that are attached to battery storage, and more. Adders attach to the base rate compensation figure to increase the total credit that a project can expect to receive per kWh.

Solar installations are either "standalone" or "behind the meter," the latter referring to solar generation that supplies a local attached electric load (for example, rooftop solar panels connected to household appliances). The method for calculating SMART incentives differs slightly between those two classifications. In both cases, the total compensation per kWh is a sum of the value of energy[11] and the applicable incentive. That total compensation per kWh of solar energy is a "tariff" set by regulation for each capacity block, depending on the utility's service territory and the local consumer's rate class. The total compensation per kWh was originally set by an auction process when the SMART program began – it answered the question "What total price per kWh over 20 years would developers require for them to risk building a solar plant?" A reset of this formula may be approved by regulators soon, due to recent volatility in electricity markets.

For Standalone installations, only the sum is fixed, neither of its components. That sum (the incentive plus the value of energy) is fixed for the 20 years of the developer's SMART approval. The value of energy (VOE) may vary frequently due to many factors, including the cost of fuel, market conditions, and periodic regulatory rate cases. The incentive is simply the difference between the fixed compensation and the variable VOE. Thus the Incentive can go to zero if energy costs (and thus the VOE) rise above the total compensation level. Once set, this compensation level does not vary with future changes in energy costs or markets; thus the developer is at risk for 20 years.

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[10] Capacity blocks are designated by the utility. Per the SMART program, qualifying solar generators offer their capacity into 16 successive capacity blocks so that a total of 200 MW of solar generation capacity can qualify for the program in each block.

[11] The "value of energy" is intended to approximate a consumer's savings from generating a kWh of solar energy on site. That kWh would offset the utility's charges for its energy (at the Basic Service Rate) plus its costs of transmission and distribution and certain other charges per metered kWh.

For behind-the-meter installations, the total compensation is still the sum of the VoE plus an incentive but that incentive per kWh remains fixed (for 10 years if less than 25 kW), based on the tariff in each block. The VoE will of course vary in the future, and so the total value received per kWh (for behind-the-meter solar generators) could go up or down over time.[12]

## Community Shared Solar

Community-shared solar (often called community solar) is a system for distributing some of the benefits of solar energy to customers in an accessible way. Community-shared solar (CSS) was designed as a more equitable model for solar energy use and distribution, as research shows that nearly half of U.S. households cannot install rooftop solar, the more traditionally accepted version of solar energy. Non-residential facilities are also limited by many factors in urban areas, including shading, historic or code limitations, roof impediments, ownership or financing restrictions, and structural and other inhibitions.

In Massachusetts, CSS was initially enabled by the "virtual net metering" bill in 2008, passed as part of the Green Communities Act (SB 2768). It allows solar-tariff generating units (STGUs) to name their subscribers and requires the distribution utilities to credit the bills of those subscribers with their respective shares of the solar generation. Prevailing laws forbid non-utilities from wiring and selling power to customers directly but also prevent utilities from owning generators. Thus the STGU must inject its power into the electric grid and the utility must bill the customers.

This constitutes "virtual net metering" because participants can receive approximately the same total benefit (value of energy plus incentives) as facility owners who install solar and elect to participate in both SMART and net metering. Their bill credits include both components.

## Renewable Energy Credits

RECs are essentially an accounting mechanism so that various players in the production of energy can record how much renewable energy is being generated and then "trade" the attributes of that energy (although the electrons themselves could be anywhere). REC trading is very similar in concept to the idea of carbon offsets in the sense that, like with carbon offsets, renewable energy does not have to be generated on-site where the RECs benefits are being experienced.

The Renewable Energy Portfolio (RPS) was established under the Massachusetts Electric Utility Restructuring Act of 1997 which set requirements for the amount of energy utility companies must provide from renewable sources. The portfolio was amended under the Green Communities Act of 2008. The Green Communities Act is also the underlying authority for community-shared solar in Massachusetts. This amendment mandated that 15% of all energy produced by all energy suppliers in Massachusetts must be derived from renewable sources. A

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[12] Their total benefit will also depend on their export of energy to the grid, which may be worth more or less than their avoided cost of consumption.

supplier's RPS obligations may be met by acquiring a specified quantity of RPS-qualified renewable energy credits (RECs).

