Framework for Collaboration on CMS Solar Project
CMSBC, CMS, and CMLP
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Introduction:

Because we have multiple parties involved, we need to define the goals, policies, and various high-level considerations that will guide our collective approach to installing solar PV & storage at the new CMS. The overall intent of this effort is to allow us to comply with the Town's wishes[1] for a zero-energy building[2] (see Appendix I for discussion of DOE's definition of a Zero Energy Building (ZEB) and the Town's Climate Action Plan[3].

Goals for PV and Storage Project:

1. Solar and storage-ready is a baseline requirement for the new CMS. The CMS will be constructed with all of the solar and storage-ready elements (Appendix II) prior to building occupancy, regardless as to the timing of the installation of the PV generation/storage system. It is possible that the building is *solar and storage-ready-only* for several years prior to the installation of the PV system.
2. The CMS Zero Energy goal is for *'100% of annual CMS kWh consumption to be off-set by on-site generation over the course of a year'*. The estimated requirement for annual generation is ~1,000,000 kWh AC, based on an EUI of 25 for a 144,000 square foot building.
3. As required by the CMLP, the project will include sufficient storage to mitigate any negative impacts on the Concord grid that are associated with peak loads.
4. The installation of the array and battery storage system shall be complete as close to occupancy as possible.

Solar and Storage-Ready:

The expenses of the solar and storage-ready aspects of the project will be rolled into the CMS project.

Possible Scenarios for Installing PV On-Site:

There are two options[4] for installing PV on-site:

- Option A - Third-Party Managed System: If the CMLP can obtain satisfactory pricing, the PV generation and storage system would be financed, installed, and maintained by a third-party and the resulting system would be integrated directly into the Concord grid in a way that is similar to

[1] Article 14 and the associated amendment on sustainability from Annual Town Meeting, 2019 and the Concord Sustainability Plan (2020), Energy Indicators of Success, page 23.
[2] U.S. Department of Energy, Energy Efficiency & Renewable Energy, A Common Definition for Zero Energy Buildings, September, 2015, Kent Peterson, Paul Torcellini, Roger Grant and National Institute of Building Sciences.
[3] Concord's Climate Action Plan (2020) includes goal for solar generation and battery storage on Town property.
[4] Both of these approaches could be combined on the CMS site. The two systems would be physically separate and would conform to the definitions above. Each would contribute a portion of the required annual generation. For example, the CMS could take responsibility for the rooftop system CMS managed-system), while the CMLP could pursue a second canopy system over the parking areas (third-party managed system).

other, large PV systems on Town-owned property in Concord where power is delivered by the third-party to the CMLP under the terms of a Power Purchase Agreement (PPA).
- Option B - Direct connect to the CMS electrical system: The alternative scenario is for a CMS-connected, behind-the meter system, including both rooftop and canopy components. This system would not be managed by a third party; rather, it would be financed, maintained, and installed by the CMS and the system would be connected directly to the CMS electric panels.

Financial Benefits to CMS:

- Option A - If a PPA is implemented for all or for a portion of the CMS's power requirements, the CMLP would provide an annual payment to the Concord Schools for its use of CMS property for power generation.

- Option B - In the event that a behind-the-meter system is installed, the CMS will be in a position to produce a portion of its annual power requirements but will continue to be dependent on the CMLP for its power at those times when the CMS PV is not meeting all of its needs. The financial arrangement between the CMLP and its customers for behind-the-meter systems is called net-metering and it would apply to the CMS, resulting in a lower monthly electric bill.

Feasibility Study and Design:

The first step is for the CMLP to contract with a solar design firm to complete a feasibility study of the project. This feasibility study will address both PV/storage system design and financial feasibility.

System design includes two major elements:

- Specification of the solar ready elements that need to be addressed during construction of the school and the parking areas. The solar design firm will refine this list of elements (see Appendix II) and will provide design specifications for each element to the CMS architects.
- Design of the solar arrays and storage system.

Financial feasibility will address each of the following options[5]:

- Flat-roof only
- Flat-roof, plus rooftop canopies
- Flat-roof, plus rooftop canopies, plus parking canopies.

Once feasibility is complete, the next step will be to develop a complete plan for the project.

Responsibilities of Team Members:

- Solar Design Firm: Feasibility study.
- SMMA: Provide a complete solar-ready design in the construction documents.
- CMS Construction Manager: build-out the 'Net Zero-Ready' elements of the building and parking areas, as defined through the Feasibility Study.

[5] See Appendix III for estimates of project size.

- CMLP: If Option A is found to be financially and technically feasible, the CMLP will proceed with an RFP for a Power Purchase Agreement. The CMLP will take responsibility for the RFP and contract negotiations to obtain the services of a third-party to develop and manage the generation system.
- Third party: For any portion of the project that is addressed though a PPA, the contracted third-party will take responsibility for the financing, construction, and maintenance of the solar and storage system over its life-time. (CMLP will retain operational control of the storage system).
- CMS: Any portion of the project that is behind-the-meter is the responsibility of the CMS.

