DYRHS BESS Feasibility Study

Feasibility Study based on a Financial Analysis of the Proposed Resilience Battery Energy Storage System (BESS) for the Dennis-Yarmouth Regional High School (DYRHS) Emergency Shelter

Supplementary Information

Prepared For:

Community Clean Energy Resilience Initiative (CCERI)

Massachusetts Department of Energy Resources

By:

Cape and Vineyard Electric Cooperative, Inc. (CVEC)
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S1: Cadmus Report

CADMUS

MEMORANDUM

To:	**Liz Argo, Special Projects Coordinator, Cape & Vineyard Electric Cooperative, Inc. (CVEC)**
From:	**Charlie McClelland, Dave Beavers, and Danielle Poulin, Cadmus**
Subject:	**Recommendations re: the DOER Community Clean Energy Resiliency Initiative**
Date:	**October 3, 2014**

Overview

The Cape & Vineyard Electric Cooperative, Inc. (CVEC), in partnership with Barnstable County and the Dennis-Yarmouth (DY) Regional School District, applied for technical assistance as part of the Department of Energy Resources (DOER) "Community Clean Energy Resiliency Initiative" (CCERI). CVEC requested a preliminary analysis of how clean energy technologies can bolster the energy resilience at one facility complex:

- Barnstable County Emergency Facility: Dennis Yarmouth High School (DYHS) Regional Shelter

A project plan, which details resiliency project options and modeling results, has been completed and submitted to CVEC. This memo identifies the most promising alternatives and recommends next steps. For the purposes of this review, it is assumed that the maximum grant CVEC can apply for is $4,059,907.[1] The grant requires a 10% cost share.

Recommendations

We recommend one project scenario for further consideration, summarized in Table 1 and described in more detail in the following sections. This recommendation is based on information provided by CVEC and modeling results.[2] Detailed modeling results are discussed in the project plans for each of the facilities. Emergency load information was not available for the facility. For purposes of modeling, we assumed that the emergency load of the facilities matches the load under normal operations. This is believed to be a conservative scenario; during a real grid interruption event, the emergency power resources could be extended through load management (e.g., turning off lights in unoccupied space, shutting down non-critical equipment).

[1] The maximum grant available will depend on communities within CVEC's jurisdiction that receive grant funding separately. This value is believed to represent the lowest maximum grant value that would be available.
[2] Modeling was performed by HOMER Energy using their proprietary model. More information is available at: http://homerenergy.com/

Table 1. Project Scenarios

Facility	Description	Benefits	Costs[1]
DY High School: Baseline	1,279 kW Solar PV PPA and 150 kW & 230 kW Diesel Gensets	• Baseline: N/A	• Baseline: N/A
DY High School: Scenario 1	1,279 kW Solar PV PPA, 150 kW & 230 kW Diesel Gensets, Islanding equipment and Switchgear, and 512 kWh of Battery Storage	• 90% of building full load covered in grid outage for three days • Storage supplies 1 hour of autonomy during average annual load, and reduces diesel consumption during a 3-day outage by 835 L (at 100% of full load).	• Solar PV Energy: covered under current PPA • Storage and Switchgear Capital Cost: $409,600 • Storage Operations and Maintenance Annual Cost: $5,120

[1]Grid interconnection and equipment costs may be higher under a line-side / virtual net metering configuration. These values represent a typical behind-the-meter configuration

Barnstable County Emergency Facility: DY High School Regional Shelter

Under Scenario 1 shown in the table, available grant funding is used to purchase, or buy down the lease, on the equipment. For the purposes of modeling the scenario, we assumed lead-acid batteries for the storage technology; however, we recommend that the Community consider all storage technology options when seeking requests for bids for the project. Additional information on battery storage is located in the appendices.

The PV systems are virtually net-metered (VNM); follow-up with the utility and detailed engineering would be required to establish the cost and feasibility of islanding the VNM systems under Scenario 1.

In a worst-case winter-storm scenario involving grid outage, we estimate that the diesel gensets, solar PV, and battery storage would be sufficient to power 100% of the facility's load for at least three days. However, critical load management could be employed to reduce energy use during emergency operations, extending the length of time during which critical operations could be sustained in the event of a power outage.

There is more than sufficient grant funding available to cover the estimated capital cost of the energy storage system modeled, or buy down the cost of a lease. Additional grant funding could be used to prepay for annual operations and maintenance costs, or increase the capacity of the storage to be procured. Autonomous power from battery storage for this Facility would cost in excess of several million dollars for a three-day outage.

At minimum, the scenario proposed in the table above would provide the following benefits:

- The proposed systems would provide enough energy to power the facility for three days during a worst-case winter-storm scenario (assuming behind the meter interconnection, or other islanding capability for the PV systems):

- Adding energy storage and islanding switchgear will reduce diesel consumption over a three-day period by 835 liters while covering 100% of the full load of the building versus 73% for the baseline scenario.
- The energy storage will enable the diesel generator to run at full load, for shorter periods of time, for better generating efficiency.

- During a summer loss of grid power, the PV system combined with battery storage, would further reduce diesel usage beyond the worst-case winter scenario.

- Refer to the appendices for additional information on battery storage.

Other Scenarios Considered

No other resiliency scenarios were considered.

Next Steps

If CVEC is interested in pursuing one of the clean energy scenario described above, we recommend applying for CCERI Project Implementation Funding by October 29th, 2014. More information related to our analysis is provided in the project plan appendices. More information about CCERI and links to the solicitation are available at: http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/resiliency-initiative.html.

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MASSACHUSETTS DOER COMMUNITY CLEAN ENERGY RESILIENCY INITIATIVE
DETAILED PROJECT PLAN
CAPE & VINEYARD ELECTRIC COOPERATIVE (CVEC) – DENNIS-YARMOUTH HIGH SCHOOL REGIONAL SHELTER

Initiative Overview

As part of the Massachusetts Administration's Climate Change Preparedness Initiatives, the Governor of Massachusetts directed the Massachusetts Department of Energy Resources (DOER) to administer a $40 million grant program to ensure energy resiliency at critical facilities in municipalities using clean energy technology. Energy resiliency is intended to reduce electric service interruptions and support critical infrastructure during power outages due to both gradual and acute pressures. The Community Clean Energy Resiliency Initiative (CCERI) recognizes that climate change-induced events impact the entire Commonwealth and that communities are at the forefront of responding to such events.

The first phase of CCERI included technical assistance to provide communities and DOER with an understanding of how clean energy technologies can bolster the energy resilience of critical facilities. DOER contracted with Cadmus to provide this technical assistance, in conjunction with Cadmus' subcontractors, HOMER Energy and MCFA.

Proposed Project and Purpose

Proposed Project

The Cape & Vineyard Electric Cooperative, Inc. (CVEC), on behalf of Barnstable County and the Dennis-Yarmouth (DY) Regional School District (the "Community"), is interested in understanding how clean energy technologies might be utilized to increase the energy resiliency of the Dennis-Yarmouth High School Regional Shelter (the "Facility") while reducing the Community's use of fossil fuels. Currently, the Facility utilizes diesel generators on-site for primary back-up. Pending final interconnection with the local electric utility, the generators will be supplemented by two solar PV arrays (641 kW and 715 kW, both using virtual net metering), when the resource is available.

Purpose

Risks from storm events on Cape Cod have continued to worsen with the expected further effects of climate change, creating challenges for emergency response teams assisting the community's most vulnerable residents and causing the use of Barnstable County shelters to increase exponentially. The Dennis-Yarmouth Regional High School is one of six regional shelters open to all residents and visitors (and accompanying pets) of the county during a natural or man-made disaster. In addition to serving as a food preparation and distribution unit for the other shelters in the county, the Facility serves 2,418 individuals in short-term emergencies and 907 individuals in long-term emergencies. The Community seeks to add battery backup, an energy management system, and islanding equipment to the soon-to-

be-complete solar PV systems in order to develop a resilient electric power supply at the shelter during typical power outages experienced by the mid-Cape region.

Technical Assistance Project Overview

Cadmus reviewed materials provided in the Community's application and conducted a desktop evaluation of the Facility. We then evaluated the potential for solar PV and battery storage to provide energy resilience benefits, including continuous power at the Facility during a three-day (72-hour) power outage. Model results and assumptions are contained in the appendices.

We analyzed the following resiliency scenarios, as depicted in Table 1:

- **Baseline**: 1,279 kW Solar PV PPA and 150 kW & 230 kW Diesel Gensets
- **Scenario 1**: 1,279 kW Solar PV PPA, 150 kW & 230 kW Diesel Gensets, Islanding Switchgear, and 512 kWh of Battery Storage

Approach

Upon review of the Community's technical assistance application, the Cadmus team noted the current onsite back-up generation capacity: one 150 kW diesel generator and one 230 kW diesel generator, in addition to the planned installation of 1,279 kW of solar PV (590 kW roof-mounted and 689 kW ground-mounted). The Cadmus team utilized this capacity as the baseline resiliency scenario for the Facility. Based on discussions with the Community and feedback from DOER, the Cadmus team evaluated adding islanding switchgear and battery storage to the planned baseline configuration.

Scenario 1

Model results indicate that the diesel generators and solar PV systems, along with the addition of switchgear and 512 kWh of battery storage, would be adequate to meet energy needs during a three-day emergency, assuming sufficient fuel and resource availability. This configuration would also be adequate to sustain operations during a majority of outage incidents, and would provide approximately one hour of autonomous power during a power outage during worst-case winter-time conditions. It would also reduce the amount of diesel required during a three-day outage by about 835 liters. Additional batteries could be installed to provide greater autonomy, though these additions would require added capital and O&M costs, as well as space. Autonomous power from battery storage for this Facility would cost in excess of several million dollars for a three-day outage.

Notes on the Analyses

The following caveats apply to the Cadmus team's model results:

- Energy usage profiles were not available for the Facility; rather, we assumed a typical school load profile and scaled this to match actual energy consumption at the Facility.
- The solar PV systems are virtually net-metered (VNM); follow-up with the utility and detailed engineering would be required to establish the cost and feasibility of islanding the VNM systems under Scenario 1. Implementing an islandable VNM system could add substantial engineering and interconnection costs.

Model assumptions and results are documented in the appendices.

Energy Usage during Normal Operations

The clean energy technologies proposed would operate during "business as usual," reducing the Community's dependence on energy from the utilities. Table 1 details costs and emissions figures associated with the baseline and proposed scenarios.

Table 1. Baseline and Clean Energy Generation Scenario Costs and Emissions

Scenario	Clean Energy Resiliency Technology Versus Baseline	Initial Capital Cost[2]	Annual Operating Cost for Community[3]	Emissions[4] (CO_2e kg/yr)
Baseline	1,279 kW Solar PV PPA[1] and 150 kW and 230 kW Diesel Gensets	$0	$272,397	64,692
1	1,279 kW Solar PV PPA[1], 150 kW & 230 kW Diesel Gensets, Switchgear, and 512 kWh of Battery Storage	$409,600[5]	$290,365	64,692

[1]Assumes a PPA rate of $0.10 per kWh produced by the solar PV.

[2]Initial capital costs include the batteries and battery management system (50 percent); and, islanding inverter and switchgear, installation, and other balance of plant equipment (50 percent).

[3]Operating costs include all electricity purchases during normal operation, system O&M costs, and amortized replacement cost of the equipment.

[4]Net emissions under normal operations, considering all electricity usage.

[5]The cost for a line-side interconnection, for virtually net-metering solar output, could add substantial costs.

Energy Usage during Emergency Operations

Table 2 compares resiliency attributes of the baseline and clean energy generation scenarios.

Table 2. Load Coverages and Fuel Requirements for Baseline and Proposed Scenarios

Scenario	Energy Resiliency Technology	% of Full Load That Can be Met for 3 Days	Diesel for 3-day Outage[1] (L)
Baseline	1,279 kW Solar PV PPA and 150 kW and 230 kW Diesel Gensets	73%	4,402
1	1,279 kW Solar PV PPA, 150 kW & 230 kW Diesel Gensets, Switchgear, and 512 kWh of Battery Storage	100%	3,567

[1]At corresponding percent of full load.

Appendices

- Appendix A: Modeling Assumptions
- Appendix B: Supporting Documentation
- Appendix C: Detailed System Reports

MASSACHUSETTS DOER COMMUNITY CLEAN ENERGY RESILIENCY INITIATIVE
APPENDICES: CAPE & VINEYARD ELECTRIC COOPERATIVE (CVEC) – DENNIS-YARMOUTH REGIONAL SCHOOL DISTRICT

Attachments:

- Appendix A: Modeling Assumptions
- Appendix B: Supporting Documentation
- Appendix C: Detailed System Reports

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Appendix A: Modeling Assumptions

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Massachusetts DOER Community Clean Energy Resiliency Initiative
Tables of Assumptions by Technology

Natural Gas Combined Heat and Power

Table 1. Combined Heat and Power

Parameter	Value	Units	Sources/Notes
Capital cost	$3,500	$/kW	NREL
Variable O&M cost	$0.06	$/kWh	NREL
O&M cost	$0.0225	$/kW/hour of operation	Assume 75% CF
APS rebate	($0.03)	$/kWh	Cadmus APS data
Overhaul frequency	20,000	hours of operation	Engineering assumption
Replacement cost	$583.33	$/kW	Assume 1/6 of capital cost
Fixed cost	$91	$/kW-yr	Engineering assumption
Fuel cost	Rate	$/m^3	
Peak electrical efficiency	33%	--	Engineering assumption
Minimum output as percentage of nameplate	50%	--	Engineering assumption
Net peak fuel efficiency (thermal and electrical)	60%	--	Engineering assumption

Table 2. Small-Scale (Less than 300 kW) Combined Heat and Power

Parameter	Value	Units	Sources/Notes
Capital cost	$4,000	$/kW	Vendor information
Availability	96%	--	Vendor information
Capital cost – hydronic loop	$50,000	$	Vendor information
Capital cost – islanding switchgear	$50,000	$	Vendor information
Utility rebate	$56,000	--	Vendor information

Biomass Combined Heat and Power

Table 3. Biomass Combined Heat and Power

Parameter	Value	Units	Sources/Notes
Capital cost	$6,067	$/kW	NREL
Fixed cost	$91	$/kW/year	NREL
Variable O&M cost	$0.06	$/kWh	NREL
APS rebate	($0.03)	$/kWh	Cadmus APS data
Overhaul frequency	20,000	hours of operation	Engineering assumption
Replacement cost	$1,011	$/kW	Assume 1/6 of capital cost
O&M cost	$0.05	$/hour of operation	Assume 75% CF
Peak electrical efficiency	24%	--	Engineering assumption
Minimum output as % of nameplate	50%	--	Engineering assumption

Table 4. Biomass Combined Heat and Power Fuel (Wood Pellets)

Parameter	Value	Units	Sources/Notes
Density	200	kg/m^3	Engineering assumption
Energy content	19	MJ/kg	Engineering assumption

Natural Gas Reciprocating Engine

Table 5. Natural Gas Reciprocating Engine Technology

Parameter	Value	Units	Sources/Notes
Capital cost	$1,000	$/kW	Vendor info
Overhaul frequency	25,000	hours of operation	Vendor info
Replacement cost	$300	$/kW	Vendor info
O&M cost	$0.01	$/kW/hour of operation	Vendor info
Minimum power output	50%	of rated power output	Vendor info
Efficiency at 100% output	30%	electricity out / fuel energy in	Vendor info
Efficiency at 50% output	25%	electricity out / fuel energy in	Vendor info

Solar Photovoltaics

Table 6. Solar Photovoltaics (Direct Ownership)

Parameter	Value	Units	Sources/Notes
Installed cost	$4.22	$/kW	Cadmus data
O&M cost	$20	$/kW/year	Cadmus data
Lifetime cost	20	years	Typical PV guarantee
Replacement cost	$4.22	$/kW	Estimated
Capacity factor	14.39%		MA DOER

Table 7. Solar Photovoltaic (Power Purchase Agreement)

Parameter	Value	Units	Sources/Notes
PPA cost	$0.10	$/kWh	Cadmus assumption (coastal and central MA)
Annual production	1,261	kWh/kW/year	Calculated based on capacity factor
Cost/year	$126.1	$/kW/year	Estimated
Capacity factor	14.39%		MA DOER

* Net metering, calculated annually, assuming net-metered energy cannot exceed grid purchases by more than 1/3.

Battery Storage

Table 8. Battery Storage

Parameter	Value	Units	Sources/Notes
Capital cost	$800	$/kWh	SANDIA, 1 kWh lead acid battery and management system
Replacement cost	$500	$/kWh	HOMER assumption
O&M cost	$10	$/kWh/year	HOMER assumption

Fuel Cells

Table 9. Fuel Cells

Parameter	Value	Units	Sources/Notes
Capital cost	$10,000	$/kW	NREL
Overhaul frequency	50,000	hours of operation	Estimated
Replacement cost	$10,000	$/kW	Assumption
O&M cost	$0.01	$/kW/hour of operation	Estimated
Minimum power output	75%	of rated power output	Engineering assumption
Efficiency at 100% output	60%	electricity out / fuel energy in	CCERI minimum eligibility
Efficiency at 50% output	60%	electricity out / fuel energy in	CCERI minimum eligibility

Fuels

Table 10. Fuel

Parameter	Value	Units	Sources/Notes
Diesel	$0.80	$/L	Vendor information
Gasoline	$1.00	$/L	Assumption
Propane	Rate	$/L	Community
Heating oil	$0.80	$/L	Assumed; heating oil = non-road diesel
Natural gas	$0.50	$/$m^3$	Assumed, if no other data provided
Natural gas	$1.4835	$/therm	Calculated
Wood pellet energy content	5	MWh/tonne	Calculated
Wood pellet energy content	18	MJ/kg	Biomass Energy Center
Wood pellet cost	$200	$/tonne	MA DOER
Wood pellet cost	$0.011	$/MJ	Calculated
Wood pellet cost	$1.172	$/therm	Calculated

Emissions

Table 11. Emissions

Parameter	Value	Units	Sources/Notes
NPCC New England (NEWE) GHG Intensity	420	gCO2e/kWh	Union of Concerned Scientists
Biomass GHG intensity	0	gCO2e/kWh	Assumption
PV GHG intensity	0	gCO2e/kWh	Assumption
Battery GHG intensity	0	gCO2e/kWh	Assumption

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Battery Storage for Energy Resiliency

There are many factors to consider when selecting a battery storage technology for a backup power system, including initial capital costs, maintenance requirements, energy and power needs, useful lifetime, charging requirements, and siting and environmental considerations. There are a variety of battery chemistries available with unique cost and performance attributes – common types include:

- Flooded lead acid batteries,
- Sealed lead acid batteries,
- Lithium-ion batteries and,
- Other types. Including nickel, hybrid, and flow batteries.

Table 1 provides a brief overview of select battery technologies, including approximate cost (inclusive of battery management system and balance of plant equipment), as well as relative rankings of energy density, maintenance, cycle life, depth of discharge, and average lifetime in standby applications.

Table 1. Baseline and Clean Energy Generation Scenario Costs and Emissions

Battery Type	Cost/kWh	Maintenance Requirements	Energy Density	Cycle Life/Depth of Discharge	Average Lifetime
Flooded lead-acid	$200-$400	High	Moderate	Moderate	Moderate
Sealed lead-acid	$400 - $800	Low	Low	Low to Moderate	Low
Lithium Ion	$1,000- $1,600	Low	High	Moderate to High	High

Flooded Lead Acid (FLA)

Flooded lead acid (FLA) batteries are one of the oldest technologies available that is suitable for backup storage in a resiliency application. FLA are typically the lowest cost solution, though have shorter lifetimes, higher maintenance requirements and safety concerns versus other technologies. The electrolyte in the FLA battery is a liquid that needs to be equalized periodically to ensure it is well mixed, which in turn helps extend battery lifetime. During equalization the battery is subjected to a high charge current and can generate hydrogen gas, an explosive gas that requires adequate ventilation. Maintenance requires measuring the specific gravity of cells and periodically adding distilled water to replace liquid lost to evaporation during charging.