Under the REC program, each megawatt hour of electricity is tracked and recorded by ISO-NE, the regional transmission organization authorized to manage these credits. One REC is created each time a qualified facility generates one-megawatt hour of electricity. RECs are broken up into Class I and II, with solar energy counting as Class I. Under the REC program, solar energy generated can be tagged as an SREC (Solar Renewable Energy Credit) and accumulated and traded within the market maintained by ISO-NE. Therefore, energy suppliers can buy renewable energy credits to count towards their RPS requirements. Specific carve-outs were originally built into RPS that required certain amounts of the RECs tracked within the program to be attached to energy generated from solar. This carveout is what would eventually become the landmark SMART Program.

The basic model for community solar can be explained in three steps:

**1. Development and Subscription:** A solar developer builds a solar garden (or other solar installation) and recruits community members as participants. Each participant is allocated a certain percentage of the energy that will be generated by the garden.

**2. Energy Delivery:** Energy from the garden is fed into the existing grid infrastructure. The solar developer works with a utility company to credit the participants' energy bills with their share of the solar energy, based on current utility tariffs. This is equivalent to "virtual net metering" for the participants.

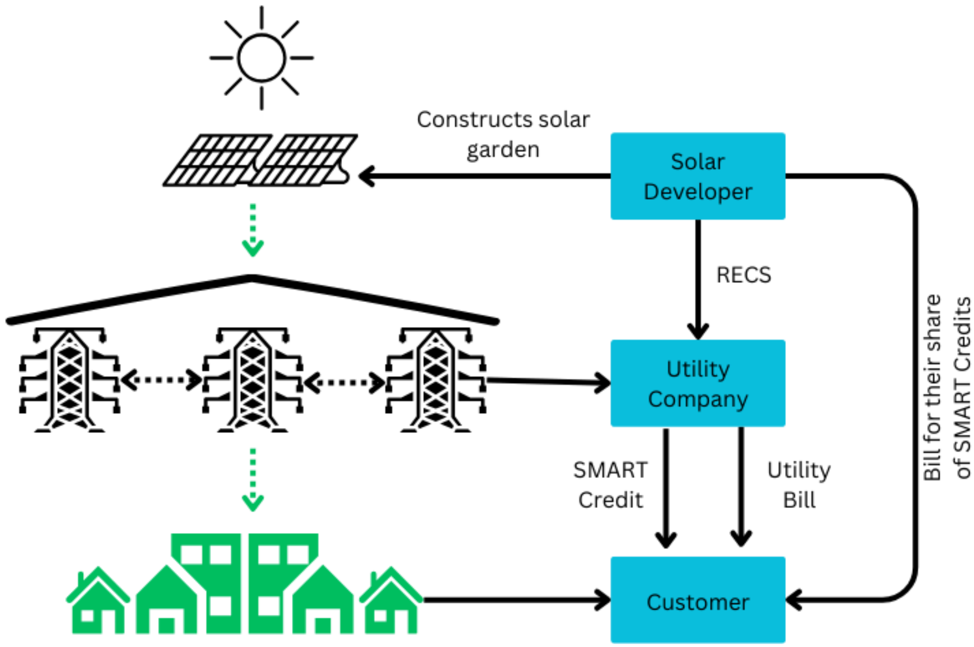
**3. Payment:**

**Subscription Model:** This is by far the more common pricing model. Under the subscription model, participants enter into a form of a Power Purchase Agreement (PPA) with the solar developer to purchase power from the garden. There are several different payment models within a PPA subscription[13].

**Ownership Model:** Under the ownership model, participants purchase and own portions of the solar garden. This might mean purchasing sections of the project or a select number of panels. Participants see a credit/saving on their utility bill for the amount of energy produced from their own share of the garden.

[13] These can include set discounts over the local utility rate, a flat rate per kWh used, flat monthly fees, lease-to-own agreements, and more.

*Figure 7: Community Shared Solar Process Diagram*




The details of each community solar program such as subscription terms, fees, geographic limitations, etc. vary from project to project but the basic structure is the same: additional clean energy is injected into the grid as a result of participants' subscription, transported to a participant's home through the electrical grid from one large-scale solar project, and the utility credits their bills for their shares of that energy. The majority of community solar follows the subscription model.

Under the subscription model, the CSS developer is paid through a set pricing model. They can apply as an STGU under the SMART program and execute a 20-year agreement to supply solar energy at a fixed rate per kWh (including the VOE + Incentives), so the CS developer can recover their costs through the pricing model. This can look like set discounts over utility rates, flat monthly fees, lease-to-own agreements, and more. Even though customers are still responsible for paying their full utility bill and also for paying the CS developer for their installation and maintenance of the solar farm, customers still see a reduced monthly utility bill as a result of credits that are applied to it.

