Clean Energy Extension

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To: Pioneer Valley Planning Commission, Develop Springfield
From: UMass Clean Energy Extension
Date: December 14, 2017
Re: Preliminary Analysis: Building Energy Loads and Solar PV Opportunity at the Proposed Mason Square Grocery Store

In August of 2017, staff from the Pioneer Valley Planning Commission (PVPC) and Develop Springfield requested assistance from UMass Clean Energy Extension (CEE) in estimating (1) projected building electric and heating/cooling loads, and (2) the potential for solar PV generation at the proposed Mason Square Grocery Store in Springfield, MA. The planned store is expected to have an area of approximately 40,000 square feet and a parking lot area of approximately 2 acres. Results from this initial analysis are presented below.

1. Building Energy Loads

According to a report published by the National Renewable Energy Laboratory titled "U.S. Department of Energy Commercial Reference Building Models of the National Building Stock", there are 16 building types that represent approximately 70% of the commercial buildings in the U.S.

Models were created based on this report for each of the 16 building types. The purpose of these models is to represent new and existing buildings. These reference building models are not intended to represent energy use in any particular building. Rather, they are hypothetical models with ideal operations that meet certain minimum requirements.

Thermal and electric loads for the Mason Square Grocery Store were developed based on methodologies presented in the aforementioned report, utilizing a model for a *Supermarket*. Site information such as building type, geographic location and square footage were used to customize a building model to best represent the proposed facility. **Table 1** and **Figures 1 – 5** below summarize the results of the analysis.

Note: As these building loads are based on hypothetical models with ideal operations they are only meant to serve as a basis for energy consumption for a building with a particular use case. As occupancy, building systems and use case may differ, the provided loads may also differ.

Table 1: Total electric usage and heating load

Month	Electric Consumption (kWh)	Heating Load (MMBtu)
Jan.	110,141	464
Feb.	99,526	379
March	112,462	293
April	115,541	197
May	125,965	96
June	137,097	30
July	153,277	16
Aug.	148,187	20
Sept.	132,382	47
Oct.	119,250	165
Nov.	112,916	279
Dec.	109,819	443
Total	**1,476,563**	**2,430**