Benefits of FLA Batteries

- Low initial cost
- Widely available and used in renewable energy and backup power applications

Drawbacks of FLA Batteries

- Require equalization charging and monitoring of electrolyte
- Sensitive to depth of discharge and temperature
- Capacity is reduced at high discharge rates

Figure 1. 350 kWh Flooded Lead Acid Battery Bank

- Require sufficient ventilation/airflow to prevent buildup of hydrogen gas

Sealed Lead Acid Batteries (SLA)

Sealed lead acid (SLA), or valve regulated lead acid (VRLA), batteries offer a compromise between cost and maintenance. SLA batteries generate very little hydrogen gas compared to FLA batteries and thus require little maintenance, making them suitable for remote installations. Typically constructed with lead-calcium plates, the two most common types of SLA batteries are absorbed glass mat (AGM) and gelled electrolyte (GEL). Generally, GEL batteries recover quicker from deep discharge, though have lower charging and discharging rates as compared with AGM batteries..

Benefits of SLA Batteries

- Minimal maintenance requirements
- Widely available and used in renewable energy and backup power applications

Drawbacks of SLA Batteries

- Sensitive to depth of discharge and temperature
- Low energy density (will require more space to store batteries than other technologies)
- Capacity is reduced at high discharge rates

Lithium-ion Batteries

Lithium-ion (Li-ion) batteries are a relatively new technology which has benefited from the popularity of hybrid automobiles and research in the area of lightweight, high-density energy storage. While the cost of Li-ion batteries has come down in recent years, they remain two to three times more expensive than lead-acid batteries. Li-ion batteries can generally tolerate deeper and more frequent discharge cycles than lead acid batteries and are less impacted by variations in temperature or discharge rate. These types of batteries, though initially more expensive, may be more cost-effective over time in cold or hot weather applications where frequent charging and discharging is expected. For occasional use in climate-controlled areas, Li-ion may not be as cost-effective as lead acid type batteries.

Benefits of Li-Ion Batteries

- Require less space for same energy storage
- Minimal effects of temperature and discharge rate on capacity
- Deep discharges have minimal effect on cycle life compared to lead acid technologies

Drawbacks of Li-Ion Batteries

- Expensive compared to other technologies
- Relatively new for small-mid scale renewable energy and backup power applications

Other Battery Technologies

The battery industry is evolving quickly and there are many other types of batteries entering the marketplace. Compared with the technologies mentioned here, however, some of these new technologies are not yet widely used in backup power applications.

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Appendix B: Supporting Documentation

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MEMORANDUM

To:	Liz Argo, Special Projects Coordinator, Cape & Vineyard Electric Cooperative, Inc.
From:	Danielle Poulin and Charlie McClelland, Cadmus
Subject:	Request for Information – CCERI Technical Assistance Application
Date:	August 26, 2014

Please provide written responses to questions outlined in the Request for Information below by Tuesday, September 9, 2014. Submission of responses prior to this date is encouraged.

Introduction

The Cadmus team will be developing a model for the proposed facilities identified by the Cape & Vineyard Electric Cooperative, Inc. (CVEC) in the Community Clean Energy Resiliency Initiative (CCERI) Technical Assistance application. In order to provide the most robust analysis and recommendations for the potential project, the Cadmus team requires additional documents and information, listed below.

Request for Information

1. Is the school's HVAC system electric? If no, how does CVEC anticipate that the facility will address thermal needs in the event of a power outage? If natural gas is used, please provide information on usage for CY13.
2. Please provide a legible copy of the current solar PV array one-line diagram.
3. Does CVEC also intend to include the ground-mounted, line-side PV system in the resiliency system?
4. During your preliminary discussions with engineers, have an estimated interconnection costs been provided? If yes, what estimates have been provided?

Please feel free to contact us with any questions or concerns.

Kind Regards,

Danielle Poulin
The Cadmus Group, Inc.
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617-673-7169

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8.28.14

Below is response to the RFI on DY High School from Cadmus dated 8/26/14

Request for Information

1. HVAC
    a. Is the school's HVAC system electric?
        i. Heat: Gas AC: Electric (partially served by generator during outage)
    b. If no, how does CVEC anticipate that the facility will address thermal needs in the event of a power outage?
        i. GAS
    c. If natural gas is used, please provide information on usage for CY13.
        i. National Grid is assembling this data and CVEC will forward asap

2. Please provide a legible copy of the current solar PV array one-line diagram.
    a. The revised one-line is being included with this response.

3. Does CVEC also intend to include the ground-mounted, line-side PV system in the resiliency system?
    a. The team is open to any option, using either or both PV systems (ground mounted and/or roof mounted). At this time it is proposed that only the roof mounted system is utilized. But there is no reason not to utilize the ground mounted system if desirable.
4. Costs
    a. During your preliminary discussions with engineers, have an estimated interconnection costs been provided?
        i. The PV system costs have been absorbed by the contractor and the system is now interconnected.
        ii. As for potential costs to add the resiliency, costs have not been discussed with any engineer with whom we have spoken regarding feasibility.
    b. If yes, what estimates have been provided?

Please feel free to contact us with any more questions or concerns.

Regards,

Liz Argo
Special Projects Coordinator

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Appendix C: Detailed System Reports

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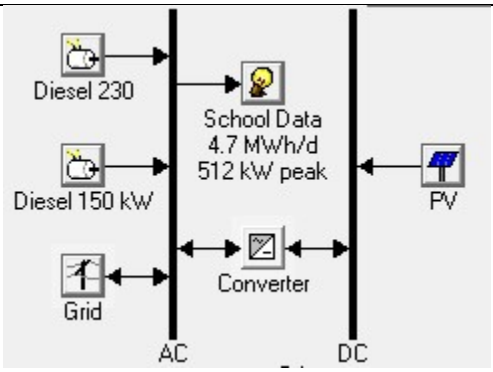
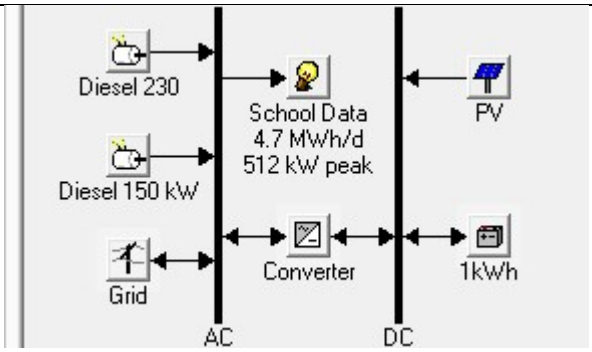
CVEC Dennis-Yarmouth HS

1 SUMMARY

We first modeled the existing and proposed system configurations to determine performance during typical operation. We then modeled how each system would perform during a 72-hour grid outage. System architectures are illustrated below.

Baseline schematic: • Existing 1279 kW PV systems • Existing 230 kW Genset • Existing 150 kW Genset	Baseline+Storage Hybrid • Existing 1279 kW PV • Existing 230 kW Genset • Existing 150 kW Genset • 512 kWh of battery storage • Switchgear and islanding equipment to allow PV systems to operate in island mode
	

2 KEY OBSERVATIONS:

0. Baseline system (Existing 1279 kW PV, 230 kW genset and 150 kW Genset)
    a. This system is not capable of meeting the load for a 3-day outage during an emergency event.
    b. Currently only the diesels are available during an outage, and these can meet 73% of the peak load using 4,402 L of diesel.
1. Baseline + Battery Storage sized for 1 hr grid outage considering average annual load
    a. 512 kWh of battery capacity to meet load
    b. This system is capable of meeting 100% of peak 72 hr energy consumption, and does so using 3,567 L of diesel.

3 System Architectures Summary:

		Normal operation			Emergency operation			
Scenario	**System Architecture**	**Initial Capital Cost[1]**	**Annual Operating Cost for Community**	**Emissions**	**% of full load that can be met for 3 days**	**Diesel for 3 Day outage**	**CHP Nat Gas for 3-day outage**	**Boiler Nat Gas for 3-Day outage**
		($)	($/yr)	(CO2e kg/yr)	(%)	(L)	(m^3)*	(m^3)
Baseline	**Existing 1279 kW PV, 230 and 150 kW gensets**	**0**	**$272,397**	**64,692**	**73%**	**4402**	**N/A**	**N/A**
1	Baseline + 512 kWh of battery storage and islanding equipment	$409,600	$290,365	64,692	100%	3,567	N/A	N/A

Detailed System Reports follow the table. All costs are in 2014 dollars.

[1]Approximate break-downs of capital and annual operating costs can be found in the project plan.
*2.967 m^3/therm

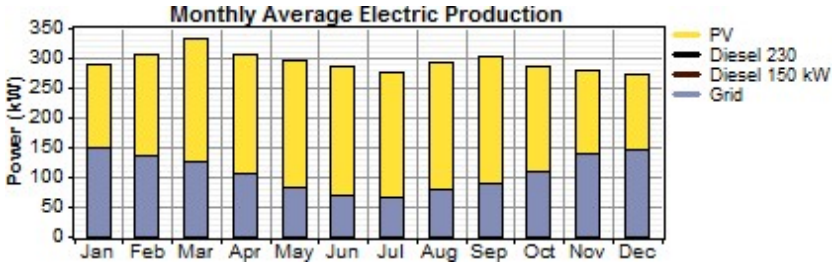
4 System Report – Architecture 3: Baseline + 1 hour Storage

4.1 System architecture

PV Array	1,279 kW
Diesel 230	230 kW
Diesel 150 kW	150 kW
Grid	1,000 kW
Battery	512 Generic 12V 1kWh Battery
Dispatch strategy	Cycle Charging

4.2 Electrical

Component	Production (kWh/yr)	Percentage (%)
PV array	1,625,986	63%
Diesel 230	0	0%
Diesel 150 kW	0	0%
Grid purchases	955,174	37%
Total	**2,581,160**	**100%**



4.3 PV

Quantity	Value	Units
Rated capacity	1,279	kW
Mean output	186	kW
Mean output	4,455	kWh/d
Capacity factor	14.5	%
Total production	**1,625,986**	**kWh/yr**

4.4 BATTERY

Quantity	Value
String size	1
Strings in parallel	512
Batteries	512
Bus voltage (V)	12

Quantity	Value	Units
Nominal capacity	512	kWh
Usable nominal capacity	307	kWh
Autonomy	1.58	hr
Lifetime throughput	409,600	kWh
Battery wear cost	0.699	$/kWh
Average energy cost	0.000	$/kWh

Quantity	Value	Units
Energy in	0.00	kWh/yr
Energy out	0.00	kWh/yr
Storage depletion	-0.268	kWh/yr
Losses	0.268	kWh/yr
Annual throughput	0	kWh/yr
Expected life	10.0	yr

4.5 GRID

Rate: Rate 1

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	($)	($)
Jan	112,272	46,598	65,673	442	0	2,149
Feb	91,438	52,792	38,647	361	0	1,753
Mar	94,851	68,569	26,282	362	0	1,757
Apr	77,027	67,048	9,979	321	0	1,560
May	62,532	75,879	-13,347	319	0	1,548
Jun	50,227	83,894	-33,667	249	0	1,211
Jul	50,456	91,068	-40,613	210	0	1,021
Aug	58,362	89,573	-31,211	211	0	1,023
Sep	65,585	80,007	-14,421	365	0	1,776
Oct	80,624	58,588	22,036	329	0	1,597
Nov	101,605	46,659	54,946	354	0	1,719
Dec	110,194	40,468	69,725	424	0	2,061
Annual	**955,174**	**801,144**	**154,030**	**442**	**21,518**	**19,175**

4.6 EMISSIONS

Pollutant	Emissions (kg/yr)
Carbon dioxide	64,692

S2: Sandia Revenue Report

Type of revenue	Revenue source (bill savings, ISO check, etc.)	Description	Target reduction (daily, monthly, annual)	Min or max size	Currently available?	Rate class requirement? (TOU, demand meter)	Supply contract requirements (TOU, full pass-through, etc.)	Metering requirements	Rough $ estimate	Notes on feasibility	Works well with, potential conflicts	Resources
Demand charge management	Electricity bill - T&D savings	Commercial rate classes shift more T&D charges into demand-based charges, which are based on peak kW/kVa by billing period (month). Generally, higher consumption means a greater proportion of charges being demand charges, which in turn, increases potential savings for demand charge management. Demand charge management consists of selectively controlling demand to reduce monthly peak.	Reduce monthly peak	None	Yes	Must be on demand rate	None	Must be on demand rate. Remote dispatch may increase likelihood of success, but not required.		Requires algorithm that can effectively predict times that peak monthly demand is likely to occur, and dispatch resource. Also worth noting - utilities propose increasing demand charges, including for residential customers, which could make this a more important source of revenue in the future.	Consistent pursuit of demand charge management could actually alter what baseline consumption looks like. For ISO markets that are based on changing demand relative to a baseline (FCM, arbitrage, reserves), this would affect ability to participate in these markets. I haven't seen this modeled, but the conflict makes intuitive sense. Works well with cap tag management, which is likely to suggest similar demand reductions during months w/ potential annual peak (July or August for most).	https://www.eversource.com/Content/docs/default-source/rates-tariffs/ema-cape-vineyard-rates.pdf?sfvrsn=6
Load Shifting	Electricity bill - power supply savings	This strategy consists simply of shifting consumption from higher-cost hours to lower-cost hours. Doing so reduces day ahead/real time wholesale electricity costs.	Shift consumption from high-cost periods to low-cost periods. Generally looking at shifting diurnal consumptions, though some week to weekend shifting could also occur.	None	Yes	See contract requirements	Requires pass-through supply contract (or some specific arrangement to capture benefits)	Would require interval meter, hourly data, to capture load shifting.		To be most effective, requires reasonably accurate pricing forecasts.	While it may seem like double-dipping, there is nothing that prevents pursuing load shifting as well as arbitrage. As noted above, however, consistently altering consumption pattern would affect baseline consumption, which would affect participation in ISO markets which compare actual consumption to a baseline, including arbitrage.	
Cap tag management	Electricity bill - power supply savings	ISO-NE capacity costs are allocated based on capacity tags. Capacity tags are established essentially by calculating a customers % of system load on the ISO-NE annual peak hour. Thus, reducing consumptioin during the one hour in which peak demand occurs reduces capacity costs for the remainder of the year, as the customer is responsible for a smaller % of total capacity costs.	Reduce annual coincident peak (consumption during peak ISO-NE hour)	None	Yes	See contract requirements	Requires pass-through supply contract (or some specific arrangement to capture benefits)	Would require interval meter, hourly data.		Requires algorithm that can effectively predict when peak ISO hour is likely to occur.	See demand charge management	http://www.iso-ne.com/static-assets/documents/2015/10/clg_james_bride_keynote_presentation_10_9_2015.pdf
Capacity	ISO-NE - forward capacity market	The forward capacity market (FCM) compensates generators for being available to generate electricity/reduce demand at a point in the future. Revenues are primarily from forward capacity payments, which are based on annual auctions for summer and winter periods. Participation obligates customers make their capacity available anytime there is a capacity scarcity condition. Failure to to so leeds to a $2,000/MWh penalty. Starting in 2018, must offer into day-ahead market daily	Make reduction (up to capacity supply obligation) available during system or local capacity scarcity conditions.	100 kW, can be aggregated w/in load zone	Yes	None	None	5-minute data - see OP14 and OP18. Note that OP18 specifies speed and accuracy of metering, but does not specify a technology, which gives some flexibility.		Greatest challenges here are metering and assuring response from participating assets (customers). How much will be automated vs. how much behavioral, etc.? Furthermore, as mentioned numerous times, careful attention must be paid to how baseline consumption may change while pursuing multiple DR revenues.	Required in order to participate in arbitrage (price-responsive demand). See above on potential issues associated with permanently changing load shape, and how this would affect baseline load calculations used for ISO programs. Link to right has good description of baseline calculation. Change in how baseline will be calculated will occur on 6/1/18. Details here: http://www.iso-ne.com/static-assets/documents/2015/08/a04_mr_1_redlined_pages_08_05_15.docx	http://www.iso-ne.com/static-assets/documents/2016/04/20160404-13-wem101-demand-resources.pdf
Arbitrage (price-responsive demand)	ISO-NE - day-ahead and real-time markets	Currently, through the transitional demand response program, demand resources can bid load reductions into the day ahead market. Some changes will occur on 6/1/18 with introduction of price responsive demand program (including ability to participate in reserve markets). If bids into day ahead market clear, revenue is calculated same as it would be for a generator, using actual production vs. baseline to calculate kW	Based on what is bid into and clears in day-ahead market.	100 kW, can be aggregated w/in load zone	Yes, some chages occur 6/1/17 - move to price responsive demand	None	None	See above.		Because of flexibility of this program, can tailor bids to work well with whatever technology, assets are enrolled.	While it may seem like double-dipping, there is nothing that prevents pursuing load shifting as well as arbitrage. As noted above, however, consistently altering consumption pattern would affect baseline consumption, which would affect participation in ISO markets which compare actual consumption to a baseline, including arbitrage. ISO does, however, account for participation in ISO-programs in calculation of baseline. In other words, consistently clearing in day-ahead market would not affect calculation of baseline.	See above. Also: http://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/mrkts_comm/mrkts/mtrls/2014/may672014/a03_iso_presentation_05_06_14.pptx
Regulation	ISO-NE - regulation market	ISO-NE's frequency regulation market allows resources w/ the ability to respond to an automated signal on a 4-second basis to participate in the frequency regulation market, which the ISO uses to maintain the grid at 60 herz. There are three signals - trinary (consume as much as possible, generate as much as possible, do nothing), continuous, and energy neutral. In theory, a demand resource could participate using the energy neutral signal for techs that can be controlled automatically and cycled frequently. Payment is based on capacity and mileage (i.e., how much energy do you actually consume/produce).	Respond to 4 second signal	1 MW minimum, can be aggregated (don't believe there is a geographic restriction on this)	Yes	None	None	4 second data, remote dispatch capability. Unlike FCM/arbitrage, does have specific metering tech. requirements.		Two main challenges I would foresee: cost of technology required for 4 second remote dispatch (or, for frequency regulation, automatic generation control (AGC)), and concerns regarding the effect of frequent cycling on equipment (i.e. will pool pump, fridge, etc. die faster with constant cycling on anf off). Another concern I hold personally - while current economics of regulation markets are strong, I wouldn't be surprised if the greater adoption of batteris started to depress these prices.	Positively, there offers are made on a day-ahead basis, so there is no long-term commitment to participate in the regulation market (though, given expense of getting set up, audits, testing, etc., one is likely to want to participate regularly). In theory, this means that participation could be focused on parts of the year when there is not likely to be a scarcity condition. Furthermore, it may be possible that a resource could be participating in frequency regulation and arbitrage or responding to a scarcity condition at the same time, though this is somewhat unclear.	http://www.dynapowerenergy.com/dpems-blog/5-things-to-know-about-the-iso-ne-frequency-regulation-market/ http://www.iso-ne.com/static-assets/documents/2015/02/2015_regulation_market_ppt_slides.pdf
Reserve (starting in 2018)	ISO-NE - Reserve market revenue (both forward and real-time)	ISO-NE reserve markets are used to ensure sufficient resources are able to supply power/reduce demand w/in 10 or 30 minutes to respond to major contingencies (lost of biggest TX line/generator, etc.). Primary revenue is from forward auction, similar to FCM. Resources that clear in this auction must be available to for entire season (winter or summer) to provide reserves, or penalties apply.	Must always be available to provide reserves bid into auction. For demand resources, this means maintaining minumum level of consumption (as reserves are based on reducing consumption).	Minimum of 100 kW, but may be aggregated across dispatch zone	Yes	None	None	5 minute? As of 9/26/13, not finalized - considered 1 minute. Also requires remote dispatch capability.		Distributed, residential DR not likely a good candidate. Costs of more more granular metering and remote dispatch may not justify additional revenue. Also, ability to provide reserves at any point may prove challenging.	Must participate in FCM in order to participate in reserve market. See above on potential issues associated with permanently changing load shape, and how this would affect baseline load calculations used for ISO programs.	http://www.iso-ne.com/committees/comm_wkgrps/mrkts_comm/mrkts/mtrls/2013/oct22013/a5_iso_white_paper_drr_reserves_09_26_13.doc http://www.iso-ne.com/static-assets/documents/2016/04/20160404-16-wem101-reserve-mkt-overview.pdf

S3: CVEC Letter to NSTAR

Cape & Vineyard Electric Cooperative, Inc.
Superior Courthouse. P.O. Box 427. Barnstable, MA 02630
508.375.6891. www.cvecinc.org

8.1.14

Charlie Tavares
Account Executive
NSTAR
One NSTAR Way
Westwood, MA 02090

RE: Energy Resiliency

Dear Mr. Tavares,

Thank you for speaking with us briefly on Thursday July 24th regarding the Cape & Vineyard Electric Cooperative's PV installation for the Dennis Yarmouth High School Regional Emergency Shelter. I understand from our conversation that you are not in a position to address my questions over the phone but, rather, would encourage me to send a letter to NSTAR with my questions and concerns. I will thus summarize CVEC's requests on behalf of the DY Regional School District and the Barnstable Emergency Preparedness Committee.