There are distinct benefits and limitations to community-shared solar. On the one hand, community-shared solar is a more equitable way to provide access to solar energy for the reasons previously described. It also can benefit from economies of scale and various state and federal incentive programs. It is generally expandable, provided that the capacity within the grid is there.

However, there are also limitations to this model that will need to be overcome for Massachusetts to meet its renewable energy goals. Siting of large CSS plants is always subject to regulatory approvals and to local opposition from abutters and other interests. The plants are reliant on the existing utility grid and interconnection thereto. The grid is highly susceptible to the increasing pressure that climate change and other threats will place on it, and the traditional CSS model does not include investment in resilience. Some parts of the grid in Massachusetts face congestion and capacity overloads, which CSS could exacerbate.Besides problems with the grid itself, the traditional model of CSS faces barriers to customer acquisition, transaction costs, and risks that developers must overcome. These are especially acute in reaching low-income subscribers, as detailed in section (d) "Hybrid Neighborhood Microgrids" below. Finally, sharing solar energy from a CSS installation does not actually deliver solar power to participating buildings since the solar energy simply mixes with other energy sources in the distribution grid. Nor does it give participants the right to claim environmental credit, since the renewable energy credits (RECs) are almost always ceded to the distributing utility. It does, however, provide economic benefits to its subscribers and it does contribute to increased solar development overall. These benefits and limitations are summarized below.

*Table 8: Community Shared Solar Benefits and Limitations*

| Benefits | Limitations |
|---|---|
| • Renewable energy expansion<br>• Accessible to those who cannot install their own solar<br>• Utilizes economies of scale<br>• Expandable, conditional on grid capacity | • Reliant on the existing grid<br>• Not localized to the customer base<br>• Lack of resilience and storage<br>• Requires substantial amounts of land, permits, local approvals<br>• Risk of non-payment by subscribers, who see two bills per month |

### Community Choice Aggregation

Community choice aggregation (CCA), also called Municipal Aggregation at times, allows any municipality or group of municipalities to aggregate the combined electrical energy load of their consumers. Part I, Title XXII, Chapter 164, Section 134 is the enabling legislation behind community choice aggregation and it stipulates that willing municipalities/groups may enter into agreements for the sale and purchase of electric energy and other related services. Essentially, this policy allows the municipality to "shop" for their energy sources on behalf of their residents. Municipalities are often able to negotiate for lower energy prices and an increased percentage of non-fossil-fuel-based power. This saves customers money on their monthly utility bills and incentivizes diversification of energy sources and renewable energy.

CCA works by allowing single cities, towns, counties, or groups of cities, towns, or counties, to enter into an agreement wherein they combine the electrical demand of their retail electricity customers. A majority vote is required from the municipality's governing body to initiate the aggregation process. After securing a majority vote from the municipality, or from each municipality involved in the aggregation, a plan must be developed and submitted to the

Department of Public Utilities detailing the “process and consequences of aggregation”. These are opt-out services in which every customer within the aggregated area will receive benefits from the aggregation unless specifically choosing to opt out within 180 days. Under this law, the municipality (on behalf of their aggregated customers) is allowed to “enter into agreements for services to facilitate the sale and purchase of electric energy and other related services including renewable energy credits.”[14]

There are significant benefits associated with CCA. It allows the jurisdiction to implement local policies regarding clean energy and pricing options via negotiation with suppliers. In such negotiations, it provides the jurisdiction with substantial purchasing power based on the aggregation of many electric loads. It establishes a large market for energy services, which may be regional if several jurisdictions agree to collaborate. As a result, community aggregation has been found to save customers an average of 0.88 Cents/kWh in 2021, according to a study from the University of Massachusetts. (Cropley, 2023). The legislation also enables a new potential revenue source by allowing the jurisdiction (all subject to DPU approval of their CCA Plan) to add a surcharge on their energy suppliers’ charges, which the jurisdiction can use for related purposes. Finally, the “other related services” enabled by the legislation could include energy efficiency programs, even diverting the jurisdiction’s share of the utility’s on-bill Ratepayer assessments for that purpose. (So far, only the Cape Light Compact has sought and received permission for that diversion, which imposes utility-like regulation on the jurisdiction.) For purposes of this proposal, CCA administration can provide an efficient mechanism for the jurisdiction to identify and recruit low-income energy consumers for participation in CCASS. This triggers one of the bonus “adders” built into the SMART Program.