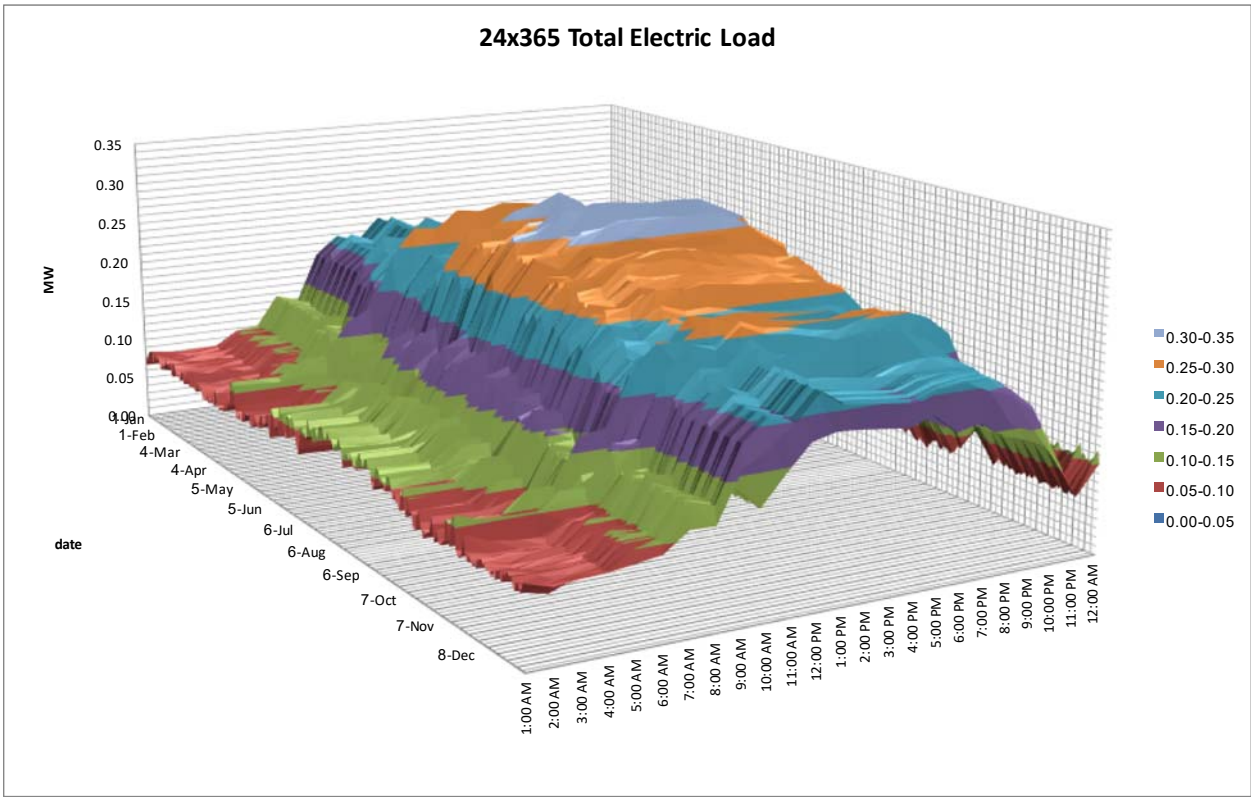

Figure 1: Total electric load

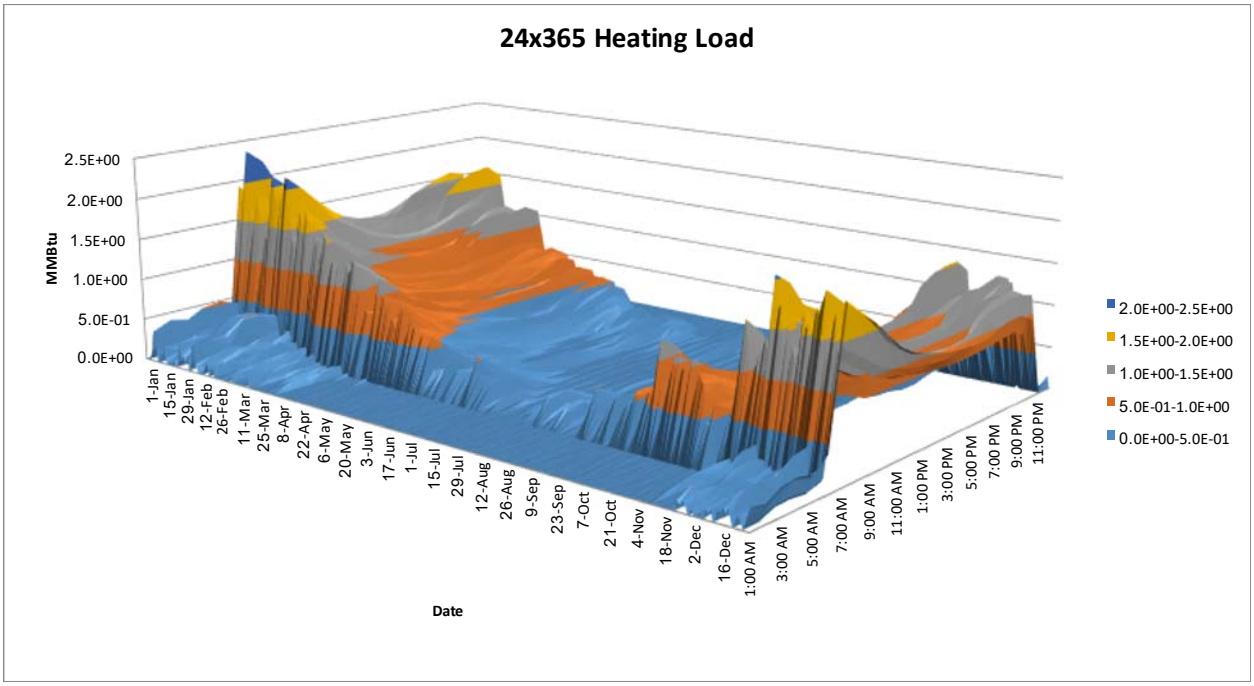

Figure 2: Heating load