On July 25th 2014, the Cape & Vineyard Electric Cooperative, in partnership with the Dennis Yarmouth Regional School District and the Barnstable County Regional Emergency Planning Committee, was notified of having received a Community Clean Energy Resiliency Initiative grant from the Massachusetts Department of Energy Resources. The grant is for Technical Assistance from the Cadmus Group in partnership with Homer Energy and MCFA. The consultants will work with the CVEC team to develop a resilient clean energy system, incorporating the DY High School's roof-mounted PV system. The resulting resilient clean energy design is intended to power the DY Regional Emergency Shelter during climate events made worse by the effects of climate change.

In order to effectively leverage the financial benefits of Net Metering, the roof-mounted PV system for DY High is to be a line-side connection, NSTAR work order # 1942559. However, the team would request installation of an additional behind-the-meter connection to allow islanding during emergencies when the Emergency Shelter would rely on the energy resilient system.

We must ask for a response to our request rather quickly, as there are deadlines associated with the DOER's Community Clean Energy Resiliency Initiative. Can NSTAR kindly give our team an indication within a week, by August 8thor so, as to the possibility of a secondary

behind-the-meter connection to be used only in emergencies or, perhaps, suggest other alternative options to allow an energy resilient system for the DY Regional Emergency Shelter?

The Cape & Vineyard Electric Cooperative, the Dennis Yarmouth School District and the Barnstable County Regional Emergency Planning Committee look forward to NSTAR's expert help.

Yours Truly,

John C. Checklick
President
The Cape & Vineyard Electric Cooperative

CC:

Liz Argo, CVEC Special Projects Coordinator
Amy Maguire, Mass DOER
Charles McClelland, Cadmus Group
Stephen Wollenburg, Cape Light Compact
Sandra Cashen, Dennis Yarmouth Regional School District Facilities Manager
Carol Woodbury, Dennis Yarmouth Regional School District Superintendent
Maggie Downey, Cape Light Compact Administrator, Barnstable County Administrative Assistant
Audrey Eidelman, BCK Law, PC
Phil Burt, Barnstable County Emergency Preparedness Project Assistant
Michael Whelan, Barnstable County Emergency Preparedness Committee

S4: DYRHS BESS RFP

Cape and Vineyard Electric Cooperative
Community Clean Energy Resiliency Initiative
Request for Proposals

Due Date - October 22, 2018

PART 1: INTRODUCTION

A: General

The Cape & Vineyard Electric Cooperative, Inc. ("CVEC"), as the Awarding Authority (Known as Owner), invites the submission of proposals by responsible companies ("Respondent") to design, present a financial analysis based on design, procure, install, test and commission a minimum two hundred and fifty kilo-watt (250 kW), four-hour Battery Energy Storage System (BESS) to be located at the Dennis-Yarmouth Regional High School in South Yarmouth, Massachusetts at 210 Station Ave, South Yarmouth, MA 02664. The primary purpose of this Community Clean Energy Resiliency Initiative Project being performed with a grant from the Massachusetts Department of Energy Resources (DOER) is to provide resiliency via energy storage for the Dennis-Yarmouth Regional Emergency Shelter using battery technology in conjunction with existing photovoltaic arrays and diesel generators on site. Secondary purpose will be to provide a source of income to CVEC and the Dennis-Yarmouth Regional School District and to allow CVEC a better understanding of BESS applications.

CVEC will consider proposals that best meet CVEC's selection criteria, which include a grant requirement that the system be owned by CVEC as the grantee. Respondents are encouraged to consider contractual approaches that reduce uncertainties associated with operational costs, system performance, and system income. For each proposed model, Respondent must provide a sample contract. Exhibit E provides more information on structures CVEC will consider.

The Successful Respondent will work with CVEC's Owner's Project Manager (OPM), Scott Reynolds of Reynolds Engineering Design. The role of the OPM is to act on behalf of CVEC and in conjunction with CVEC, to manage the project award, design and construction activities. The OPM is contracted by CVEC and CVEC has delegated authority to the OPM to act as CVEC's agent. Also, CVEC may retain the services of Sandia National Labs, under contract to the US DOE's Office of Electricity, as an independent third party Energy Storage analysis consultant. Respondents must demonstrate successful completion of energy storage systems using the same or functionally similar technology proposed in their response.

All submissions, to be considered, must be prepared in accordance with the requirements specified in this Request for Proposals document and in accordance with applicable provisions of Massachusetts General Laws. This RFP is issued pursuant to M. G. L. c. 30B, §6 for energy-related supplies and services.

Any exceptions to the requirements of this RFP are to be identified on a separate form and clearly marked.

If an agreement cannot be reached with CVEC's first choice, the Awarding Authority will negotiate with the next highest ranked Respondent.

The performance degradation over the life of the project will be considered in the selection process. This is a total cost of ownership-based selection process.

The Respondent's price proposal and financial analysis are to be placed in a separate sealed envelope bearing the title "Price Proposal – CVEC Community Clean Energy Resiliency Initiative" and included with the non-price proposal. The contract will be awarded to the Respondent with the most advantageous and responsive submittal taking into consideration both price and non-price submittals ("Selected Respondent"). **Copies of the full RFP documents and required forms are available at the CVEC offices and on CVEC's website.**

An electronic submission of the non-price proposal meeting CVEC requirements and ten (10) hard copies of all submissions, non-price and price proposal, meeting CVEC requirements must be submitted to:

Liz Argo, Manager
CVEC
23H2 White's Path, Suite 2
South Yarmouth, MA 02664
largo@cvecinc.org

Submissions are due on or before October 22, 2018 **at 1:00 pm**. Any submission received after this time and date will not be considered and will be returned to the Respondent unopened. The clock in the CVEC office shall represent the official time for purposes of this determination.

Copies of Submission Forms, and any inquiries regarding the information contained in this Request for Proposals, shall be directed to the Manager at the address above, or by telephone (774-722-1812) or by email (largo@cvecinc.org). **The deadline for written questions is 5:00 PM on September 10, 2018. Responses to questions will be posted on the CVEC website.** Interested parties are responsible for checking the website for addenda and responses to questions.

CVEC reserves the right to waive any informality in the submissions, to reject any or all submissions, or to accept any submission which it deems to be in the best interest of CVEC.

Price and non-price submissions are to be sealed and properly identified on the outer envelope as Proposals - CVEC Community Clean Energy Resiliency Initiative. Price proposals are to be included in a separate sealed envelope, appropriately identified.

PART 2: GENERAL

A. Background

The CVEC Team, consisting of the Cape & Vineyard Electric Cooperative, Inc. (CVEC), the Dennis Yarmouth Regional School District (DYRSD), and the Barnstable County Regional Emergency Planning Committee (BCREPC), is one of 13 awardees to partake in $18.4 million awarded to Massachusetts municipalities and Regional Planning Agencies by the Massachusetts

Department of Energy on December 29, 2014. The grant to the CVEC team in the amount of $1,479,193 is for the addition of battery back-up and energy management equipment to complement approximately 590kW of roof-mounted solar photovoltaics CVEC installed at the Dennis Yarmouth Regional High School in 2014.

The DOER grants were awarded under the DOER's Community Clean Energy Resiliency Initiative (CCERI) as part of the Patrick Administration's Climate Preparedness Initiative. Under the Resiliency Initiative, facilities were identified where the loss of electrical service would result in the disruption of a critical public safety or life sustaining function, including emergency shelters, food and fuel supply, and communications infrastructure. The grants will fund the installation of clean energy technologies to keep these emergency facilities' energy systems operable during critical events, like storms and black-outs.

The Dennis Yarmouth Regional High School was selected due to its designation as a Regional Shelter by the Barnstable County Regional Emergency Planning Committee (BCREPC). It is one of six regional shelters open to all residents and visitors to Barnstable County during an emergency. It also serves as a food preparation and distribution center for the remaining shelters due to its size and capacity. The grant will allow the design and implementation of a battery system to work in conjunction with a diesel generator and a 590 kW rooftop CVEC solar array installed on the shelter in 2014. This photovoltaic system is owned by a third-party which sells all of the net metered electricity to DY Regional School District, through CVEC. This third-party has agreed to allow changes to the interconnection of the PV system necessary to incorporate the BESS as a source of backup power during grid outages in conjunction with the proposed BESS. With the addition of the battery technology, the solar system will provide power for critical load during extreme storm events and black-outs.

In addition, the back-up battery system is to provide an income stream to CVEC.

About the Cape & Vineyard Electric Cooperative

The Cape & Vineyard Electric Cooperative, Inc. (CVEC) is an electric cooperative comprised of 17 towns on the Cape and Martha's Vineyard plus Barnstable County, Duke's County and the Cape Light Compact. CVEC was formed out of a strategic planning process commissioned and undertaken by the Cape Light Compact (CLC) in 2007. CVEC is a tax-exempt energy cooperative formed under Massachusetts General Laws, chapter 164, section 136. CVEC's objectives include developing and/or owning renewable electric generation facilities and procuring or selling long-term electric supply or other energy-related goods and services at competitive prices to member communities and consumers within member communities. (www.cvecinc.org)

B. Project Description

CVEC intends to install a Battery Energy Storage System (BESS) at the DY Regional High School to support the School's Emergency Shelter functions in the event of an extended grid outage due to a natural disaster or other grid outage. CVEC has installed a 590 kW roof-mounted ahead-of-the-meter system at the school through a power purchase agreement with a third party. In the event of

an extended grid outage, the battery system will be used to power the local emergency facility in conjunction with two on-site diesel generators near the point of interconnection and the solar array. The BESS will act as a grid reference to the solar power plant so it can generate power if solar resource is available. During islanding mode, excess energy supplied by the solar plant will be stored by the battery system to extend the amount of time that the battery system can be used to provide power to the emergency response facility in conjunction with the diesel generator. The BESS shall be sized for a minimum of 250 kW capable of operating for a minimum of 4 hours at nameplate rating.

In addition, when the BESS is not being utilized as source of resiliency, it will be used to provide services that can produce a source of income and/or savings to CVEC. These services may include a combination of real-time demand response, frequency regulation, off-peak to on-peak load shifting, reducing coincident peak, and any other advantageous use of the BESS. CVEC is encouraging respondents to indicate in their proposal how to best stack these values, and potential contractual means to minimize uncertainty associated with revenue from the system.

The DYRHS Microgrid will be comprised of the battery, the two existing diesel generators (150kW and 230kW), the existing PV array (a roof mounted 590kW system), control systems, and all necessary ancillary equipment. As currently configured, the roof-mounted PV system is installed ahead-of-the-meter behind a retail meter separate from the school's load. CVEC will consider configurations in which the PV system remains behind its own meter but is able to be sectioned off from the grid to serve the school's load during grid outages, or a reconfiguration in which the PV system's interconnection is relocated to behind the school's retail meter. Please note that all costs necessary for such an alteration should be included in the cost proposal. The BESS must also be capable of being remotely dispatched to allow for the flexibility to engage it in a variety of income-producing activities.

As stated above, CVEC is interested in optimally stacking services in order to maximize revenue from the system while still meeting resiliency objectives. In addition to covering its own costs, CVEC wants to maximize the net benefit from the system to promote the adoption of similar energy storage systems in the Commonwealth that may not have the benefit of grant opportunities.

CVEC is generally agnostic to which revenues the system will pursue. CVEC expects that Respondents with differing battery chemistries/technologies may target different sources of revenue that are best suited for their proposed system. With that said, preference will be given to systems with the flexibility to shift their operation over time as regulations, market prices, and other changes occur over time.

As detailed in Part 10, A, Required Materials, Respondents must provide cost and projected revenue information associated with the specific proposal submitted. The price proposal and Financial Analysis and Exhibit C Worksheet will include projections produced by Respondent showing cash flows associated with the proposed system. For any sources of revenue or savings included in the price proposal and Financial Analysis, the Respondent's proposal must indicate how any required battery scheduling or dispatching would occur. This should include reference to specific Respondents' subcontractors providing any specified service, even if it is not the Respondent, and include estimated costs. Respondent must indicate all other cash flows

associated with their proposed structure, which might include lease payments, shared savings payments, or other cash flows. Again, all proposals must include CVEC ownership of the BESS.

Due to the terms of CVEC's CCERI grant, initial payments are to be tied to construction milestones, and the total may not exceed $1,400,000. Respondents may propose systems with an installed cost that exceeds this amount, but only if the additional amount can be financed by Respondent and is paid for by revenue and/or savings from the BESS. While this RFP requires a minimum size of a 250 kW, four hour BESS, the winning bid may be for a larger system. Larger systems that are evaluated as more financially attractive will score higher in the evaluation process, as attractive financials are key criteria.

C. Proposal Process and Schedule

CVEC is requesting proposals from qualified Battery Energy Storage System (BESS) providers to design, provide a design and technology-specific price proposal and financial analysis, to procure, install with all necessary infrastructure, test and commission an Energy Storage System as a turnkey system to meet the requirements as described in this request for proposals document for CVEC under the Community Clean Energy Resiliency Initiative (CCERI) Project.

CVEC will facilitate a site visit following RFP release.

Subsequent to opening the Respondent proposals, CVEC will assemble a Feasibility/Economic Analysis for submission to the Department of Energy as required in the CCERI grant contract. Respondents' Financial Analyses may be incorporated into the CVEC Feasibility/Economic Analysis submitted to the Massachusetts Department of Energy Resources.

Interviews between the CVEC Team and Respondents who have complied with the submission requirements and met all quality requirements for responsiveness and responsibility will be held at the CVEC offices in Yarmouth, MA or by phone to discuss the details of the Respondent's proposal. If required, the Respondents may submit clarifications as an addendum to their proposal.

CVEC and the Selected Respondent will then enter into contract negotiations. If an agreement cannot be reached with the Selected Respondent, the Awarding Authority will negotiate with the next highest ranked Respondent.

The desired schedule for the BESS project is shown in the below table.

RFP issued	8/15/18
Site Visit	8/22/18 @ 10AM, 210 Station Avenue, South Yarmouth, MA
Questions Due	9/10/18
Responses to Questions Posted	9/17/18
Proposals Due	10/22/18
Interviews conducted	11/13/18
Contract awarded	11/26/18

BESS Microgrid startup with utility Permission to Operate received	1/2/20
BESS Microgrid accepted	2/4/20

PART 3: SCOPE OF WORK / REQUIREMENTS

The purpose of this scope of work section is to provide qualified bidders with more detail on the description of the project, explanation of how it will be managed, and to clarify what deliverables are to be provided by the successful BESS RFP Respondent.

A. Scope of Services

The scope of services for the BESS shall include the following principal elements. The Respondent shall be responsible for identifying and providing any and all equipment, components, and services necessary to install a fully functional BESS and achieve all proposed sources of revenue included in the price proposal and financial analysis. If any such functions (including, as an example, BESS scheduling for a specific revenue source) cannot be provided by Respondent, such functions must be identified and estimates for costs and revenues be provided. Models must provide CVEC ownership.

- Design, analyze markets, fabricate, procure, ship, assemble, construct site and any peripheral systems needed to install and integrate with existing solar generator, diesel generator, school switchgear and utility grid, test, startup, commission, make ready for service, operate and warrant a fully functional turnkey BESS and balance of plant equipment that meets or exceeds all requirements delineated herein, including the ability to provide services included in Respondent's provided price proposal and financial analysis.
- All required equipment / materials, labor and tools required to permit, install, test, control, commission, warrant, operate and maintain the BESS.
- Respondent's Proposal must include the cost and execution of the Eversource utility integration process as well as grid interconnection modifications if any are deemed necessary.
- Design, install and test a Human Machine Interface (HMI) onsite with remote dispatch and remote status monitoring capabilities.
- Provide 1-year warranty
- Provide operations and maintenance subcontracting costs for 5, 7, and 10 year intervals.
- Provide spare parts lists and associated costs.
- Provide on-site training classes for CVEC personnel as well as School District maintenance personnel.
- Supply an initial complement of spare parts.
- Provide a minimum five-year warranty for inverters and bulk of system with a five-

year warranty for batteries and a separate cost breakdown for at least an additional five-year warranty for inverters and bulk of system and batteries.
- Provide cost of Energy Assurance Guarantee for life of project.
- Submit for CVEC review a price proposal and financial analysis for all BESS proposals.
- Submit design drawings, O&M manuals, and miscellaneous documentation required to provide a complete installation. Provide all as-built documentation including interconnection agreements, calculations, software, design drawings, equipment drawings required for the BESS and the calculations used to produce all financial analyses.
- Provide and maintain a schedule for all design, fabrication, installation, market operations, testing and maintenance activities for the project for at least ten years.
- Provide and maintain a control system for scheduling the BESS to participate in all proposed sources of revenue or savings included in financial analysis.
- Provide and maintain a fire suppression and fire alarm system which integrates with the local fire department fire alarm system as required.
- Criminal Offender Record Information (CORI) review certificates will be acquired by Selected Respondent prior to any individual's appearance on site. The CVEC site visit prior to proposal submissions is an exception to the CORI certification requirement.
- Provide decommissioning and removal process and costs in year 2030.

B. Documentation Deliverables

The Respondent shall furnish complete documentation that will be used for determination of contract compliance, as well as, operation and maintenance of the BESS. The documentation shall be in English, well detailed and instructive.

At a minimum, Selected Respondent's documentation shall consist of the following (For minimum documentation details see page 18, Part 8 "Submission Requirements"):

- Complete design package including all site works, Balance of Materials (BOM) and calculations for CVEC review
- Complete design package, BOM and calculations issued for construction
- Network diagram of the BESS system and Supervisory Control and Data Acquisition (SCADA) points list
- Complete commissioning plan including test and startup procedures for CVEC review
- Complete set of as-built drawings post construction
- Complete set of test results package for record-keeping
- Statement of completion and Permission to Operate from local utility
- Installation manuals, instruction manuals and operation guides for all equipment,

markets, and subsystems. Specific instruction manuals for operation of the BESS controller is required.
- Other project documentation that would reasonably be required for CVEC to document the construction of the BESS, operate the BESS in the future, and engage in proposed markets in the future.
- BESS control and protective settings.
- Maintenance Schedule.
- Project Schedule.
- Software and associated software operations documentation.
- Decommissioning and/or end-of-life refurbishment procedures.
- Equipment warranties.
- Performance guarantees and guaranteed output over system life.
- Safety data sheets for all components.
- Fire safety rating and compliance documentation.

All Documentation Deliverables shall be provided in:
- Paper hard copy (ten copies).
- PDF format, all documents are to be provided in PDF format.
- Native file format when applicable. In addition, PDF format documents shall be provided with native file format. Drawing shall be provided in PDF and AutoCAD format. Documents that were created in Word or Excel, etc. shall also be provided in those formats in addition to PDF.