## Appendix C: CESI Parametric Model & Cash Flow Projections

***These materials are attached separately as a link on the Town of Milton Website.***

## Appendix D: Complete Facility Energy Audit Findings

***These materials are attached separately as a link on the Town of Milton Website.***

## Appendix E: Grant Application Inserts to MA Clean Energy Center

### Section 1. Contact Information.

### Section 2. Experience and Qualifications

*(a) Describe each individual or organization’s history of experience in working with Priority Groups*

[14] https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section134

Clean Energy Solutions, Inc. (CESI) is the engineering and financing designer of EJ neighborhood-led MGs originally sponsored by CEC's "Community Microgrid" Program and is designing solar- and battery-based microgrids for Boston's Chinatown, Chelsea, Cambridge, Milton, and other EJ communities. CESI's work is entirely focused on bringing clean-energy benefits to Priority Groups, through technical and financial innovations.

All of CESI's work is devoted to and often led by Environmental Justice populations. CESI was chosen by Chinatown, Chelsea, and MA CEC as the Technical Consultant for their Community Microgrids and has a Corporate commitment to sharing resources with Priority Groups. CESI voluntarily shared half of their TA grants with their Chinatown and Chelsea partners, subcontracting for community support and design collaboration. CESI is also known for its energy efficiency work on behalf of public housing residents nationally; it is under contract to Lawrence Berkeley National Laboratory to draft national standards for performance contracting; and it is the Independent Engineer that validates property-assessed clean-energy (PACE) financing applications in Washington DC.

***(b) Share one example of a completed or ongoing program that supported one or more Priority Groups (200 word limit)***

***(c) Clarify the role & function of partners***

The three Partners in this application constitute a special team of participant-beneficiaries, municipal authorities, and technical experts who are already working on related programs in other Massachusetts cities. We believe this offers a unique opportunity for EmPower to advance the state of the art.

The Town is able to serve as a "laboratory" for several technical innovations that can remove long-standing barriers to Priority Group benefit. (See Section 3, "Proposed Approach.") They have engaged CESI to conduct a Microgrid Feasibility study and have designated the Town Hall and Police Department to participate, with other facilities likely. Town officials will participate in the design process, approve tests, identify and convene stakeholders, coordinate schedules and approvals, document progress, and generally oversee the project.

The management and residents of Winter Valley, including low-income utility-metered customers, are able to participate actively in designing and evaluating solutions to these barriers and will receive stipends for their time. They have already contributed valuable insights in community meetings organized by the Town. It is unusual to have access to the personal experience of Priority Groups as a regular part of the design process.

CESI is able to bring designs and lessons from the solar-based microgrids it is designing in other environmental justice communities (Chinatown, Chelsea, Cambridge, and others). CESI's role is to apply its engineering, financial, regulatory, and contractual expertise to adapt existing MA programs to reach those who remain untouched by them.

This partnership can combine existing programs with some innovations that CESI is developing in its other microgrids. These include aggregating distributed Community Solar resources and building direct cash payments into low-income SMART participation. The programs are in place, but they have not been tailored to benefit Priority populations in EJ neighborhoods.

***(d) [ Insert summary of Town's "Diversity, Equity, and Inclusion" statement. Describe what the Town is "proactively doing to promote" D,E&I. ]***

- See the Town website.

**<u>Section 3. Proposed Approach</u>**

***Program Title:*** Clean Energy Access Innovations By and For Metered Tenants

***Provide a 2-3 sentence summary of your proposed Project or Program. Think of this as your "elevator pitch." (100 word limit)***

A team of Priority Group residents, Town officials, and technical experts is developing ways around long-standing barriers to clean energy benefits. Utility-metered low-income tenants are always last to benefit from actual cash savings, the resilience of power and communications, healthier homes, and job opportunities. We have identified innovations in key energy programs that address the barriers. The programs include Community Solar, Virtual Microgrids, DER sharing, and performance contracting. We have a team that can install and test them, in time to take advantage of IRA funding for wide deployment.