***Appendix I*: Determination of Applicability of DOE's Common Zero Energy Definition**

Introduction:

The purpose of this discussion is to illuminate the definitional aspects of net zero buildings and to determine how these definitions apply to the CMS Project. Our objective is to minimize potential ambiguities in our approach to the question of *'Are we net zero'* and to determine if we will be in a position to claim this status, if we implement one or more of the scenarios outlined below. And, the answer to this question is 'yes', the project as defined herein would be considered Zero Energy or ZEB under DOE's definition.

Background:

'A zero-energy building (ZEB) produces enough renewable energy to meet its own annual energy consumption requirements, thereby reducing the use of non-renewable energy in the building sector. ZEBs use all cost-effective measures to reduce energy usage through energy efficiency and include renewable energy systems that produce enough energy to meet remaining energy needs.'

Zero Energy Building (ZEB) and Measurement and Implementation Guidelines:

- Energy accounting and measurements: A ZEB is typically a grid-connected *building* that is very *energy* efficient. ZEB *energy* accounting would include *energy* used for heating, cooling, ventilation, domestic hot water (DHW), indoor and outdoor lighting, plug loads, process *energy* and transportation within the *building*. *Delivered energy* to the *building* includes grid electricity, as well as non-renewable fuels. A ZEB balances its energy use so that the *exported energy* to the grid is equal to or greater than the *delivered energy* to the building on an annual basis.
- *A ZEB* may only use *on-site renewable energy* in offsetting *delivered energy. On-site renewable energy* is *energy* produced from *renewable energy* sources within the *site boundary.*
- Source energy calculations: *Source energy* factors make it possible to account for a situation where different energy or fuel types are being used in a single site, for example, both natural gas and electricity. Given that the DOE conversion factor for imported electricity is the same as the factor for exported electricity, in a situation where a building is all-electric and no other fuels are used to support the energy requirements of the building, we do not need to use a source-energy based formula. Rather, the formula requires simply matching energy generated on-site with energy consumed on- site.
- 100% ZEB: On-site consumed electricity = on-site generated electricity over the course of a year.

Using Renewable Energy Certificates (RECs):

Renewable Energy Certificates (RECs) are tradable instruments that can be used to meet voluntary *renewable energy* targets. Energy users can meet voluntary *renewable energy* goals and support the deployment of green power through the purchase of RECs. RECs are a credible and easy means to keep track of who can claim the environmental attributes of renewable electricity generation on the grid. Once a buyer makes an environmental claim based on a REC, the buyer can no longer sell the REC and the REC is considered permanently "retired".

The ZEB definition requires that *on-site renewable energy* to be used to fully offset the actual *annual delivered energy* and requires the RECs to be retained or retired. The definitions do not allow *renewable electricity* purchased through the use of *renewable energy certificates* (RECs) to be used in the ZEB *energy* accounting.

Concord Middle School Scenarios:

The two basic configuration and business scenarios for ZEB for the CMS project approaches meet the DOE definitional requirements to enable us to consider them to be bonafide ZEB's. These options are described above under *'Possible Scenarios for Interconnect and Power Purchase Agreement'*. These options also conform if both are implemented on the same site.

In both cases, RECs need to be retired commensurate with the amount of renewable energy generated on the CMS site. In the case of the behind the meter generation scenario (Option B), RECs will be delivered to the CMS for the kilowatt hours generated and the CMS will need to retire these RECs. In the case of the kilowatt hours generated by the CMLP via direct connect to the grid (Option A), the CMLP will need to purchase sufficient REC's to claim the green attributes for Concord.

***Appendix II*: Preliminary CMS Net Zero-Ready Requirements:**

- SMMA's building design optimizes for solar to the extent possible:
    - Roof form (flat or within 30 degrees of south for sloped roof)
    - Maximize roof area (minimize rooftop equipment and penetrations)
    - Minimize rooftop daylighting
    - Maximize roofing durability (30 years)
    - Avoid structures and objects that shade the panels
    - Provide install and maintenance accessibility to roof
    - Parking lot layout and orientation optimized for solar
- CMS construction includes (at CMS expense):
    - Panels and switch gear meet technical requirements to support interconnect to school
    - Roof meets structural requirements for support of rooftop array
    - Wiring chases from panels to roof

***Appendix III*: Preliminary estimates of project size (SMMA, May 22nd Feasibility Report):**

The CMS rooftop, including rooftop canopy area, and parking areas on the site should be close to sufficient to meet the estimated requirement for generation.

Area	Square feet
Flat roof	30,000
Canopy over equipment	25,000
Parking canopy	35,712
Total	90,712

Note. Additional ground mounted PV areas have not been included in the assessment at this time.