C. Design Conditions
- Design Temperature Range: min -30 F, max 110 F
- Peak Wind Gust: 110 mph
- Seismic Zone: 2A

D. Electrical Design Parameters
- Nominal voltage at proposed interconnection point is 480VAC
- Normal frequency = 60 Hz with normal deviation of +/- 0.2 Hz
- Frequency design tolerance = 59.0Hz – 61.0Hz

E. BESS Minimum Requirements
- 250 kW / capable of operating at nameplate rating for 4 hours, at a minimum. The system must maintain this capability over the expected lifetime (as identified in the Respondent's proposal, and the respondents use cases per the proposed sources of revenue).
- Degradation is to be calculated and a degradation curve is to be provided using the following simultaneous use cases. This degradation curve will give a common use

case scenario for all respondents.
    - Full power discharge, for 4hrs, 2 times / day, 2 days /week
    - 50% maximum output power, for 6 hours, 2 times / day, 2 days/ week, 14 weeks/year
    - Shallow discharge, 70% power for 2 minutes, 50 times/day
- A separate degradation curve shall be provided assuming the use cases as dictated by the revenue sources included in the Respondent's proposal. State those use cases with the Respondent's specific degradation curve.
- BESS Efficiency –
    - Minimum 87% AC round trip for Li-Ion and Lead Acid technologies
    - Minimum 65% AC round trip for flow battery technology
- THD < 5% as per inverter spec and Institute of Electrical and Electronics Engineers (IEEE) 519.
- Ambient temperature range -30 degree F to 110 degree F.
    - It is the responsibility of the BESS Respondent to design all components to operate at safe rated sustainable operating temperatures over the required ambient temperature range.
- Monitoring requirements must include, but are not limited to:
    - AC Voltage
    - Total DC Voltage
    - Max module voltage
    - Min module voltage
    - State of charge
    - DC charge energy available
    - DC discharge energy available
    - String Current
    - Zone current
    - Total DC current
    - Total AC current
    - DC power
    - AC power
    - AC power factor
    - AC VARS
    - AC total harmonic distortion
    - AC discharge energy
    - AC charge energy
    - AC auxiliary load energy
    - AC auxiliary load power
    - Internal container temperature
    - Max module temperature

    - Min module temperature
    - Mean module temperature
    - Event record and fault codes.
- Data Acquisition System shall have 30 days on site data storage and capability to be remotely accessed and data downloaded.
- Data points shall have the ability to be recorded at a minimum of 1 minute, with the capability for instantaneous collection of data when data is outside of set parameters.

F. Internet connection

The respondent will be required to procure necessary data connection via a third party service provider in order to provide the remote connectivity for data acquisition and control required in other sections of this RFP.

- Data Acquisition / Monitoring / Alarms

  The Data Acquisition/monitoring/alarm system or procedures shall have a minimum of the following capabilities
    - Alert CVEC, via text message and email when the number of failed or inadequately performing cells or other Respondent determined conditions indicate that;
        - Preventative maintenance should be performed to keep the BESS at the specified performance levels.
        - The BESS is in imminent danger of failing to meet specified performance levels or potential safety hazards exist.
        - The BESS can no longer meet the specified performance criteria or safety hazards exist.
        - The BESS Selected Respondent shall have the capability to remotely monitor the BESS and independently and automatically be alerted to BESS alarms and corrective actions without relying on CVEC personnel to communicate such an alarm condition exists. The BESS Selected Respondent shall have the capability to respond to alarm conditions and provide required service to correct such alarm conditions within four hours from the inception of the alarm condition.
        - The Selected Respondent shall include, in the Operation and Maintenance Manual, the recommended corrective action and maintenance procedures for each alarm level or observed condition provided. Selected Respondent will include Safety Data Sheets and Fire Avoidance and Corrections information.

- In order to meet CVEC's cybersecurity requirements, virtual access to the BESS shall be by the BESS Selected Respondent via a virtual private network (VPN) connection.

- The BESS control system shall be designed to provide for automatic, unattended operation of the BESS. However, the control system design shall also provide for local manual operation, remote operation, or dispatch from Independent System Operator-New England, INC. (ISO-NE) control signal. All modes of operation and its operational set-point functionality shall be remotely adjustable from the CVEC offices to allow change in settings and to turn on/off all controls or modes when appropriate.

G. Modes of Operation

Resiliency for Emergency Conditions

In the event of an extended grid outage, the BESS shall be used to power the local emergency response facility. The battery shall also act as the grid reference to allow the 590-kW solar generation plant to produce power if solar resource is available. Both the BESS and the solar plant shall be connected to the same 480VAC school distribution system during resiliency mode. Excess energy supplied by the solar plant will be stored by the battery system to extend the amount of time that the battery system can be used to provide power to the emergency response facilities along with the diesel generator. The nominal load required for the emergency response facilities is 115 kW. CVEC assumes that some proposals will specify a need to maintain a minimum state of charge at all times to meet resiliency requirements. CVEC expects proposals that anticipate the use of predictive resilience, in which the BESS may be used for revenue-producing activities during regular operations without maintaining a reserve charge, but can be charged to stand ready in anticipation of outage conditions based on weather forecasts. All proposals using this approach must state it as such and identify how the system would be dispatched to charge in anticipation of outage conditions.

Other operations modes

The BESS will be capable of operating in a manner consistent with any other sources of revenue or savings included in the Respondent's provided Price Proposal and Financial Analysis.

H. Harmonics

The BESS must meet the harmonic specifications of IEEE 519.

I. Protection Requirements

The BESS system shall contain protective relaying features, circuit breakers or fuses which self-protect the BESS in the case of internal electrical faults.

The BESS shall be housed according to local health, water and fire department restrictions.

BESS Selected Respondent shall procure and install Balance of System (BOS) components with the following requirements:

- Make and Model of BOS components is allowed to be chosen by Selected Respondent.
- Provide the functionality described elsewhere in the specification documents.

- DC disconnect switches: UL listed, blade-type, heavy duty fused safety switches on the output of the Battery array in NEMA enclosure rating as required by installation location or may be integrated to the Inverters.
- AC disconnect switches: UL listed, blade-type, heavy duty fused safety switches on the output of Inverter(s) in National Electrical Manufacturers Association (NEMA) enclosure as required by installation location or may be integrated to the Inverter.

J. Labeling

Install signage posted at site, including at least the following but also any signage required by the National Electric Code (NEC) or other applicable codes:

- Laminated Diagrams including:
  - AC and DC disconnect locations for the system indicated on a site plan.
  - Electrical one-line diagram of system
  - All signage required shall be mounted in appropriate and visible locations
- All equipment shall be appropriately identified with permanent, self-adhesive labels.
  - Each DC disconnect shall be labeled with label material described above for operating DC current (Imp), system operating DC voltage (Vmp), maximum string DC voltage (Voc), and maximum system DC current (Isc).

The BESS interconnection point shall be labeled as such indicating the system AC voltage, current, and the BESS rating in kW-ac and kWh.

K. Grounding

A suitable equipment grounding system shall be designed and installed for the BESS system. This system shall be tied to the existing grounding system if required per NEC. The Selected Respondent shall determine, design and install the required interconnections between the BESS and the existing grounding systems. The Selected Respondent shall perform the alterations needed to the existing location grounding and install the connections from the existing grounding system to the external grounding locations of the BESS as needed. The appropriate external grounding locations for the BESS shall be determined and provided by the Selected Respondent.

The grounding system shall provide personnel protection from shock hazard. The system also shall be adequate for the detection and clearing of ground faults within the BESS.

L. Structural / Foundation Pads / Conduit

The Selected Respondent shall furnish the design for the structural components of the BESS, concrete pads/foundations, housing as required, including self-containment building or trailer(s) if required, and buried conduit required for the complete BESS. All BESS foundations and structures, if required, shall be designed by a qualified registered professional engineer licensed in the state of Massachusetts. All final (Issued for Construction) drawings, specifications and calculations shall be wet-stamped by a Registered Civil/Structural Engineer licensed in the state of Massachusetts. The Respondent is responsible for Geotechnical surveying if required.

Selected Respondent will perform the installation of the concrete pad/foundation or other enclosure requirements and buried conduit installation. and provide site visits to local authorities upon request with CVEC facilitation

M. Spill Containment

The BESS design shall mitigate against electrolyte spills that are credible for the types of cells used. The design shall include features that contain electrolyte spills (to be emptied by contracted chemical disposal company in the event of a spill) and prevent discharge to surrounding site soils. Such designs must adhere to all local and state laws and regulations. One site visit by local authorities will be coordinated with Selected Respondent representatives with CVEC facilitation.

N. Audible Noise

The maximum sound level generated from the BESS system and any associated equipment supplied by the Selected Respondent under any output level within the BESS operating range, shall be limited to 65 dBA at 50 feet in any direction from the equipment fence.

O. Personnel Safety

The BESS shall include eyewash stations in the battery area as applicable. In general, the BESS shall be designed with personnel safety as the top priority.

P. Fire Protection

The Selected Respondent shall design and install a fire protection system that conforms to national and local codes. The fire protection system design and associated alarms shall take into account that the BESS will be unattended at most times. The fire protection alarm system provided as part of the BESS shall interface to provide fire alarming to the local fire department alarm system. In the event codes do not exists for the proposed BESS, current industry accepted best practices shall be employed. One site visit by local first responders will be coordinated with the Selected Respondent representative with CVEC's coordination.

Q. Spare Parts and Equipment

The Selected Respondent shall evaluate its design with regard to failure rates, effects and BESS reliability. The Selected Respondent shall provide a recommended spare parts list, including prices and availability, as part of the proposal.

R. Factory Testing - Battery

The Selected Respondent shall test and submit test data for the cells designated for use on this project. At a minimum, the following tests shall be performed.

- Capacities, Amphour and Watthour
- Ramp rate
- Heat Generated
- Efficiencies
- As applicable, maximum noxious and toxic material release rates
- Application simulations as required by CVEC

The Selected Respondent shall capacity test 100% of the production cells to ensure compliance with design requirements. The Respondent may propose optional alternate testing programs that result in a benefit to CVEC. However, the base proposal shall include capacity testing of 100% of the cells. All proposals for alternate testing shall include details of the proposed plan and the cost benefit to CVEC.

S. Commissioning - Acceptance and Performance Testing

The Selected Respondent shall develop and perform a commissioning program that will include, but not be limited to, procedures for design verification, operational acceptance testing, start-up procedures, functional acceptance testing and safety testing. This commissioning program will assure that the BESS will perform as designed and that the system meets the performance criteria specified elsewhere in these specifications. All modes of operation as described in these specifications shall be tested. The Selected Respondent shall determine that the BESS is fully operational and suitable for acceptance testing witnessed by CVEC. The Selected Respondent shall document all acceptance and performance tests performed. The Selected Respondent shall submit documentation, analyses, and a summary in a test report for CVEC's records. The commissioning program will be developed by the Selected Respondent (approved by CVEC) and shall demonstrate to CVEC that the BESS is operational and performs as specified. These tests shall include, as a minimum:

- Grounding and electrical resistance testing
- Verification of sensors, metering and alarms
- Verification of all control functions, including automatic, local and remote control
- Verification of performance criteria
- Verification of relays, breakers and fault protection
- Verification of DAS functionality and on site stored database

T. Warranty

Respondent must warrant to CVEC that the equipment and materials furnished hereunder and the completed BESS project are fit for the purpose of producing and storing electricity in accordance with the requirements and are free from defects in workmanship and materials. Proposals must include five-year warranties for the entire system, including inverters and battery warranties for a minimum of a period of five (5) years after the date of acceptance of the project by CVEC. In addition, Respondent shall clearly indicate life expectancy given discharge profiles provided in this RFP. Respondent will also indicate the expense needed to extend the BESS warranty at least an additional five years (for a total ten-year warranty).

U. Interconnection

- The existing photovoltaic system and the BESS will be connected to the grid, or the interconnection will be adjusted to behind-the-meter by the Selected Respondent, based on Selected Respondent's recommendations following CVEC's acceptance of Selected Respondent's proposed design. Respondent will be required to install an IEEE 1547 compliant disconnection means and provide all controls necessary to automatically isolate the Microgrid from the grid.

Selected Respondent will coordinate with Eversource, CVEC's local electric distribution company, and file all forms required for interconnection. Selected Respondent will provide CVEC copies of documented interaction with the local utility.

V. Modifications

Modifications to the CVEC conceptual design, outlined in Exhibit G, may be made. The presented conceptual design is one viable design, but others will be considered. As these changes affect the BESS, Selected Respondent, will communicate any changes at a site meeting with Selected Respondent's engineer in attendance and coordinated with the CVEC OPM. The BESS Selected Respondent shall work in cooperation with CVEC to exchange information as needed.

W. Additional Requirements

The project design shall meet all applicable industry standards and codes including, but not limited to, NEC, National Electrical Safety Code (NESC), American Society of Civil Engineers (ASCE), IEEE, standard utility practice. In the event specific codes are not available for the BESS, current industry accepted best practices shall be employed.

The BESS Selected Respondent's project manager shall attend bi-weekly phone meetings with CVEC representatives during certain portions of the design, construction and commissioning process. The purpose of these meeting is to receive a status report on the progress of the project and to discuss any open items or requests for information each party may have submitted to the others.

PART 4: EXCLUSIONS

The Respondent's base proposal should be for a complete turnkey project solution. If there are certain scope items that the Respondent would prefer to exclude or believes it is a better value for CVEC to complete a scope item outside of the turnkey contract with the Respondent, this may be detailed in an alternative proposal with optional scope exclusions. Price reductions shall be included for each optional scope exclusion proposed by the Respondent in its alternative proposal. It is at CVEC's sole discretion to decide to accept any or all of the proposed optional scope exclusions which may be proposed by any Respondent.

PART 5: SCHEDULE

The BESS Respondent shall provide a proposed duration schedule with their proposal. The schedule shall include delivery of design, fabrication, site meetings with local first responders, equipment delivery, on-site construction, testing, and utility interconnection phases with subtasks as needed. The schedule will be discussed and finalized in conjunction with the OPM prior to the final award of this project.

PART 6: PRICE PROPOSAL AND FINANCIAL ANALYSIS

A. The Energy Storage System (BESS) contract is a fixed price contract. Travel time to and from the site will not be reimbursed.

B. Each Respondent may submit up to two separate Price Proposals and Financial Analyses, corresponding to two Proposals with different system designs and/or contracting structures. If exclusions to the scope items are included, as discussed in Part 4, this constitutes one of the two price proposals.

C. Respondent shall refer to the attached Exhibit B, Cost Proposal. Clearly indicate each job category and rate on this form. All hourly rates shall meet the prevailing wage schedule that includes overhead and labor burden.

D. The final total indicated on the cost proposal shall include all costs associated with completing the work, including all the staff and manpower projections provided by the Respondent.

E. Each Price Proposal and Financial Analysis is to be placed in a separate sealed envelope bearing the title "Price Proposal and Financial Analysis – CVEC Community Clean Energy Resiliency Initiative" and included with the Proposal submission. If two independent Proposals are being submitted, the two corresponding independent Price Proposals and Financial Analyses should be marked on their outside envelopes to link them with their corresponding Proposal. Respondents shall include Price Proposals which at a minimum include the following line items.
   - Energy Storage system equipment itself; designed, delivered, installed, tested and commissioned
   - Financial Analysis
   - Operations service schedule and costs
   - Maintenance service schedule and costs
   - Extended warranty offering (in addition to 5-year base warranty)

F. The Price Proposal must include the Respondent's Financial Analysis, which must be specific to the proposed structure. The Financial Analysis must include all cash flows associated with the ownership and operation of the system, specific to the Respondent's proposed structure. Should financing be utilized in the Financial Analysis, the common denominator is a 3% rate for any financing secured by CVEC. See Exhibit B.

PART 7: SELECTION PROCESS

A. General

1. The CVEC CCERI Team, the CVEC President, and the CVEC Manager in consultation with the CVEC Owner's Agent (OPM) and Sandia National Labs under contract to the DOE's Office of electricity will form the Selection Committee ("Selection Committee"). They will utilize the SELECTION CRITERIA (see below) to evaluate submissions. The evaluation will be based upon the information submitted and information solicited by the Selection Committee from various sources and references.
2. Interviews will be held for the Respondents who have complied with the submission requirements and met all quality requirements for responsiveness and responsibility.
3. During the evaluation or review process, the Selection Committee reserves the right to request additional information or clarification from any Respondent, and/or to allow corrections of errors or omissions in accordance with Massachusetts Law.
4. The Selection Committee shall make a recommendation to the CVEC Board of Directors. CVEC reserves the right to reject any or all proposals and to waive any informalities or irregularities should it deem it to be in the best interest of CVEC.
5. All Respondents, firms or individuals submitting proposals will be notified of the final selection by the Awarding Authority.

PART 8: SUBMISSION REQUIREMENTS

A. Required Materials

1. Cover letter outlining Respondent's contact person including title, telephone, and e-mail address.
2. Completion and signing of Certification attached as Exhibit A.
3. Names and addresses of all partners, officers, directors and owners, i.e., persons with an ownership interest in the firm of more than five percent.
4. A full listing of all persons to be assigned to the project, including all staff, sub consultants, including the following:
    a. Above individuals' resumes including work performed on all projects of similar scope and scale over the past five (5) years.
    b. Each individual's qualifications for the project including a listing of all Massachusetts Registrations by discipline, licenses, or other documentation of qualifications. The skillsets of the engineering team should cover the entire scope of work required.
    c. The Respondent shall state which of these team members are direct employees of the Respondent and which are subcontracted or casual resources. It is required that the team presented in the proposal will be the team assigned to the project if the Respondent is awarded the project, unless changes are agreed to by CVEC in writing.
5. Respondents must demonstrate successful completion of energy storage systems using the same technology proposed. Provide a complete listing of and contact information for all similar projects performed by your firm over the past five (5) years. For each such project, provide a complete project description, including project size, completion date, major equipment contractors used, warranty claims, uptime percentage, market participation and revenues, as well as client name and contact person, including address, telephone and email addresses. The Awarding Authority reserves the right to contact any

client listed for the purpose of obtaining reference information.