***Based on the above, what will the requested funding specifically be used for? For example, we will use our funding to hire part-time staff to conduct outreach in a priority group neighborhood. (200 word limit)***

The requested funding will support three activities: First, we intend to pay stipends to residents for their time and to cover any expenses they necessarily incur. Second, we intend to cover the costs that the Town incurs for meetings and presentations. Third, we intend to contract with expert consultants and contractors committed to this mission and experienced in its complexities. We intend to build an exemplary implementation team to detail the technical, community-engagement, legal, financial, and contracting improvements to the existing tools described below. We and the new team will then be positioned to immediately launch a Solar for All program in Milton and elsewhere next summer, and to manage its successful deployment.

We have the tools in Massachusetts, but they have not been made to work for the Priority Groups. ESCOs can identify, install, monetize, and guarantee savings and home improvements but need to expand their scope where paybacks are long or access difficult. Low-income participation in SMART projects has been unsuccessful because utility bill credits are not valued, but a direct-cash design is possible. Incentives exist for battery-based resilience but getting its benefits to individually-metered apartments requires modifications to wiring and switching. Community Solar resources, are necessary to reach metered tenants and can be aggregated among multiple hosts within the Town.

***What is the Priority Group you are seeking to benefit and how will they benefit?***

Winter Valley residents. EJ category: age and income.

***Please include whether your proposal would target a geographic community (i.e. City/Town, neighborhood) or non-geographically based community (i.e. affinity group, religious network, shared language community). (200 word limit)***

We are targeting the low-income tenants in Winter Valley housing who represent populations that have not been reached by most clean-energy benefits, because of barriers including:

- On-site solar is generally inaccessible to tenants. Low-income Community Solar credits have little value to them. They would have to pay two bills, one to the utility and one to the developer. The calculation of the credit is obscure, utility bills are not generally understood, and the claim that the two new bills add up to less than what they would have paid is not trusted.
- Resilience of power and communications is too expensive to install in each apartment and cannot currently be shared.
- Energy education, participation in energy-related decisions, having some environmental impact, being able to afford the time and expense of learning, and generally exercising some choice in these matters, is generally beyond reach.
- Although many programs of energy efficiency retrofits and behavioral incentives exist, they are not promoted or presented in accessible form and language.

The tenants will benefit from actual cost savings (paid in cash), resilience of energy and communications in their apartments, education and training with stipends, and healthier homes.

What are the specific goals or targeted outcomes expected from the implementation of your proposed program model or project? For example: Program team anticipates we will successfully facilitate the sign up of 50 households to a shared solar project, through which households will save 20% on their utility bill. (200 word limit)

The number of Priority-Group residents engaged and benefitted are listed in the following section. The outcomes that will enable those benefits are:

(a) provision of affordable resilience to metered tenants in multifamily apartments. This has rarely been achieved elsewhere. In Milton, we are engaging engineers from CESI, a specialized electrical contractor, and Eversource to install "cold sequence" switching that will allow the insertion of a transfer switch and BESS-generator combination at the input of each bank of meters.

(b) sharing of storage and solar resources among buildings that are separately metered but on contiguous property under a common owner. This is possible in Milton because of Town property ownership and authorizations.

(c) payment of low-income community solar credits in the form of cash or equivalent value in place of utility bill credits[15]

(d) modification of Community Solar deployment under the SMART program for low-income residents, to allow aggregation of multiple Town sites in place of remote "solar farms."

The proposed EmPower funding will initiate testable installations. Once tested we will be able to look to SolarForAll Funding to cover full deployment in Milton and elsewhere.

What activities have been completed in preparation for the implementation of this project?

The Town of Milton has held a series of pubic forums, including the low-income

[15] This arrangement pays actual cash to LI consumers, avoids double billing, and is offered by the Town and trusted building managers. Solar developers need only a single contract (with the Town and its Payment Agent), freeing them from marketing to many "off-takers" including low-income subscribers. The utility need not arrange SMART credits to participants' accounts, but simply pays a monthly solar credit to the Developer and bills all customers as normal. A diagram of this design is attached.

residents of Winter Valley, to assess resident concerns and priorities regarding clean energy benefits and resilience. As a result, the Town issued an RFP and chose CESI to conduct a Microgrid Feasibility Assessment. Two meetings with Priority Group and other residents have since been held to discuss designs and get feedback on priorities. The CESI recommendations include installing solar panels on the roofs of all Winter Valley and two Town facilities, with battery energy storage systems (BESSs) to provide resilience. The general design and specifications will be completed this winter.

