CLEAR Recap & Summary Findings

Program Design

- The Clean Energy and Resiliency ("CLEAR") Program seeks to support energy resilience investments in Massachusetts by advancing first-stage energy resilience system designs for critical facilities in Massachusetts communities.
- MassCEC awarded funding to three consultants: GE Energy Consulting, The RAND Corporation, and Willdan, to conduct feasibility studies for nine facilities, campuses, or communities in Boston (2), Framingham (2), Cohasset (2), West Tisbury, Natick, and Bedford.
- As part of CLEAR, MassCEC also awarded funds to GE Energy Consulting to create a Resiliency Toolkit that helps communities identify their resiliency needs and gather preliminary pricing and sizing information.
- Finally, MassCEC retained the RAND Corporation to develop a Resiliency Certification that provides a method to certify specific sites as "resilient" to outages.

Drawing from the first eight studies, we have so far been able to gather the following insights and conclusions.

Observations

Need for Resilience

- Greater frequency and severity of weather events increase the Commonwealth's need for resiliency in the face of major events and disturbances.
- Future electrification of both transportation and heating—essential to the Commonwealth's decarbonization goals—further heightens the importance of distribution grid resiliency to ensure the safety of Massachusetts residents during outages; electrification also demands greater resilient generation capacity in order to meet future critical loads.

Financial Considerations

- The installation of rooftop or canopy solar arrays tends to be a sound financial investment for municipalities, particularly given state and federal incentives.
- Energy storage also has the ability to stack value and prove a good investment for towns and cities; however, if used for resilience purposes and not purely to maximize profit, revenue will be reduced.
- Existing diesel back-up generation substantially diminishes the required size of the battery, reducing the overall cost of the project.
- Diesel generators typically run through on-site storage between 3 and 7 days; their ability to support a system during an outage can be greatly lengthened with the addition of solar power.
- Investments in electric distribution equipment tend to be the costliest portions of these systems; however, they do not allow for revenue generation, and as a result they often cause the costs to outweigh the monetary benefits for projects that are otherwise financially beneficial.
- While these systems are typically able to generate revenue on an ongoing basis, they often require significant up-front capital costs that are not necessarily recouped during the life of the project.
- This process points to limitations of traditional cost-benefit analysis in assessing projects' feasibility; without a quantification of resiliency benefits, the additional investments required to allow islanding capabilities will likely look financially imprudent.

- Grant support from state or federal agencies can be the key factor in making the project economical for the municipality.

Operational Insights

- The specific details of implementation and procurement are particularly important for the success of projects at the municipal level. Lack of well understood pathways to funding and procurement—as is the case for energy storage solutions—can make promising projects difficult to execute for resource-constrained municipal staff.
- Reducing the load that the resilient generation must meet (either through energy efficiency measures or turning off load during outages) is, in theory, a helpful way to reduce the generation and storage requirements of the microgrid. In practice, however, guaranteeing load reductions in future outages can prove difficult due to the uncertain and emergency nature of outages and the costly electric rewiring sometimes required.
- Large medical facilities present particular challenges in decarbonizing and remaining resilient due to their high energy needs (including heating and cooling) around the clock and the critical nature of their work.
- Novel Vehicle-to-Grid solutions may be a financially viable way to electrify and provide resiliency.

Analytical Challenges

- Defining "typical" outages based on historical data can prove misleading—particularly as climate change worsens, historically atypical events will occur more frequently.
- Without measuring the load characteristics of critical infrastructure in the midst of an outage, it is difficult to predict exactly how typical load shapes will adapt to unanticipated demands and system constraints.
- Establishing parameters, accepted definitions, and benefits of resilience can also prove challenging. Notably, municipal leaders were understandably unwilling to receive a "resilience certification" if this meant that their facilities would be deprioritized for repairs during an outage.

Conclusions

A focus on resiliency is critical not only for climate adaptation, but for climate change mitigation through second-order effects. Indeed, the actual carbon reduction of replacing diesel generators with solar and storage is marginal, and there are likely numerous ways to reduce emissions more cost-effectively. However, improved resiliency of electric infrastructure will accelerate mitigation by establishing a safe and secure path to greater electrification. In order for the state's transportation and heating systems to both become largely reliant on our electricity distribution grid—as they will need to be to reach net zero emissions—communities must be assured of the system's resilience. In this way, rather than focusing on the primary emission impacts of electric resilience, policymakers and community leaders should consider the secondary mitigation effects of improved resilience as well.

The efforts through the CLEAR program reveal that the marketplace will likely not provide resilience as currently constructed. Furthermore, due to the high input costs and challenges with procurement, resilience-minded community leaders may find it surprisingly challenging to spearhead electric resiliency efforts locally. As such, it would be wise to consider a statewide strategy that provides goal-setting, planning, and potentially resources to support greater resilience at the community level.