6. Evidence that the Respondent possesses the knowledge and skill to:
   a. Recommend solutions to problems encountered during the work and direct field changes.
   b. Provide the Awarding Authority with periodic status reports, as agreed upon by the parties, with respect to the overall status of the work for the length of the contract term.
   c. If applicable, maintain and/or operate the system in the manner proposed.
7. Describe the ability of the system(s) to provide different types of services over its life. As an example, if the BESS targets power-intensive markets that later become less financially attractive than energy-intensive markets, describe whether the system, with or without hardware changes, would be able to adapt to providing a different mix of services.
8. Documentation of financial stability, documentation of bonding capacity, credit references, or other documentation to demonstrate financial solvency of the firm or individual responder.
9. Additional information related to the Respondent's (and sub-consultant's, if any) qualifications and experience to perform the work (letters of reference, description of project methods utilized for comparable projects, etc.), and similar supplementary information may be provided.
10. A Price Proposal and the correlating Financial Analysis for each proposed model, will be submitted in a separate, sealed envelope, clearly marked *Price Proposal and Financial Analysis for Energy Storage System for the CVEC Community Clean Energy Resiliency Initiative Project PON-ENE-2016-35.* If two independent Proposals are being submitted, the two corresponding independent Price Proposals and Financial Analyses should be marked as such on the corresponding, separate sealed envelopes to link them with their corresponding Proposal.
11. Sample contract specific to any proposed structure must be included in Respondent's response.
12. If Respondent proposes to operate a proposed system and assume risk associated with market revenue, the proposal should show projected revenues and costs to CVEC associated with this arrangement.
13. Provide list of exceptions and clarifications to the technical proposal(s) and commercial terms and conditions, or written verification that no exceptions or clarifications are taken.
14. The BESS Respondent shall provide a proposed duration schedule with each proposal(s). The schedule shall include design, fabrication, delivery, on site construction, interconnection, and testing phases with subtasks as needed and potential decommissioning or hand-over of BESS. The schedule shall include a two-week review duration by CVEC for each submitted design package. This schedule shall be tracked and maintained by the Selected Respondent throughout the project.
15. The Respondent shall submit with each proposal(s) a list of information that the firm will require from CVEC at the kickoff of the project in order to be able to proceed with design.
16. The Respondent shall submit with each proposal(s) a conceptual design package for CVEC review:
   a. Description of battery technology
   b. Interconnection schematic
   c. Description of control system, both during normal operation and in islanded-

mode

d. Safety data sheets

17. The Respondent shall indicate in its proposal(s) an electrical energy storage capacity (MWh) on an as-output basis.
18. The Respondent shall indicate in its proposal(s) maximum storage discharge power (MW).
19. The Respondent shall indicate in its proposal(s) maximum storage charging power (MW).
20. The Respondent shall submit indicate in its proposal(s) response time (*e.g.* how quickly the BESS can be brought online).
21. The Respondent shall indicate in its proposal(s) duration the BESS longest continuous operation and MW level.
22. The Respondent shall indicate in its proposal(s) discharge ramp rate (MW/min).
23. The Respondent shall indicate in its proposal(s) charging ramp rate (MW/min).
24. The Respondent shall indicate in its proposal(s) any limits on charging and discharging (based on ambient temperature or other conditions).
25. The Respondent shall indicate in its proposal(s) forced outage rate.
26. The Respondent shall indicate in its proposal(s) design depth of discharge.
27. The Respondent shall indicate in its proposal(s) discharge capacity for different discharge durations (e.g. rated power for different discharge duration).
28. The Respondent shall indicate in its proposal(s) recharge time for the storage from full depth of discharge to maximum state-of-charge.
29. The Respondent shall submit with its proposal(s) typical degradation curve information for the battery system proposed based on the provided use cases and a separate degradation curve based on the proposed use cases per the Respondent's proposed finance model of stacked services.
30. If it is recommended by the battery supplier that cells be changed out at regular intervals, the Respondent shall submit with its proposal(s) a proposed battery replacement schedule with battery replacement and service costs and a description of escalation factors used to determine actual battery costs at the time of replacement. Information on battery replacement procedure must be included, including estimated time to complete replacement.
31. The Respondent shall submit with its proposal(s) a warranty terms and conditions document.
32. The Respondent shall submit with its proposal(s) a recommended spare parts list and prices.
33. The Respondent shall submit with its proposal(s) a description of all required maintenance activities, including estimated man-hours and frequency of occurrence and cost for each activity.
34. The Respondent shall submit with its proposal(s) information on AC/AC round trip efficiencies (excluding step-up transformer).
35. The Respondent shall submit with its proposal(s) information showing the length of time the battery can maintain constant output at demand levels less than rated output.
36. The Respondent shall submit with its proposal(s) information showing the length of time the battery can maintain rated output at a reduced state of charge.
37. The Respondent shall submit with its proposal(s) information on guaranteed life expectancy to maintain rated capacity as number of discharges or total energy delivered variances.
38. The Respondent shall submit with its proposal(s) information on the controlling

parameters that determine life expectancy for the proposed system.

39. The Respondent shall submit with its proposal(s) information on required environmental conditions or maintenance procedures (if any) that performance guarantees are based on.
40. The Respondent shall submit with its proposal(s) a Power Conversion System (PCS) according to manufacturer specifications.
41. The Respondent shall submit with its proposal(s) information on how the charging cycle changes as maximum demand is reduced.
42. The Respondent shall submit with its proposal(s) information on the state of charge of the battery as a function of time during the charge cycle.
43. The Respondent shall submit with its proposal(s) proposed factory and commissioning plans to include performance and "Modes of Operation" testing.
44. The Respondent shall provide a performance curve indicating number of cycles vs. depth of discharge.
45. The Respondent shall submit with its proposal(s) the self-discharge rate (or parasitic energy requirements)
46. The Respondent shall submit with its proposal(s) a description of the BESS Respondent's remote alarm monitoring capabilities and service dispatch capability.
47. The Respondent shall submit information describing and scheduling the BESS system's distribution of savings or revenues.

PART 9: GENERAL PROVISIONS

A. General

1. The Awarding Authority reserves the right to reject any and all proposals and to waiveany informalities or irregularities as it deems in the best interest of CVEC.
2. All proposals and related documents submitted in response to this RFP are subject to Massachusetts Public Record Laws, M. G. L. Chapter 66, Section 10 and M. G. L. Chapter 4, Section 7, Clause 26, regarding public access to such documents. Statements or endorsements inconsistent with those statutes will be disregarded. The Proposer is hereby warned that any part of its proposal(s) or any other material marked as confidential, proprietary, or trade secret, can only be protected to the extent permitted by Commonwealth of Massachusetts laws. Any contract signed following the award of this RFP to a Respondent will incorporate the contract terms and conditions included in Exhibit G, in addition to other contract terms negotiated with the Selected Respondent.
3. The consideration of all submittals and the subsequent selection of the successful responder shall be made without regard to race, color, sex, age, handicap, religion, political affiliation or national origin.

PART 10: ATTACHED DOCUMENTS

1. Exhibit A – Certification Form
2. Exhibit B – Price Proposal Worksheet
3. Exhibit C - Financial Analysis Worksheet
4. Exhibit D – Certificate of Authority Form
5. Exhibit E – Tax Compliance Certification Form
6. Exhibit F – Selection Criteria
7. Exhibit G – General Contract Terms and Conditions
8. Exhibit H – CCERI Contract between CVEC and State Excerpts
9. Exhibit I - One Line diagram (CVEC conceptual design for RFP)
10. Exhibit J - 15 minute usage interval data
11. Exhibit K - 15 minute 590kW PV production data

Exhibit A
CERTIFICATION[1]

The applicant hereby certifies that:

1. The applicant has not given, offered, or agreed to give any gift, contribution, or offer of employment as an inducement for, or in connection with, the award of contract for these services.
2. No consultant to, or subcontractor for, the applicant has given, offered, or agreed to give any gift, contribution, or, offer of employment to the applicant, or, to any other person, corporation, or entity as an inducement for, or, in connection with, the award of the consultant of subcontractor of a contract by the applicant.
3. No person, corporation, or, other entity, other than a bona fide full-time employee to the applicant has been retained or hired to solicit for or in any way assist the applicant in obtaining the contract for services upon an agreement or understanding that such person, corporation, or entity be paid a fee or other compensation contingent upon the award of the contract to theapplicant.
4. The undersigned certifies that this proposal has been made and submitted in good faith and without collusion or fraud with any other person. AS used in this certification, the word "person" shall mean any person, business, partnership, corporation, union, committee, club or other organization, entity, or group of individuals.

I hereby attest with full knowledge of the penalties for perjury that all information provided in this application for services is correct.

_____
Firm

_____
Signed (Typed)

_____
Signed (Written)

_____
Title

_____
Date

[1] EXHIBIT A

Exhibit B[2]

Price Proposal

The Respondent is to return a separate Exhibit B – Price Proposal and Financial Analysis - as part of the cost proposal. Exhibit B is to be provided in hard copy and MS excel format. It is expected that not all line items will be required for this project by all Respondents. It is acceptable and expected to have $0 cost line times. A $0 cost line item does not equal a formal exception taken of a requirement of this RFP. All exceptions must be listed as per Part 8 "Submission Requirements", Section A "Required Materials", item 13.

Please use this link to access the "Price Proposal and Financial Analysis" excel spreadsheet:
http://www.cvecinc.org/wordpress/excel-spreadsheet-for-price-proposal-and-financial-analysis

For each proposal (if more than one system configuration or contractual model is proposed), Respondent must provide a Price Proposal and Financial Analysis that includes projected costs and savings by year for the project life based on the specifics of the proposed structure. If Respondent proposes to operate the system and assume risk associated with market revenue, the analysis should show projected revenues and costs to CVEC associated with this arrangement. The Financial Analysis should include all assumptions, including, when appropriate, electronic copies of spreadsheets with cell references and formulas intact. Should financing be utilized in the Financial Analysis, the common denominator is a 3% rate for any financing secured by CVEC.

In addition, all Price Proposals should include the cost for CVEC to purchase the system in accordance with disbursement phases as identified in the CCERI contract. Due to the terms of CVEC's CCERI grant, payments are tied to construction milestones, and cannot exceed $1,400,000. A payment schedule can be included in the Price Proposal in accordance with the phased disbursements identified below as per the CCERI contract:

First Disbursement: For the purposes of permitting and partial utility interconnection and permitting.

Second Disbursement: Remaining interconnection costs.

Third Disbursement: Energy storage equipment, optional accessory building for safe battery storage, and installation labor costs.

Final Disbursement: Routine maintenance, operational expenses, remaining total Project costs.

Respondent may also propose systems with an installed cost that exceeds the $1,400,000 amount, but only if the additional amount can be financed by Respondent and is paid for by revenue and/or savings from the BESS. While this RFP requires a minimum size of a 250 kW, four hour BESS, the winning bid may be for a larger system. Larger systems that are evaluated as more financially attractive will score higher in the evaluation process as, as attractive financials are key criteria.

All Price Proposals must include Respondent's cost and payment schedule for the entire system, including all interconnection costs, siting or permitting fees, equipment and labor costs, warranties,

[2] EXHIBIT B PRICE PROPOSAL

and scheduling and/or dispatching services for periods in which the system is operated and/or maintained by the Respondent as a subcontractor to CVEC. If Respondent proposes to operate a system and assume risk associated with market revenue, the Price Proposal should include costs and benefits to CVEC associated with this arrangement.

The Financial Analysis should take into account degradation and should include an estimated cost to decommission and/or refurbish the system. If Respondent proposes to operate a system and assume risk associated with market revenue, the Financial Analysis should include costs to CVEC associated with this arrangement.

The Financial Analysis must also account for the need to meet resiliency requirements.

Any potential source of revenue must be accompanied by evidence of utilization in similar BESS models. Potential sources of revenue may include, and are not limited to:

a. ISO-NE demand response market
b. Capacity tag management (lowering annual coincident peak)
c. Transmission and distribution demand charge management (lowering monthly peak)
d. ISO-NE frequency regulation market (CVEC acknowledges that current rules require 1 MW minimum for participation, but CVEC is in talks with parties that may be able to aggregate multiple similar assets that could meet this 1 MW threshold)
e. ISO-NE reserves market
f. Energy arbitrage, as a price-responsive demand asset

Please note that any proposed system(s) must be designed to meet all criteria necessary to produce any of the savings or sources of revenues included in the Financial Analysis.[3]

[3] EXHIBIT B PRICE PROPOSAL

Exhibit C[4]
CERTIFICATE OF AUTHORITY

At a meeting of the Directors of _____

duly called and held at_____

on the _____ day of_____20_____, at which a

quorum was present and acting, it was VOICED THAT_____

the_____of this

corporation is hereby authorized and empowered to make, enter into, sign, seal

and deliver, in behalf of this corporation, a Contract for _____

with the Cape & Vineyard Electric Cooperative, Inc.

I DO HEREBY CERTIFY that the above is a true and correct copy of the record,

that said vote has not been amended or repealed and is in full force and

effect on this date, and that_____

is duly elected_____of this

corporation.

ATTEST:

Clerk or Secretary of the Corporation

(Affix Corporate Seal Here)

[4] EXHIBIT C CERTIFICATE OF AUTHORITY

Exhibit D[5]

TAX COMPLIANCE CERTIFICATION

Pursuant to M.G.L. Ch. 62C, Sec. 49A, I certify under the penalties of perjury that I, to the best of my knowledge and belief, am in compliance with all laws of the Commonwealth of Massachusetts relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

_____ _____

Date Signature of individual submitting bid or proposal

_____

Printed or typed name of person signing

_____

Company or Corporati o n Name

[5] EXHIBIT D TAX COMPLIANCE CERTIFICATION

Exhibit E[6]

Models

CVEC is seeking Respondents to propose system configurations, operations models, and financing arrangements that best meet CVEC's listed criteria. All proposals must allow CVEC ownership of the system. BESS configurations must be 250 kW, 4 hour systems at a minimum. Each Respondent may submit up to two proposals with different system designs and/or contractual models.

Respondents should describe the structure of each proposed BESS model, and should provide a sample contract for each for review by CVEC. Performance guarantee terms and calculations should be clearly specified in the sample contract. Proposed models may include, but are not limited to, the following contract structure:

1. As Built Purchase: Selected Respondent provides turn-key system design, installation, and commissioning. CVEC purchases the Energy Storage Facility upon commissioning and manages operations. Respondent should specify the total cost to purchase the Facility and, separately, the projected annual operations and maintenance ("O&M") costs for CVEC to hire a third party to perform such operational services. A proposed O&M contract with the Respondent is acceptable.

2. Lease Arrangement: CVEC owns the system and leases it to Selected Respondent for a fixed fee. Selected Respondent operates the system, is responsible for all O&M costs, and retains all revenues and savings associated with the operation of the system.

3. Shared Savings Arrangement: CVEC owns the system, and Selected Respondent operates the BESS and is responsible for all O&M costs. Revenues and savings associated with the operation of the system are split between Selected Respondent and CVEC.

[6] EXHIBIT E MODELS

Exhibit F[7]

Selection Criteria

A. Participation Requirements

For a bid to be submitted, the Respondent must have the following minimum qualifications. Qualifications shall be included in writing as part of the Respondent's proposal.

1. Respondent has experience successfully installing and integrating similar scale battery projects using the same or similar original manufacturer equipment as is being proposed. References for these projects may be contacted.
2. Engineering subcontractors must have 5 years of design experience on similar type projects

B. Evaluation Criteria

The Selection Committee's evaluation will include the following criteria:

1. Microgrid and Market Operation - The BESS proposed must be able to satisfy the economic and critical power requirements as described in this RFP and the Respondent's Price Proposal and Financial Analysis, including grid interconnection and integration of existing solar and diesel generation.
2. Financial stability - The Respondent and major equipment vendors must be financially stable companies capable of providing long term service of the BESS and meeting warrantee obligations.
3. Technical feasibility – Points will be awarded by examining a number of factors, including technology, operational, and resource feasibility. Note: There should be adequate and appropriate data to describe the energy storage technology and its intended operation, including the physical storage mechanism, size, operational and maintenance needs of the technology with due consideration of area's closeness to a school and local water supply, i.e., noise, toxicity and fire containment. This information should be presented in a clear and orderly fashion to demonstrate that the project is feasible.
4. Resource flexibility – Points will be awarded based on the ability of BESS to alter the mix of services provided over the economic life of the project to best meet the needs of the territory as the relative benefits of various markets change. The need to change software and controls, as opposed to make significant changes to BESS hardware, will be considered in awarding these points.
5. Financial risk mitigation – Points will be awarded to proposed system and ownership structures that minimize financial risk to CVEC. Risks considered include operational risk (does the system operate as designed?), market risk (how do prices change, market rules change?), and dispatching strategy risk (is the system dispatched in such a way that it achieves projected sources of revenue/savings?).
6. Respondent DAS / HMI, Remote Dispatch Capabilities - Points will be awarded by examining the level of development, functionality and robustness offered by the BESS HMI and the ability for the BESS HMI, as well as the ability of the BESS to respond to remote dispatch signals.
7. Project Plan - Points will be awarded based on the completeness and description of a well thought out and well-presented project plan tailored to the specific CVEC project objectives. The proposal(s) shall clearly explain that the BESS meets the CVEC requirements and shall explain how the requirements are met.
8. Previous Project Experience - Points will be awarded based on the amount of successfully

[7] EXHIBIT F SELECTION CRITERIA

implemented previous project experience presented which is of similar size and technology. The experience of the specific project manager and project team proposed will be factored into the evaluation. Feedback from past customers shall be taken into consideration. CVEC may reach out to references provided by the Respondents.

9. Service - Points will be awarded based on the Respondent's ability to provide emergency response service in a short amount of time after an issue with the BESS is detected. Service organization, infrastructure, location and response time will be taken into consideration.
10. Service Providers – to the extent that Respondent's proposal(s) includes services provided by third parties, the experience, financial stability, and qualifications of these firms will also be considered.
11. Schedule - Points will be awarded based on the BESS lead time and Respondent's ability to meet the CVEC proposed schedule.
12. Interview Performance - Points will be awarded based on the Respondent's demonstrating an understanding of the key issues of the CVEC project and an ability to work with CVEC in order to successfully complete the project in the best interest of CVEC.

The following evaluation guide will be used as a tool to assess the responses to this RFP. Each of the proposals will be compared by the Selection Committee to determine which proposal is classified as "highly advantageous", "advantageous", "not advantageous" or "unacceptable". Price Proposal and Financial Analysis will be opened and reviewed separately.

BESS Proposal Evaluation Guide

Item #	Gating Criteria Description
1	Microgrid Operation
2	Financial Stability
Item #	**Evaluated Criteria Description**
3	Technical Feasibility
4	Resource Flexibility
5	Financial Risk Mitigation
6	Respondent DAS / HMI
7	Project Plan
8	Previous Project Experience
9	Service
10	Service Providers
11	Schedule
12	Interview Performance

[1] EXHIBIT F SELECTION CRITERIA

Exhibit G[8]

General Contract Terms and Conditions

The following terms will be incorporated into any contract awarded to Selected Respondent.

1. **Certification**. Contractor certifies under the pains and penalties of perjury that pursuant to M. G. L c.62C, §49A, that the Contractor has filed all state tax returns, paid all taxes and complied with all applicable laws relating to taxes; and that pursuant to M. G. L c.151A, §19A(b), has complied with all laws of the Commonwealth relating to contributions and payment in lieu of contributions to the Employment Security System; and, if applicable, with all laws of the Commonwealth relating to Worker's Compensation, M. G. L c.152 and payment of wages, M. G. L c. 149, § 148. Pursuant to federal law, Contractor shall verify the immigration status of all workers assigned to the contract without engaging in unlawful discrimination; and Contractor shall not knowingly or recklessly alter, falsify, or accept altered or falsified documents from any such worker.
2. **Conflict of Interest**. Contractor acknowledges that it may be subject to the Massachusetts Conflict of Interest statute, M. G. L c. 268A, and to that extent, Contractor agrees to comply with all requirements of the statute in the performance of this Contract.
3. **Compliance with Laws**. Contractor and any sub-consultants of the Contractor shall be expected to comply with all federal, state, and local rules, regulations, and laws applicable to the project(s) without limitation including all federal, state, and local bidding, environmental, building and safety rules, regulations, and laws in the performance of services.
4. **Fair Employment Practices Law.** The selected responder, and all sub-consultants of the Contractor, shall adhere to the provisions of the Fair Employment Practices Law of the Commonwealth (Chapter 151B of the Massachusetts General Laws).
5. **Title VI.** The Contractor, and all sub-consultants of the Contractor, shall assure the Awarding Authority that it will carry out the performance of services in full compliance with all requirements imposed by or pursuant to Title VI of the Civil Rights Act of 1964 (78 Stat.252), and any executive orders of the Governor of the Commonwealth as such may from time to time be amended.
6. **Nondiscrimination in Employment.** The Contractor shall not discriminate against any qualified employee or applicant for employment because of race, color, national origin, ancestry, age, sex, religion, physical or mental handicap, or sexual orientation or a person who is a member of, applies to perform, or has an obligation to perform service in a uniformed military service of the United States, including the National Guard on the basis of that membership, application or obligation. The Contractor agrees to comply with all applicable Federal and State employment statutes, rules and regulations
7. **Nondiscrimination and subcontracts.** The provisions related to non-discrimination and affirmative action in employment shall flow through all contracts and subcontracts that the Selected Respondent may receive or award as a result of this contract on behalf of the Awarding Authority.
8. **Independent Contractor Status.** The Contractor is an independent contractor and not an employee or agent of CVEC. No act or direction of CVEC shall be deemed to create an employer/employee or joint employer relationship. CVEC shall not be obligated under any contract, subcontract, or other commitment made by the Contractor.
9. **Contractor's Qualifications and Performance.** In accordance with the terms and conditions of this Contract, the Contractor represents that it is qualified to perform the services set forth herein and has obtained all requisite licenses and permits to perform the services. In addition, the

[8] EXHIBIT G GENERAL CONTRACT TERMS AND CONDITIONS

Contractor agrees that the services provided hereunder shall conform to the professional standards of care and practice customarily expected of firms engaged in performing comparable work; that the personnel furnishing said services shall be qualified and competent to perform adequately the services assigned to them; and that the recommendations, guidance, and performance of such personnel shall reflect such standards of professional knowledge and judgment.