***<u>Section 4. Proposed Timeline and Outcomes</u>***

**TIMELINE FOR USE OF FUNDS:**

Task 1. Recruit, train, and engage in design reviews of 5 to 15 low-income metered residents (and their successors if needed) of Winter Valley; meet quarterly for 2 years; pay stipends for attendance @ $100 apiece per session, plus expenses): Average cost per Quarter = $1200/Q over 2 years

Task 2: Engage (via CESI employment and consulting contracts) expert technical advisers including an electrical contractor, a utility engineer, a master electrician, an ESCO supervisor, a labor union official, and a regulatory attorney. Assign and oversee their work to achieve the Outcomes described at the end of Section 3. Average cost per Quarter = $12,000/Q over 2 years

Task 3: Work with Eversource engineers to approve the cold-sequence metering and prepare an Interconnection Service Agreement for solar + battery systems. Average cost per Quarter = $ 6,000/Q over the last 6 quarters.

Task 4: Install, in one building of Winter Valley, the electrical connections and automatic transfer switch to feed the apartments from a battery and solar system (with backup green-fueled generators) during outages and peak hours. Test the system with a simulated outage and load, using an emergency generator (separately funded). Electrical hardware and contractor costs:
Q. 5 = $12,000
Q.6 = $14,000
Q.7 = $15,000
Q.8 = $20,000

Task 5: Prepare specifications and RFP for solar, battery, and controls EPC contractor; identify and qualify candidates:

$6,000 per quarter in Quarters 6, 7, and 8

Task 6: Engage part-time staff and expenses for extra Town and Winter Valley work: $3,000 per month ($9,000/Q) for 2 years

**DELIVERABLES: NUMBER OF PRIORITY GROUPS AFFECTED:**

1. By receiving cash credits equal to at least 10% of their electrical energy costs: 36 households
2. By avoiding loss of heat, cooling, light, power, refrigeration, cell phone & internet connection, over the next 10 years: 36 households
3. By obtaining training and energy education, with stipends: 15 Priority-Group residents over two years

**Section 6. Proposed budget:**

$292,600

***Narrative requesting additional funds*:**

The “additional” funds will support the innovations that allow us to reach those left behind in the clean-energy revolution—low-income metered tenants—with the benefits they need: > economic benefits, in a form they can use (like cash or equivalents), not bill credits that they can’t use and don’t understand or trust

- resilience benefits—power and communications in emergencies, in their own apartments, not just common areas
- energy education & training benefits, with stipends

What are the innovations?

*Economic* – The only way for solar energy benefits to reach the target residents is by participation in Community Solar. The prevailing deign in Massachusetts, however, issues bill credits to the intended low-income beneficiaries. These may be worthless because of utility allowances, are not understandable, and are not trusted. Moreover, the recipients must pay two bills, one to the utility and one to the CS developer. The result has been a very low uptake by low-income folks. An alternative developed by CESI and Peregrine Energy Group[16] is described in the attachment. It is better for the utility and the developer, and gets cash into the hands of the beneficiaries.

*Resilience* – Nearly all backup power, by solar and batteries as well as by emergency generators, is limited to emergency circuits and common areas. Yet immobile and isolated

[16] Members of the “RUN-GJC” Team that has been advising Chinatown and Chelsea on their community microgrids.

low-income tenants need and deserve immediate power and communications in their own homes in emergencies. At Winter Haven, a means of feeding multiple apartments from a shared emergency generator has been designed by an electrical contractor and approved by Eversource, and is in the process of procurement. This provides an opportunity to demonstrate the same functionality using solar and BESS installations at the Winter Valley facilities. It will be an important innovation, applicable in other apartment buildings with compatible wiring.

***Activities, Team members, & Funding Amounts:***

Task 1 – Residents -- $9,600
Task 2 – Expert technical consultants, CESI staff -- $96,000
Task 3 – CESI -- $36,000
Task 4 – Electrical contractor and electrical equipment and parts -- $61,000
Task 5 – CESI -- $18,000
Task 6 – Town and Winter Valley -- $48,000

***In-kind technical services from Mass CEC*:**
[ check “no” ]

***Grant Payments:***
[check the third box. Add ]: We request eight quarterly payments of $36,575 each, payable upon receipt by Mass CEC of a Quarterly Progress Report.

**Section 7. Review of Att. 3**
[check the first box “yes” and the second box “no”]