10. **Subcontracting**: The Contractor may only subcontract work with prior written approval of CVEC. The Contractor shall be fully responsible for the acts and omissions of its subcontractors.
11. **Recordkeeping, Audit, and Inspection of Records.** The Contractor shall maintain books, records and other compilations of data pertaining to the requirements of the Contract to the extent and in such detail as shall properly substantiate claims for payment under the Contract. All such records shall be kept for a period of six (6) years or for such longer period as is specified herein. All retention periods start on the first day after final payment under this Contract. If any litigation, claim, negotiation, audit or other action involving the records is commenced prior to the expiration of the applicable retention period, all records shall be retained until completion of the action and resolution of all issues resulting therefrom, or until the end of the applicable retention period, whichever is later. The Governor, the Secretary of Administration and Finance, the State Comptroller, the State Auditor, the Attorney General, the Federal grantor agency (if any), CVEC, or any of their duly authorized representatives or designees shall have the right at reasonable times and upon reasonable notice, to examine and copy, at reasonable expense, the books, records, and other compilations of data of the Contractor which pertain to the provisions and requirements of this Contract. Such access shall include on-site audits, review, and copying of records.
12. **Political Activity Prohibited**. The Contractor may not use any Contract funds and none of the services to be provided by the Contractor may be used for any partisan political activity or to further the election or defeat of any candidate for public office.
13. **Title, Ownership**. Unless provided otherwise by law or CVEC, title and possession of all data, reports, programs, software, equipment, furnishings, and any other documentation or product paid for with CVEC funds shall vest with CVEC at the termination of the Contract. If the Contractor, or any of its subcontractors, publishes a work dealing with any aspect of performance under the Contract, or of the results and accomplishments attained in such performance, CVEC shall have a royalty-free non-exclusive and irrevocable license to reproduce, publish or otherwise use and to authorize others to use the publication.
14. **Assignment and Delegation.** The Contractor shall not assign or in any way transfer any interest in this Contract without the prior written consent of CVEC, nor shall the Contractor subcontract any service without the prior written approval of CVEC. Any purported assignment of rights or delegation of performance in violation of this Section is VOID.
15. **Decommissioning Assurance**: The Contractor must provide adequate financial assurance, in a form reasonably satisfactory to CVEC, to fully cover the cost of decommissioning the BESS System and restoration of the surrounding property. Such assurance is required as of commercial operation of the BESS System, and may be included as part of the Payment and Performance Guarantee required upon execution of the Contract.
16. **Choice of Law.** This Contract is entered into in the Commonwealth of Massachusetts, and the laws of the Commonwealth, without giving effect to its conflicts of law principles, govern all matters arising out of or relating to this Contract and all of the transactions it contemplates, including, without limitation, its validity, interpretation, construction, performance and enforcement.
17. **Dispute Resolution; Applicable Law and Venue**: The Contract will contain[9] an alternative dispute resolution clause prior to litigation except in the case of requests for

[9] EXHIBIT G GENERAL CONTRACT TERMS AND CONDITIONS

injunctive relief. The Contract will be governed by Massachusetts law and venue for any judicial actions relating to the Contract will be Barnstable County Superior Court.[10]

18. **Forum Selection**. The Parties agree to bring any action arising out of or relating to this Contract or the relationship between the Parties in the state courts of the Commonwealth of Massachusetts which shall have exclusive jurisdiction thereof. The Contractor expressly consents to the jurisdiction of the state courts of the Commonwealth of Massachusetts in any action brought by the Commonwealth or CVEC arising out of or relating to this Contract or the relationship between the Parties, waiving any claim or defense that such forum is not convenient or proper. This paragraph shall not be construed to limit any other legal rights of the Parties.
19. **Force Majeure.** Neither party shall be liable to the other or be deemed to be in breach of this Contract for any failure or delay in rendering performance arising out of causes beyond its reasonable control and without its fault or negligence. Such causes may include, but are not limited to, acts of nature or of a public enemy, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or unusually severe weather. Dates or times of performance shall be extended to the extent of delays excused by this section, provided that the party whose performance is affected notifies the other promptly of the existence and nature of such delay.

20. **Indemnification**. The Contractor will be required to fully indemnify CVEC and the CVEC Team for all third-party claims related to the Contractor's performance or failure to perform under the Contract. The Contractor will also be required to indemnify CVEC for violations of environmental and intellectual property laws.
    PURSUANT TO MASSACHUSETTS LAW (MASS. CONST. AMEND. ART 2, SEC. 7; M.G.L. C. 44, §31), MUNICIPALITIES ARE PROHIBITED FROM PROVIDING INDEMNIFICATION TO THE CONTRACTOR UNDER THE CONTRACT. UNDER NO CIRCUMSTANCE WILL CVEC PROVIDE CONTRACTUAL INDEMNIFICATION RIGHTS TO THE CONTRACTOR.

21. **No Limitation of Liability**. The Contract will not contain a clause limiting the Contractor's liability under the Contract.
22. **Risk of Loss.** The Contractor shall bear the risk of loss of any Contractor materials used for a Contract and for all deliverables and work in process.
23. **Waivers.** All conditions, covenants, duties and obligations contained in this Contract can be waived only by written agreement. Forbearance or indulgence in any form or manner by a party shall not be construed as a waiver, nor in any way limit the legal or equitable remedies available to that party.
24. **Amendments.** This Contract may be amended only by written agreement of the Parties, executed by the Parties' authorized representatives and in compliance with all other regulations and requirements of law.

[9] EXHIBIT G GENERAL CONTRACT TERMS AND CONDITIONS

Exhibit H[11]

CCERI Contract Excerpts

Community Clean Energy Resiliency Initiative

PON-ENE-2014-036

Community Clean Energy Resiliency Initiative Project Implementation
Barnstable County Emergency Facility: DY High School Regional Emergency Shelter
Cape & Vineyard Electric Cooperative, Inc.

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[11] EXHIBIT H CCERI CONTRACT EXCERPTS

II. Background

Predicted climate changes – in particular, sea level rise and more frequent extreme storm events- have the potential to impair public and private services and business operations across the Commonwealth of Massachusetts. Preparing for these future impacts will take a coordinated effort of private and public sectors, non-profit organizations, and managers and users of infrastructure resources. To increase energy infrastructure resiliency and reliability will also require investment in new technologies. Realizing this, Governor Patrick announced a multi-dimensional strategy to help Massachusetts prepare for climate change and the increasing incidence of severe weather.

As part of the Administration's Climate Change Preparedness Initiatives, the Governor directed the Department of Energy Resources (DOER) to administer $40 million grant program to ensure energy resiliency at critical facilities in municipalities using clean energy technology. As such, DOER's "Community Clean Energy Resiliency Initiative" (Initiative) recognizes that climate change-induced events impact our entire Commonwealth and municipalities and other public entities are at the forefront of responding when such events occur.

For this grant, DOER defines critical facilities as: buildings or structures where loss of electrical service would result in disruption of a critical public safety life sustaining function. DOER has prioritized these critical facilities and provided examples of critical facilities, as follows:

1. Life safety resources, e.g. police, fire, hospitals, wastewater treatment plants, emergency communication resources and shelters;
2. Lifelines resources, e.g. food and fuel supply, and transportation facilities and resources; and
3. Community Resources, such as city/town halls, senior centers, schools and/or multifamily housing developments capable of acting as alternative shelters.

Projects incorporate eligible clean energy technologies at critical facilities, including clean energy generation, energy storage, energy management systems, islanding technology, and microgrids. Accepted projects must: use eligible clean technologies; be sited at eligible critical facilities; demonstrate strategic electric isolation of critical loads from non-critical building loads to effectively extend resiliency capacity; be able to operate in parallel with the grid during "blue sky" days and island and operate in isolation from the grid during a broader grid outage; and meet utility interconnection strategy guidelines, as well as the Initiative funding guidelines.

Scope of grant performance to be achieved or funded under the grant:

1. On May 15, 2014, DOER issued the Community Clean Energy Resiliency Initiative Program Implementation Program Opportunity Notice (PON) PON-ENE-2014-036, ("the PON"). The grant agreement resulting from this process is subject to 815 CMR 2.00 et seq.

2. The Cape & Vineyard Electric Cooperative ("Grantee") submitted a response to the PON on November 10, 2014.

3. DOER has selected the Grantee to receive Alternative Compliance Payment funds for projects described in Contractor's response to the PON.

4. DOER approves the expenditure of funds as described in Attachment D (Budget) for the work planned and described in Attachment C (Scope of Grant Award).

5. The Grantee agrees to complete the projects described in the Scope of Grant Award (collectively referred to as "the Project").

III. ATTACHMENT A

Community Clean Energy Resiliency Initiative

PON-ENE-2014-036

PROJECT IMPLEMENTATION APPLICATION INFORMATION

A. Background

Predicted climate change impacts—in particular, sea level rise and more frequent extreme storm events —have the potential to impair public and private services and business operations across the Commonwealth of Massachusetts. Preparing for these future impacts will take a coordinated effort of private and public sectors, non-profit organizations, and managers and users of infrastructure resources.[12] To increase energy infrastructure resiliency and reliability will also require investments in new technologies. Realizing this, Governor Patrick announced a multi-dimensional strategy to help Massachusetts prepare for climate change and the increasing incidence of severe weather.[13]

B. Clean Energy Resiliency Initiative

As part of the Administration's Climate Change Preparedness Initiatives, the Governor directed the Department of Energy Resources (DOER) to administer a $40 million grant program to ensure energy resiliency at critical facilities in municipalities using clean energy technology.

As such, DOER's "Community Clean Energy Resiliency Initiative" (Initiative) recognizes that climate change-induced events impact our entire Commonwealth and that municipalities and other public entities (as defined in the Eligible Applicants sub-section below) are at the forefront of responding when such events occur. Therefore, the Commonwealth's municipalities and other public entities are eligible to apply for these grants. DOER anticipates geographic distribution of these funds across the Commonwealth.

Applicants can request support for eligible projects for eligible projects by completing and submitting DOER's Technical Assistance (TA) Application available through PON-ENE-2014-035 or a Project Implementation (PI) Application which is described below. These opportunities are related in that there will be two rounds of PI Applications; the first will fund projects that do not require technical assistance; the second will serve as the process by which plans coming out of the TA Application awards can become implemented projects. It is

[12] Massachusetts Climate Change Adaptation Report, Part II, Chapter 5, Key Infrastructure, September 2011
[13] EOEEA Press Release, "Governor Patrick Announces $50M for Comprehensive Climate Change Preparedness Initiatives, Includes $40M to harden energy services," January 14, 2014.

important to understand both parts of the Initiative so please review both this solicitation and the TA Application solicitation, and apply for the opportunity that best suits your needs.

1. Eligible Applicants

Massachusetts municipalities are eligible to apply for the Initiative, regardless of Green Community designation status or electric utility provider. Eligible applicants also include regional school districts, regional water districts, regional sewerage districts and regional planning agencies (RPAs).

Municipal Applications – A municipality may submit one application that includes one or more projects involving one or more facilities.

Public/Private Partnerships – Municipalities or other public entities as described above may partner with private entities as the project host, as described in the "Eligible Critical Facilities" section below or as project developers under agreement with the municipality or other public entity. The municipality or other public entity must serve as the lead applicant.

Joint Applications by Multiple Municipalities - Multiple municipalities may submit a joint application to share an energy resilient critical facility project. One municipality must be designated the lead, and if the application is awarded funds, DOER will contract with the lead municipality to manage the funding.

Regional Planning Agencies - RPAs may apply for the Initiative funding on behalf of at least 2 municipalities intending to share an energy resilient critical facility project.

- A single RPA may submit more than 1 application, but no more than 3 applications for multiple municipalities.
- If DOER awards funds for a RPA submitted application, DOER will contract with the RPA to manage the funding.
- To the extent that the facility(ies) addressed in an RPA application is in a municipality that has also applied for support through the Initiative, the RPA facility(ies) must demonstrate serving a regional need.

2. Eligible Critical Facilities[14]

For this grant, DOER defines critical facilities as: *buildings or structures where loss of electrical service would result in disruption of a critical public safety life sustaining function.* DOER has prioritized these critical facilities and provided examples of critical facilities in the list below, but DOER does not limit the critical facilities to only these examples.

1. ***Life safety resources*** – e.g., police, fire, hospitals, wastewater treatment plants, emergency communication resources and shelters;

2. ***Lifeline resources*** – e.g., food and fuel supply, and transportation facilities and resources; and

3. ***Community resources*** – e.g., city/town halls, senior centers, schools and/or multi-family housing developments capable of acting as alternative shelters.

[14]EXHIBIT H CCERI CONTRACT EXCERPTS

Critical facilities may be publicly or privately owned and operated. The lead eligible applicant, however, must demonstrate to DOER that any private facilities (e.g. hospitals, fueling stations, grocery stores, or housing) have entered into or are pursuing entry into a Memorandum of Understanding to provide the applicant critical functions for public benefit in the case of an emergency event. Such a Memorandum of Understanding must be completed prior to any award being made by DOER.

3. Eligible Clean Energy Technologies

DOER may fund projects that incorporate the eligible clean energy technologies ***at critical facilities.*** The eligible technologies are listed below. These eligible technologies may be strategically integrated with existing or new conventional back-up generation (such as diesel generator), but funds from this Initiative cannot be expended on such conventional technologies. Eligible technologies include:

Clean Energy Generation, such as:

- Renewable electric energy generation
- Renewable thermal energy generation
- Combined heat and power (CHP) and district energy systems utilizing natural gas or renewable fuels.
    - CHP or Fuel Cell systems with waste heat utilization must achieve annual system efficiency of at least 65%
- High efficiency (at least 50%) fuel cells

Energy Storage, such as:

- Batteries, flywheels, electric vehicles with vehicle to grid capabilities, thermal storage including hot/cold water, ice, and other phase change storage

Energy management systems that enable load shedding used to isolate and serve critical loads during an event, such as:

- Advanced controls, switches, load management software and critical load panels

Islanding Technology, such as:

- Advanced controls, switches, inverters and other grid stability technologies

Microgrids

- Defined as multiple buildings on one or more meter that are interconnected with electric and/or thermal distribution infrastructure, are served by distributed generation, and can operate either in parallel with or islanded from the broader utility grid.

4. Project Implementation Application

The opportunity allows eligible applicants to pursue either technical assistance **OR** project implementation. This solicitation is for the Project Implementation (PI) Application. The solicitation under PON-ENE-2014-035 describes the Technical Assistance (TA) Application.

DOER anticipates providing awards for project implementation only to applicants who demonstrate a suitable technical and financial readiness. The projects on this application must meet the following:

- use eligible clean energy technologies;
- be sited at eligible critical facilities;[15]

- demonstrate strategic electric isolation of critical loads from non-critical building loads to effectively extend resiliency capability; [16]
- be able to operate in parallel with the grid during "blue sky" days and island and operate in isolation from the grid during a broader grid outage;

- meet utility interconnection strategy guidelines; and
- follow the Initiative funding guidelines.

Acceptable projects may include retrofitting a system with existing generation to become resilient or installing a new resilient distributed generation system. These system types may be sited at a single facility, at multiple isolated facilities or among a network of connected facilities.

For Project Implementation (PI) Applications, all applications are due to DOER by 5:00 p.m. on November 10, 2014 at which time DOER will begin to review all PI Applications received.

5. Applications Criteria and Submittal

Number of Facilities - Applications may consist of a project at a single building project, multiple independent buildings, or multiple interconnected buildings (a microgrid).

Incomplete Applications - Applications must contain, at a minimum, the information requested in the application. DOER will reject incomplete applications.

Submittal Process - All applications are to be submitted via the submission process outlined below in the "Instructions" section. All applications or supporting documents received after these dates and times will not be considered.

6. Funding Guidelines

For PI Application funding, all applicants must demonstrate that they have fully utilized and accounted for available federal, state, and utility incentives outside this grant opportunity in the determination of the grant need from this solicitation. A list of potentially available financial resources can be found on the DOER website.

Initiative funding will cover the following costs:

- system design and engineering costs;
- clean energy generation (electric and thermal) and storage costs that are not covered by other incentives;
- clean energy equipment that provides for resiliency;
    - For example, energy storage for solar photovoltaic panels and additional power electronics for islanding capability or grid-isolation and black start equipment for CHP systems.
- interconnection costs related to resiliency equipment;
- installation costs;
- administrative costs (not to exceed 10% of total costs); and
- other costs as deemed appropriate by DOER.

Initiative funding will NOT cover the following costs:

- the portion of the cost of clean energy equipment that is already financially incentivized by other state, federal, utility, non-profit or private programs;
    - For example, solar photovoltaic panels that qualify for Solar Renewable Energy Credits (SRECs) and net metering, and CHP systems that qualify for Alternative Energy Certificates (AECs) and utility energy efficiency rebates.
- project costs at non-critical facilities;
- conventional energy generation, such as diesel generators;
- non-energy related infrastructure and capital costs; and
- other costs deemed inappropriate by DOER.

DOER will award up to $20 million of the grant funding in the first round of PI Applications. The remaining $20 million or more will be available to second round PI applicants that have previously received a technical assistance award the Initiative as well as any PI projects that scored well in their evaluation but went un-funded in the first round. Any PI project applicant that was funded less than 100% of their requested first round PI project application dollar amount may submit a revised PI project Application in the second round of PI project Applications, which will be evaluated by DOER against all other second round PI project Applications. Information on the TA Application process can be found through the solicitation PON-ENE-2014-035.

The applicant submitting a PI Application must provide a minimum of 10% match of funding for the project, with no more than half of the match allowed as in-kind. Match provided by an RPA applying on behalf of multiple municipalities is acceptable.

The **MAXIMUM** grant funding available for any PI applicant will be calculated based on a relative per capita income and population multiplier for the applicant's municipality and be subject to an **overall upper limit of $5 million**. There is no floor for grant requests. Projects serving more than one municipality should use the summation of the maximum grant award calculation for all municipalities involved. DOER does maintain the right to consider projects beyond this funding limit based on available budget particularly in the case of coordinated applications across more than one municipality, as well as complex microgrid projects. DOER reserves these maximum amounts for applicants who have demonstrated preparedness and capacity to implement significant projects or comprehensive efforts across multiple facilities. More straightforward energy resiliency projects should not need to seek these maximum amounts.

The **MAXIMUM** grant award calculation is as follows:

- $125,000, plus
- A municipality specific adder based on per capita income (2011 Massachusetts Department of Revenue data) and population (2012 US Census data) calculated as follows: $10.00*population*(state median per capita income/municipality per capita income).
- A further 10% for interconnection costs and a second 10% for administrative costs.
- The overall grant maximum is $5 million.

For example, a municipality with a median per capita income of $25,000 and a population of 100,000 would be eligible for a maximum award of $1,586,496, calculated as follows:

=($125,000+($10*100,000*$29,927/$25,000))*1.2.

Note: This is based on a state median per capita income of $29,927.[17]

[17] 2011 Massachusetts Department of Revenue, State per capita income (median), US Census and EQV

A broad range of projects are possible under this Initiative. Samples of projects across this range are listed below. These projects are not prescriptive or comprehensive of the possible options, but an example of projects of varying complexity, cost and benefit.

a) ***Single Facility, Electrical: A municipal fire house (single building project)*** – Retrofit of an existing rooftop solar PV system adding battery storage, a critical load panel to allow the system to just serve critical loads, an inverter that will allow for islanded operation, and any necessary interconnection upgrades to satisfy utility requirements.

b) ***Single Facility, Thermal: School serving as community shelter during an emergency (single building project)*** – Installation of an islandable and black-start capable gas-fired CHP system with a thermal storage system to serve critical electric loads and provide building heating or cooling.

c) ***Multiple Facilities: Waste water treatment plant (WWTP) and a municipal police station (multiple building project)*** – Retrofit of an existing anaerobic digestion system at the WWTP to make the system islandable and black start capable; the addition of solar PV, battery storage, a critical load panel, an inverter that will allow for islanded operation, and any necessary interconnection upgrades to satisfy utility requirements at the WWTP; and a similar islandable solar PV and storage system at the municipal police station. These would be projects at two independent sites within one municipality, submitted under the same application.

d) ***Microgrid: Health services and shelter microgrid project*** – The incorporation of an islandable, black-start capable CHP system at a hospital with an islandable solar PV system and battery storage (as described in numbers 1 and 3 above) at a neighboring school that can serve as a shelter. This project requires working with the local utilities to allow the distribution of electricity across public ways.

Disbursement of funds will be based on contracts signed with each awarded applicant. Milestones and reporting requirements will be established through the contracting phase.

For projects submitted under a Round 2 Project Implementation application where the complexity of the project requires additional design and engineering, an applicant may opt to be awarded based on a phased contract approach, by indicating as such on their application form. The phased contract would allow for an initial disbursement for design costs related to the pre-construction expenses (e.g., feasibility study, engineering, and utility impact study costs) and subsequent disbursement(s) for the construction expenses once the design phase is complete and cost estimates refined. A Round 2 Project Implementation application will be evaluated on the full project proposal and should provide a best estimate for construction expenses as the amount specified for construction expenses will be reserved for the second phase of disbursement. A budget, revised upon completion of the full design work, that is significantly in excess of these estimates may be approved on a competitive basis, given funds are available.

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https://dlsgateway.dor.state.ma.us/DLSReports/DLSReportViewer.aspx?ReportName=IncomeEQVperCapita&ReportTitle=DOR+Income+and+EQV+per+Capita

EXHIBIT H CCERI CONTRACT EXCERPTS

C. Evaluation Criteria

Geographic Diversity:

In recognition that climate events are known to affect all regions of the Commonwealth, DOER will make awards, to the extent possible, in a manner that fairly distributes this public support across all regions of the Commonwealth.

Proposal Content*:*

- Thoroughness of the entire proposal package;
- High quality and realistic project plan;
- Comprehensive reasoning behind project site selection:
  - Identification of critical services to be supported,
  - Prioritization of critical facilities that will provide those services,
  - Anticipated outage duration being addressed;
- Demonstrated effort to address the primary vulnerabilities and needs of the community including, but not limited to: high population density, high-need populations, and specific environmental hazards and risks to the community; and
- Demonstrated past and ongoing commitment to addressing climate change and emergency response and recovery such as participation in the Green Communities program, energy efficiency audits and measure implementation at critical facility(ies), deep energy retrofit at critical facility(ies), and comprehensive emergency planning.

Proposal Finances:

- Meeting or exceeding cost share requirement.
- The extent of incorporation of all relevant financial resources, including but not limited to state and federal incentives (grants, tax credits, RPS/APS, net metering), loan opportunities, private partnerships, ancillary market participation (reserve capacity and/or voltage regulation), demand response market participation, etc. with more comprehensive incorporation evaluated more strongly.
- Clear plan for ongoing operations and maintenance costs.

Proposal Technical Details:

- Projected technical and operational performance, and reliability of the project, including the incorporation of islanding and black start capability.
- Well-described plan to continuously operate with no planned outage or down time for maintenance while in island mode 24x7, despite an extreme weather event, for at least 3 days, with longer duration receiving higher scores.
- Demonstration of energy efficiency audit and implementation of recommendations at project site.
- Demonstrated success in working with utility company in pursuing interconnection procedures, including advanced communications and planning for any microgrid application.
- Clear plan to expeditiously execute the proposed project.
  - For Single building projects, proposals with a plan to complete projects before the end of calendar year 2014 will be given priority.[18]

- More complex projects will be evaluated more strongly the sooner they can be completed.[19]
- All projects should demonstrate a strong plan for completion by the end of calendar year 2015 at the latest.

- Clear plan for continued operation and maintenance of installed equipment.

D. Webinars and Outreach

DOER will also host webinars on Thursday, May 22, 2014 at 11 a.m. and Wednesday, May 28, 2014 at 11 a.m. to provide an opportunity to more thoroughly explain the Initiative and answer questions from potential applicants. The first webinar will provide an overview of the solicitation and the second will provide a more in-depth look at the requirements for the PI Application. There will also be a third webinar covering the requirements for TA Application and an in depth discussion of the technical assistance services offered by the consulting team on Tuesday, May 27, 2014 at 3 p.m. for those who might be interested in that opportunity as well.

E. Procurement Calendar and Asking Questions

DOER issues PON	May 15, 2014
Deadline for submitting PI Application questions	July 8,2014
ROUND ONE PI APPLICATION DEADLINE	July 15, 2014
Round One PI Application awards announced (subject to change)	August 15, 2014
ROUND TWO PI APPLICATION DEADLINE	November 10, 2014

As mentioned above, there will be a follow-on round of project implementation funding available to TA applicants looking to implement projects outlined through the technical assistance process. The deadline for these applications is November 10, 2014. Any PI Applications from Round One that scored well in their evaluation but went un-funded will be reconsidered for funding in this second round. Round Two awards will be announced on December 12, 2014 (subject to change). Information on the TA Application process can be found through the solicitation PON-ENE-2014-035.

F. Contact Information

For further information, questions and submissions please contact:

Amy McGuire
Massachusetts Department of Energy Resources
Renewable Energy Project Coordinator - Community Clean Energy Resiliency Initiative
Amy.McGuire@state.ma.us

Questions and answers will be posted periodically on the DOER website at http://www.mass.gov/eea/grants-and-tech-assistance/guidance-technical-assistance/agencies-and-divisions/doer/doer-procurements.html

G. Instructions

- Applicants must complete all required application forms and attach all requested documents. Incomplete applications will not be accepted.
- Applications must be submitted via email to Amy McGuire at Amy.McGuire@state.ma.us.
- All Round One PI Applications are due to DOER by 5:00 p.m. on July 15, 2014.
- All Round Two PI Applications are due to DOER by 5:00 p.m. on November 10, 2014.
- Milestone reporting is required for all awarded PI Applications. DOER will provide grant recipients with detailed requirements after a grant award is executed.
- This application information is available at www.commBuys.com as PON-ENE-2014-036.[20]

EXHIBIT H CCERI CONTRACT EXCERPTS

V. ATTACHMENT C – SCOPE OF CONTRACT AWARD

COMMONWEALTH OF MASSACHUSETTS SCOPE OF CONTRACT AWARD AGREEMENT

By and Between
Massachusetts Department of Energy Resources (DOER)
and
Cape &Vineyard Electric Cooperative, Inc.

SCOPE OF CONTRACT AWARD

1. **Overview**

The purpose of this Contract is to award a grant to the Cape & Vineyard Electric Cooperative, Inc. ("Grantee") for a maximum obligation not to exceed $1,479,193 to fund the feasibility study and the installation of solar storage at the DY Regional High School Emergency Shelter located at 210 Station Avenue, S.Yarmouth ("Project"). Specific Project components and corresponding costs are limited to the following:

$25,000 for engineering cost
$180 for permitting fees
$10,000 for feasibility study fees
$50,000 for installation labor costs
$80,000 for interconnection costs, including testing and commissioning
$17,968 for operating expenses
$570,200 for routine maintenance and consumables
$30,000 for legal and insurance
$680,845 for energy storage equipment
$15,000 for accessory building for safe battery storage

2. **Contingencies:**

Grantee shall submit the following:

(#1) A copy of the signed Memorandum of Understanding between the Grantee and Dennis-Yarmouth Regional School District allowing the installation of the Project as well as the use of the Dennis-Yarmouth Regional High School critical facility in the case of an emergency event.

(#2) Confirmation that all necessary municipal and state approvals have been obtained for the Project to proceed and a commitment to provide information to meet all other contingencies for the Project. Attachment E provides a template letter for providing this confirmation. In addition, a copy of the Interconnection Pre-Application Report from the electric utility shall be submitted to DOER, if applicable.

(#3) Confirmation that all necessary pre-construction permits have been acquired for the Project.

(#4) Submission of the Interconnection Pre-Application Report from the electric utility to DOER, if applicable, and confirmation that all necessary permits have been acquired for the Project. [21]

[21] EXHIBIT H CCERI CONTRACT EXCERPTS

(#5) A copy of the interconnection application and Impact Study that was submitted to the electric utility.[22]

3. Procurement:

All procurement contracts and subcontracts entered into by public agencies and governmental bodies shall be governed by and in accordance with Massachusetts General Laws. Where applicable, such procurements, contracts and subcontracts shall be governed by the all provisions of either M.G.L. c.25A, § 11C or §11I, M.G.L. c.30B, or M.G.L c.149. All designer selection for building projects shall be governed by M.G.L. c.7, §§38A1/2 - O.

4. Program Schedule:

The following milestone is to ensure timely completion of the Project. If the Grantee cannot meet these milestones, it will contact DOER immediately.

~~1. Feasibility Complete April 2017~~
~~2. Procurement Complete July 2017~~
~~3. Construction Complete January 2018~~

5. Disbursement of Funds:

Initial Disbursement: Up to thirty five thousand dollars and 00/100 ($35,000), shall be disbursed by DOER for the purposes of engineering and feasibility study fees only after (1) the execution of this Contract and (2) DOER is satisfied that contingency #1 has been met.

Second Disbursement: Up to seventy thousand one hundred eighty dollars and 00/100 ($70,180), will be disbursed by DOER for the purposes of permitting, legal and insurance, and partial utility interconnection and permitting once all reporting and contingency requirements have been met, including contingencies #2-5. This will include submittal by Grantee to DOER of detailed dated invoices for costs incurred and verification of payment.

Third Disbursement: Up to forty thousand dollars and 00/100 ($40,000) shall be disbursed by DOER for the remaining interconnection costs once all reporting requirements have been met. This will include submittal by Grantee to DOER of detailed dated invoices for costs incurred and verification of payment.

Fourth Disbursement: Up to seven hundred forty-five thousand eight hundred and forty-five dollars and 00/100 ($745,845) shall be disbursed by DOER for energy storage equipment, accessory building for safe battery storage, and installation labor costs once all reporting requirements have been met. This will include submittal by Grantee to DOER of detailed dated invoices for costs incurred and verification of payment.

Final Disbursement: Up to five hundred eighty-eight thousand one hundred sixty-eight dollars and 00/100 ($588,168) shall be disbursed upon verification by DOER for the purposes of routine maintenance, operational expenses, and after a site visit, a review of detailed invoices for a total Project costs, submission of any other requested documentation, and that all reporting requirements have been met as well as the submittal of the Final Report and the Cost Sharing Commitment Letter. Attachment F provides a template Cost Sharing Commitment Letter. The Grantee will submit to DOER detailed dated invoices for costs incurred and verification of payment.

Funds cannot be used for reimbursement of any work related to this Project performed before the date of execution of this Contract, as set forth in the Standard Contract Form. Please note that, due to the competitive

nature of this grant program, the use of these funds is restricted to the specifically approved Project. Please be advised that, in the event that the Project does not move forward, DOER will rescind the funding for the Project and said funding may not be applied to other work.

6. Separate Accounts

The Grantee shall at all times conduct its business and affairs in such a manner that any and all ledger accounts and records pertaining to the receipt and expenditure of DOER funds under this Agreement shall be kept separate and distinct from all ledger accounts and records of the Grantee relative to any other enterprise which the Grantee has engaged in, developed, or administered.

7. Unused Funds:

Any funds undisbursed or uncommitted by the Grantee after the end of the grant period shall be returned to the DOER within 60 days.

8. Publicity

The Grantee will coordinate with DOER on all publicity regarding this Project.

9. Reporting and Other Required Documentation:

a) Should Grantee engage a third party to manage administrative functions of the program and rely on the internal controls of that third party, the third party shall provide the results of an internal controls audit annually according to the provisions Statements of Auditing Standards No. 70 to DOER and Grantee.

b) Grantee shall have a program to combat fraud, waste and abuse of funds and shall incorporate into its program guidance provided by the Office of the State Comptroller

Required interconnection documentation: The Grantee shall be required to file copies of the utility interconnection application, Impact Study and Interconnection Service Agreement when available. This includes a copy of the Retrofit Program Customer Pre-Approval Letter indicating the system passes the Benefit/Cost Ratio (BCR) test and documentation that Project interconnection has been approved by the electric utility including a copy of the Project's interconnection approval from the gas utility when available. All interconnection documentation shall be submitted to:

Kara Sergeant, Renewables Program Coordinator, 617-626-7392
kara.sergeant@state.ma.us

Required storage data and documentation: The Grantee shall be required to file copies of any storage performance and operation data to DOER and any designated partners working on enhancing energy storage in Massachusetts. All storage data shall be submitted to the below DOER contact unless otherwise specified:

Kara Sergeant, Renewables Program Coordinator, 617-626-7392
kara.sergeant@state.ma.us

Quarterly reports: The Grantee shall be required to file progress and financial reports once every quarter, unless specifically exempted by DOER. Quarterly reports are due by 5pm 4 days after the completion of each of the following quarters: July 1 – Sept 30; Oct 1 – Dec 30; Jan 1 – Mar 30; Apr 1 – June 30. These reports shall include:

a) the progress and status of activities performed in relation to the Scope of Grant Award including an explanation of any delays or obstacles encountered in meeting the performance schedule as well as a description of efforts taken to resolve delays. [23]

[23] EXHIBIT H CCERI CONTRACT EXCERPTS

b) the actual costs incurred to date by the Project, breaking down all costs in such manner as DOER may prescribe. [24]

Final report: The final report shall be submitted within 2 months after completion of the final project receiving funding, and shall include a summary of the projects completed, including project locations and capacity and required interconnection documentation. All quarterly and final reports above shall be submitted to:

Kara Sergeant, Renewables Program Coordinator, 617-626-7392
kara.sergeant@state.ma.us

NOTE: If the services funded by this Contract are solicited pursuant to M.G.L. c. 25A § 11C or § 11I, then the Grantee shall also comply with the monitoring and reporting requirements set forth in DOER's regulations at 225 C.M.R. 10.00, 19.00, or other applicable regulations. For solar PV systems, registration with and reporting to the Massachusetts Clean Energy Center Production Tracking System (PTS) is required.

10. Ownership of Reports and Other Required Documentation:

The reports and other required documentation shall be owned by the Commonwealth of Massachusetts and treated as public documents. Following the completion of the Contract both the Commonwealth and the Grantee retain the right to make further use of the reports and other required documentation.

[24] EXHIBIT H CCERI CONTRACT EXCERPTS

VI. ATTACHMENT D - BUDGET

Check one: X Initial Budget

____Budget/Account Amendment. Maximum Obligation before this Amendment: $_____

PRIOR MMARS DOCUMENT ID:_____(for reference - if applicable)

CURRENT DOC ID:_____.

[See Instructions for Additional Guidance on completion. Insert as many additional lines as necessary.]

A	B	C	D	E	F	G	H	I
B	Account	O	Description	Initial Amount / or Amount Prior to Amendment	In	A	Enter "YES" if Amount is a prior FY budget reduction or a current FY "Carry-in" authorization for Federal Funds	New Amount After Amendment
2	7006-7056	A	APS	$145,180*		$		$
2	7006-7056	A	APS	$1,334, 013*		$		$

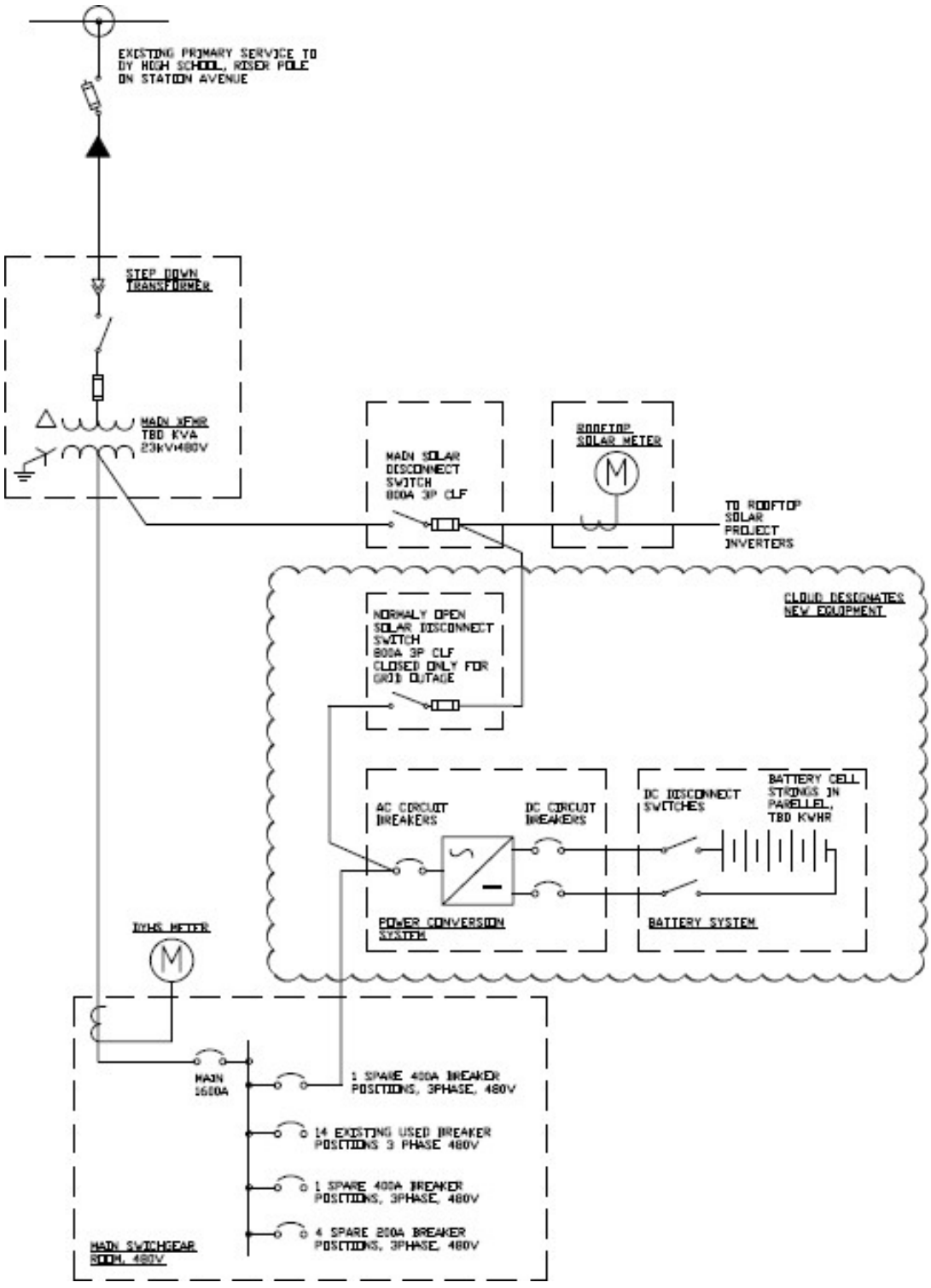
FISCAL YEAR SUBTOTALS AND TOTAL MAXIMUM OBLIGATION FOR DURATION OF Contract	
FISCAL YEAR: _2016____ SUBTOTAL (*or New Subtotal if Fiscal Year Subtotal being amended*	45,180*
FISCAL YEAR:___2017_____(or *New Subtotal if Fiscal Year Subtotal being amended*	1,334, 013*
FISCAL YEAR:_____SUBTOTAL (*or New Subtotal if Fiscal Year Subtotal being amended*	
FISCAL YEAR:_____SUBTOTAL (*or New Subtotal if Fiscal Year Subtotal being amended*	
TOTAL MAXIMUM OBLIGATION FOR DURATION OF Contract (*or New Total Maximum Obligation if amended*)	1,479,193*

*Final award will be commensurate with eligible expenses as verified through the invoicing and reporting process[25]

[25] EXHIBIT H CCERI CONTRACT EXCERPTS

Exhibit I[26]

One-Line Diagram (CVEC conceptual design for RFP)



[26] EXHIBIT I ONE-LINE (CONCEPTUAL)

Exhibit J

15-Minute Usage Interval Data for Account 1376 729 0029

Use link below to access CSV file with interval data

http://www.cvecinc.org/wordpress/15-minute-usage-interval-data-for-account-1376-729-0029

Exhibit K

15-Minute 590kW PV System Production Data

Use link below to access Excel file with PV interval data for 2017

http://www.cvecinc.org/wordpress/15-minute-590kw-pv-system-production-data/

S5: Ameresco RFP Clarification Response

REQUEST FOR CLARIFICATIONS FOR

COMMUNITY CLEAN ENERGY RESILIENCY INITIATIVE

PREPARED FOR

CAPE AND VINEYARD ELECTRIC COOPERATIVE

NOVEMBER 20 , 2018 ELECTRONIC SUBMISSION

Cape & Vineyard Electric Cooperative Inc.

AMERESCO
Green • Clean • Sustainable

PREPARED FOR

CAPE AND VINEYARD ELECTRIC COOPERATIVE

Novemb er 2 0 , 20 18

REQUEST FOR CLARIFICATIONS FOR

COMMUNITY CLEAN ENERGY RESILIENCY INITIATIVE

PRESENTED BY

Ameresco, Inc.
111 Speen Street
Framingham, MA 01701
T: (508) 661.2200 • F: (508) 661.2201

AMERESCO
Green • Clean • Sustainable

TABLE OF CONTENTS

SECTION 1: MONETIZING THE BESS

In the interest of having a role in operation and maintenance of the proposed BESS, Ameresco has conducted a preliminary analysis to determine the most effective revenue streams for the proposed Battery Energy Storage System ("BESS"). Both external and internal modeling tools have been used to simulate the various opportunities that the BESS could participate in during the project life. The proposed revenue streams were decided by weighing the projected revenue, the associated expenses (including increased degradation, costs of charging from the distribution grid, and more), and the reliability of these programs.

For example, Frequency Regulation is 24/7 merchant market which seems attractive because it allows the BESS to generate revenue throughout its project life. However, revenue from the program is not as easy to be confident in because a part of the revenue comes from a performance score. If the system, for whatever reason, does not operate as intended it can face penalties from ISO-NE.

In our preliminary assessment, Ameresco suggests that the Forward Capacity Market ("FCM") (via ISO-NE), Utility Demand Response Programs ("DR") (via Eversource), and CAPTag Savings (via ISO-NE) are the most valuable of the opportunities available to DY High School. Behind-The-Meter ("BTM") Demand Savings, as discussed later in this section, can yield ~$16,000 per year, though this is not included in the Ameresco analysis due to the increased cycling required.

We wholeheartedly understand that the main use of the BESS is resiliency, therefore, even with the lucrative returns that we are projecting, the BESS operations proposed will ONLY have ~15 equivalent full discharges of the battery per year, thus extending the life of the asset. This will ensure that the BESS will be available to serve its prime objective of resiliency.

Of note, please assume the additional Year 1 cost of a few thousand dollars ($5,000-10,000) not previously included for metering and monitor for market participation.

10-YEAR LOOKAHEAD

Based on the 10-year manufacturer's guarantee from NEC Energy Solutions, we have projected the subsequent 10-years of revenue potential.

The following table summarizes Ameresco's revenue projections.

	Year	1	2	3	4	5	6	7	8	9	10
Parameter	BESS Reduction (market participation)	250	250	250	250	250	250	250	250	250	250
	BESS Reduction (CAPTag)	225	225	225	225	225	225	225	225	225	225
ISO-NE FCM	$/kW-month per year	$ 6.04	$ 5.30	$ 4.63	$ 4.49	$ 4.49	$ 4.49	$ 4.49	$ 4.49	$ 4.49	$ 4.49
	Annual Total Revenue	$ 18,120	$ 15,900	$ 13,890	$ 13,473	$ 13,473	$ 13,473	$ 13,473	$ 13,473	$ 13,473	$ 13,473
Eversource DR Program	$/kW-yr (estimated)	$ 35	$ 35	$ 35	$ 35	$ 35	$ 35	$ 35	$ 35	$ 35	$ 35
	Annual Total Revenue	$ 8,750	$ 8,750	$ 8,750	$ 8,750	$ 8,750	$ 8,750	$ 8,750	$ 8,750	$ 8,750	$ 8,750
CVEC % Share of Revenue*		60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
TOTAL ANNUAL BENEFIT (REVENUE AND SAVINGS) TO CVEC:											
	ISO-NE FCM	$ 10,872	$ 9,540	$ 8,334	$ 8,084	$ 8,084	$ 8,084	$ 8,084	$ 8,084	$ 8,084	$ 8,084
	Eversource DR	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250	$ 5,250
	CAPTag Savings	$ -	$ 22,260	$ 19,446	$ 18,863	$ 18,863	$ 18,863	$ 18,863	$ 18,863	$ 18,863	$ 18,863
	Total	$ 16,122	$ 37,050	$ 33,030	$ 32,197	$ 32,197	$ 32,197	$ 32,197	$ 32,197	$ 32,197	$ 32,197
	Cumulative	$ 16,122	$ 53,172	$ 86,202	$ 118,399	$ 150,595	$ 182,792	$ 214,988	$ 247,185	$ 279,382	$ 311,578

* = this market participation rate is based on the Fair Market Value of systems under 1MW (60:40 split).
As a municipality, CVEC may be able to have better terms available for market participation or DR through DCAMM contracts

FORWARD CAPACITY MARKET (FCM)

Forward Capacity market operates on a 3-year auction. The pricing supplied in our estimates is based on the "reconfiguration auction," as we will integrate our asset for market participation in the middle of a current auction. By year 4 of operation, however, we will be able to participate at full market value; that said, our projections are forecasted and conservative, demonstrating an assumed 3% decrease from year 3, with that value constant for years 4-10. As shown previously, **we project FCM payments to be between $13,000-$18,000** dependent on the annual market clearing price.

Once the BESS is constructed, it can participate in its first FCM auction. As previously mentioned, this auction determines the rate that capacity will be valued at a rate in $/kW-month that will become active three years from the auction date. So, for most of the system's lifetime, it will be able to participate at the full FCM clearing price so long as the system is bid into the Market each year. Ameresco can be responsible for this bidding process to ensure that the BESS can participate.

That said, the first two years that the system is constructed, it will have to participate in the previously mentioned "reconfiguration auction," also known as the secondary auction. This auction on average has a lower clearing price in $/kW-month, but is critical because it allows the BESS to generate capacity revenue during years 1 and 2 of operation.

UTILITY DEMAND RESPONSE PROGRAM

Ameresco is familiar with National Grid's Demand Response program which currently markets a $35/kW-year revenue stream. An Eversource DR program is still forthcoming, but based off conversations with our DR partners, we expect that the revenue will be similar to National Grid's program. National Grid's Demand Response Program can provide a project of this size **~$8,000-$9,000 annually**.

CAPTAG SAVINGS

CAPTag prices are associated with electric utility bills, based on a customer's energy supply contract. If CVEC unbundles their electric supply, the customer can have the ability to actively curtail facility load on ISO-NE peaks. CAPTag is a recurring component of the electric bill that relates to the facility's usage during the ONE (1) 1-hour ISO-NE annual peak.

In 2017, the recorded CAPTag event occurred on 6/13/18 from 16:00 – 17:00. Since Ameresco was provided with DY high school's 2017 load data, we have sorted through the data to determine that DY high school at an average peak load of 247 kW during that time. Therefore, the entirety of the proposed battery would only be able to reduce the site load by 247 instead of the full 250. Since DY high school's load is not safely above the BESS nameplate capacity, we have taken a conservative estimate to say that the site's demand will only be 225 kW during the annual CAPTag event.

CAPTag pricing is based on a 3-year auction. Our year 1 pricing ($6.04/kW-month) is based on the average of the three next prices which have been determined in the three past years auction price. After the year 1 value, we take a 3% decline each year to be conservative. While recently the FCM clearing prices have been on the decline, it is common belief in the industry that Capacity prices are expected to increase in the coming years.

Utility demand response program participation, as discussed previously, will provide a “double-dip” for CVEC on their bill, allowing them to realize CAPTag savings without the burden of many additional discharges.

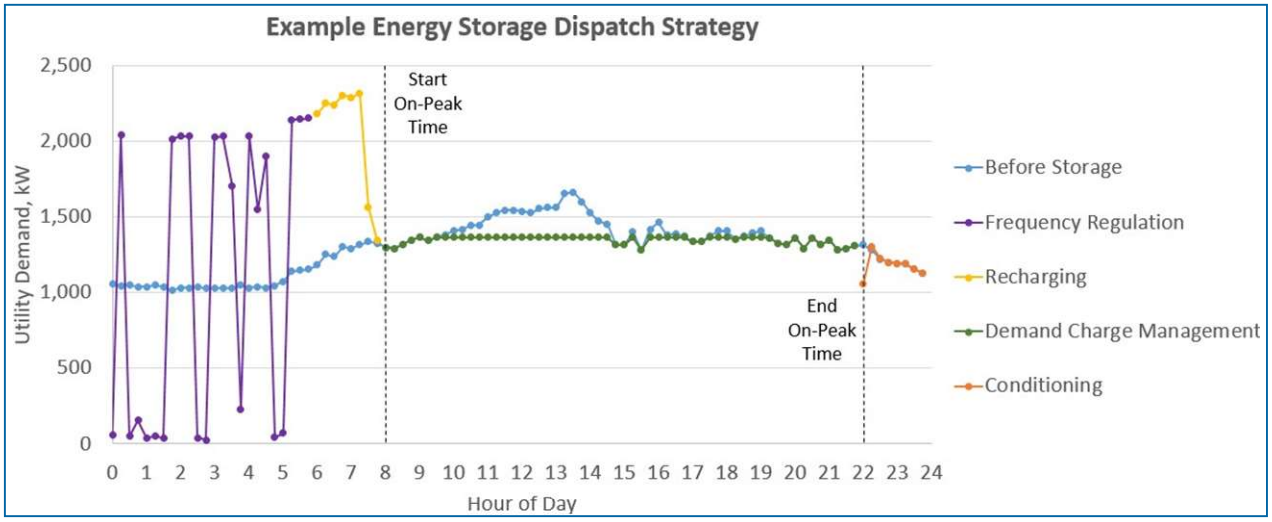
CAPTag would most likely not be recognized in the first year of BESS operations, however we anticipate that **CAPTag savings could be $18,000-$24,000 annually**. This value can be estimated, based on experience as 1.4x FCM payments from ISO-NE.

BTM DEMAND SAVINGS

Demand savings is projected to generate ~$16,000 in savings per year, but this still would require several equivalent full charge cycles every week throughout the year and would degrade the battery at a faster rate than projected. Leaving a state of charge necessary for resiliency features, ~50%, would decrease potential savings shown in the $16,000 figure. That said, behind the meter demand savings was not included or recommended at this time for the BESS.

SECTION 2: TOOLS USED

Ameresco is currently in development of *AESOP* (Ameresco Energy Storage Optimization Program), our in-house value-stacking model that has been in the works for over two years. This program is the only one of its kind that can actively simulate value-stacking Demand Savings, Frequency Regulation, Capacity, and other revenues through analysis of historical load and pricing data.



Our Demand Savings projections were also cross-referenced using "Homer Grid". This is a third-party software originally developed at National Renewable Energy Laboratory (NREL). HOMER (Hybrid Optimization Model for Multiple Energy Resources) nests for 3 powerful tools clubbed into one software so that engineering and economics work side by side. The simulations use load data, applicable rate tariffs, weather data, and equipment degradation to determine the most realistic output.

Finally, we have used internal expertise as well as our consultant, Winkler Consulting, to prioritize the revenue streams that are the ideal balance of significant and reliable revenue, while also requiring minimal expenses. Winkler Consulting is founded by its principal, Eric Winkler, Ph.D., who has many years of experience working directly for ISO-NE. If CVEC would like to have an interview with Eric and our team to discuss our suggested markets, Ameresco would be happy to coordinate this.

SECTION 3: OPERATION & MAINTENANCE EXPENSES

3.1 : O&M ESTIMATES

Operations & Maintenance – For the annual O&M rate for Ameresco to maintain warranties and perform preventative maintenance, including fire suppression, the cost will be ~$13,000 per year.

Dispatch Services – If CVEC would like Ameresco to be the one managing the contract with DR dispatcher, an additional operations rate would be a shared savings model. This would benefit CVEC because it would give a single entity responsible for everything related to BESS.

Operational Expenses – The cost of charging the BESS, at an estimated 15 full charges of 1000 kWh at the off-peak rate blended rate of $0.123/kWh, is projected to be ~$1,845 per year.

An alternate option is to have the BESS charge from the solar through scheduling of the Trimark controller. This would need to likely be addressed through a simple amendment to the existing PPA agreement.

3.2 : BATTERY DEGRADATION

The following degradation curves were generated by NEC to provide CVEC with an idea of how they can expect the system to degrade over its project life depending on which revenue streams CVEC decides to pursue. For clarity, this is indicating that if the BESS is only responsible for Resiliency and Capacity purposes that CVEC can expect the storage capacity at the end of the system's life to be ~90% of the original 1,000 kWh capacity. This means that at year 20, the battery could only discharge at 250 kW for 3.6 hours. On the other hand, if the BESS performs demand savings, then the system will be left with closer to 80% of its original capacity, 250 kW for 3.2 hours.

Time (Years)	Indicative % of BOL System Capacity (24 Equiv Cycles/Yr)	Indicative % of BOL System Capacity (240 Equiv Cycles/Yr)
0	100%	100%
1	100%	99%
2	99%	98%
3	99%	97%
4	98%	95%
5	97%	94%
6	97%	93%
7	96%	92%
8	96%	91%
9	95%	90%
10	95%	89%
11	94%	88%
12	94%	87%
13	93%	86%
14	93%	85%
15	92%	84%
16	92%	83%
17	91%	82%
18	91%	81%
19	90%	80%
20	90%	79%

SECTION 4: BESS ELECTRICAL CONFIGURATION

Fischbach & Moore Electric Group, LLC. respectfully submitted the following design / sequence for the DY BESS project:

It is our understanding that the CVEC would like to use portions of the existing rooftop solar array (589.68 Watt DC / 520.00 kW AC) to help recharge the batteries of the proposed BESS during extended power outages. In order to accomplish this, we propose the following.

We proposed to intercept ½ of the array (294,840 watt) prior to the existing CT compartment and install a double throw disconnect with a kirk key interlock (K2) and add a kirk key interlock to the high school main circuit breaker (K1).

In normal operation, the intercepted array feeder would be routed back to the CT compartment and the system would operate as it does now.

During extended outages, when it is desired to have the PV system charge the BESS, an operator would open the high school's main breaker, activate the kirk key interlock 1 isolating the switchboard from the grid, and then would operate kirk key interlock 2 at the double throw switch to place the system in the PV-battery mode. In this configuration, the battery will act as the grid reference for the PV system recharging the batteries and helping to reduce the building loads. When PV battery power is no longer required, the operator would reverse the steps and place the building back in normal operating mode.

In normal operating mode the Battery system will be behind the meter and can be used for demand management and other revenue-generating modes.

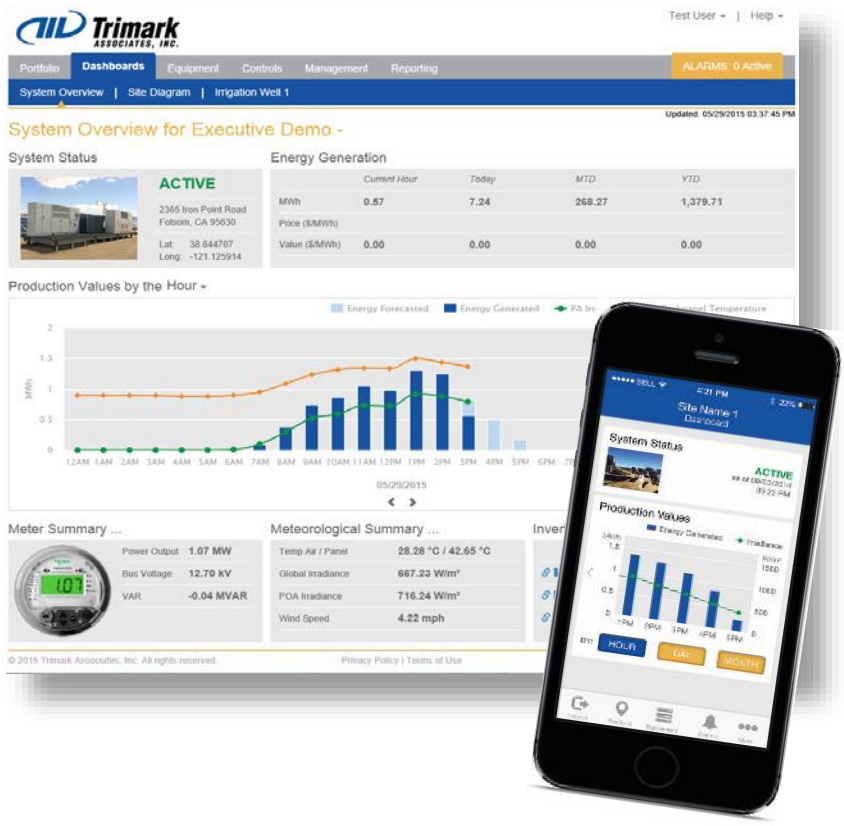
Please refer to **Attachment A: Single Line Diagram**.

If the CVEC would like to use the battery system to export power or to support the grid during normal operations we can accomplish that by adding an additional double throw switch with a kirk key interlock, metering equipment and running a new feeder to the existing transformer. This is predicated on the utility company approval.

Fischbach & Moore Electric Group, LLC appreciates the opportunity to provide a support for this work. If you have any questions or desire additional information, please feel free to contact Steve Hopkins at 617-474-0500 extension…274

SECTION 5: USER-INTERFACE & BESS SCHEDULING

Using a combination of NEC's AEROS and Trimark's Vantage software, interfacing with the BESS will be a simple and straightforward task. First, we will focus on the requirement of resiliency since that is the priority for CVEC. During a grid outage event, an individual with administrative access to the BESS will have the ability to easily log-in and control the battery system in real-time.



Ameresco understands the complexities of the project and hope that this section and the associated documents in **Attachment B: Trimark Materials** will provide CVEC with a peace-of-mind regarding our operations and controls of the BESS.

Trimark Associates, Inc. (Trimark) develops best-in-class metering and data telemetry solutions required for regulatory (ISO) compliance, optimization of power generation and consumption, and accurate billing and settlements.

Trimark is devoted to helping power generators and consumers access and report information required to:

- Participate in open energy markets and meet ISO reporting requirements;
- Support accurate billing and settlements;
- Manage power usage;
- Optimize performance of energy production resources; and
- Support business planning and capital investment decisions.

Founded in 2000, Trimark has built a reputation for excellence in metering, secure data telemetry, SCADA, control, communications and meter data management (MDMA).

For further details on Trimark, their experience, and how the administrator can interact with the Trimark program, please refer to **Attachment B: Trimark Materials**.

It should be noted that training will be provided by Trimark staff to the system administrator(s). The Ameresco Team would appreciate the time of CVEC to schedule a demonstration of the Trimark System operations.

ATTACHMENT A: SINGLE LINE DIAGRAM

Please refer to the following page for the Single Line Diagram.