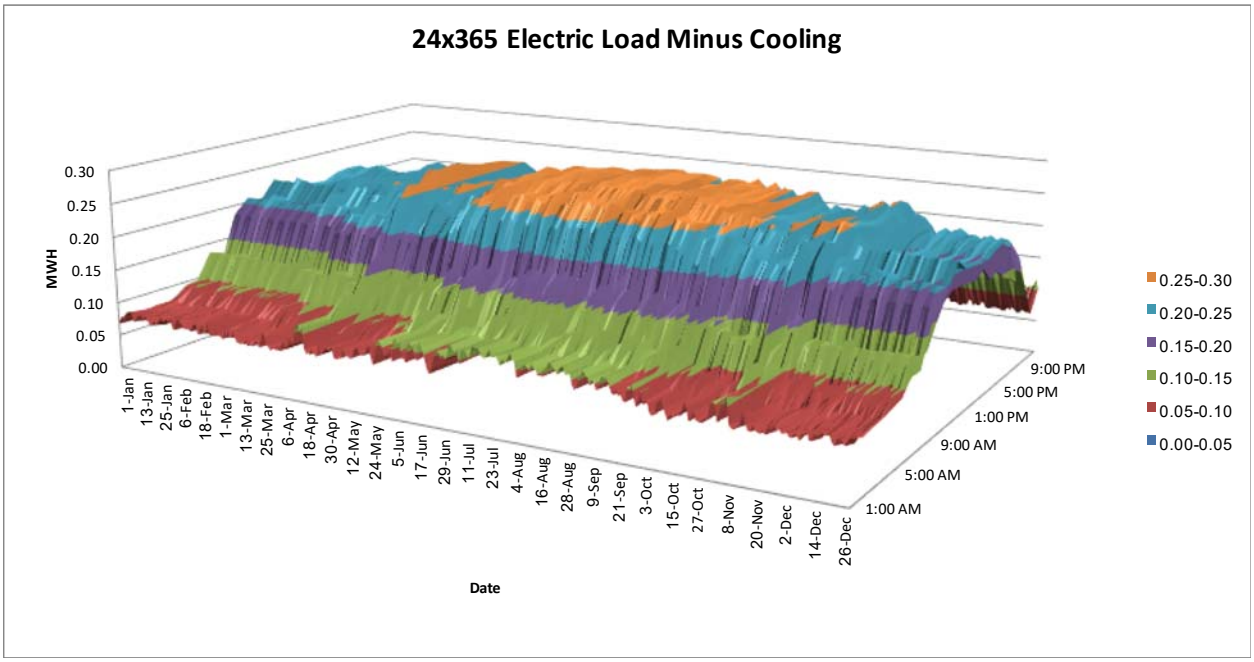

Figure 3: Electric load minus cooling

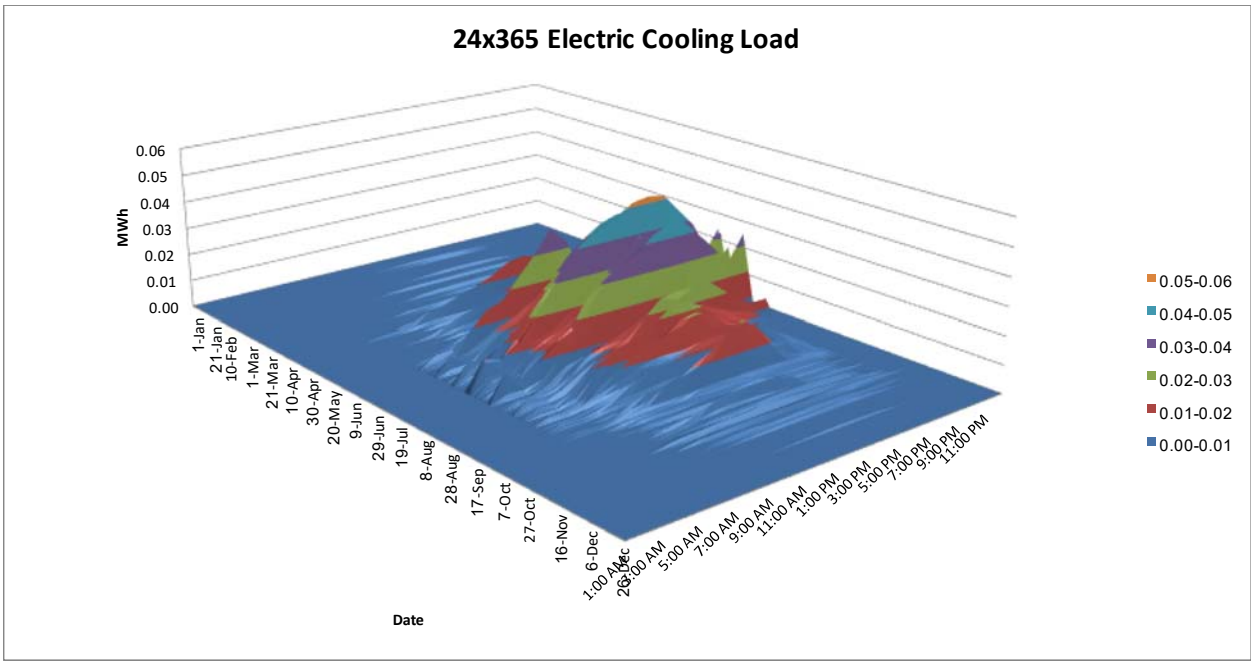

Figure 4: Electric cooling load

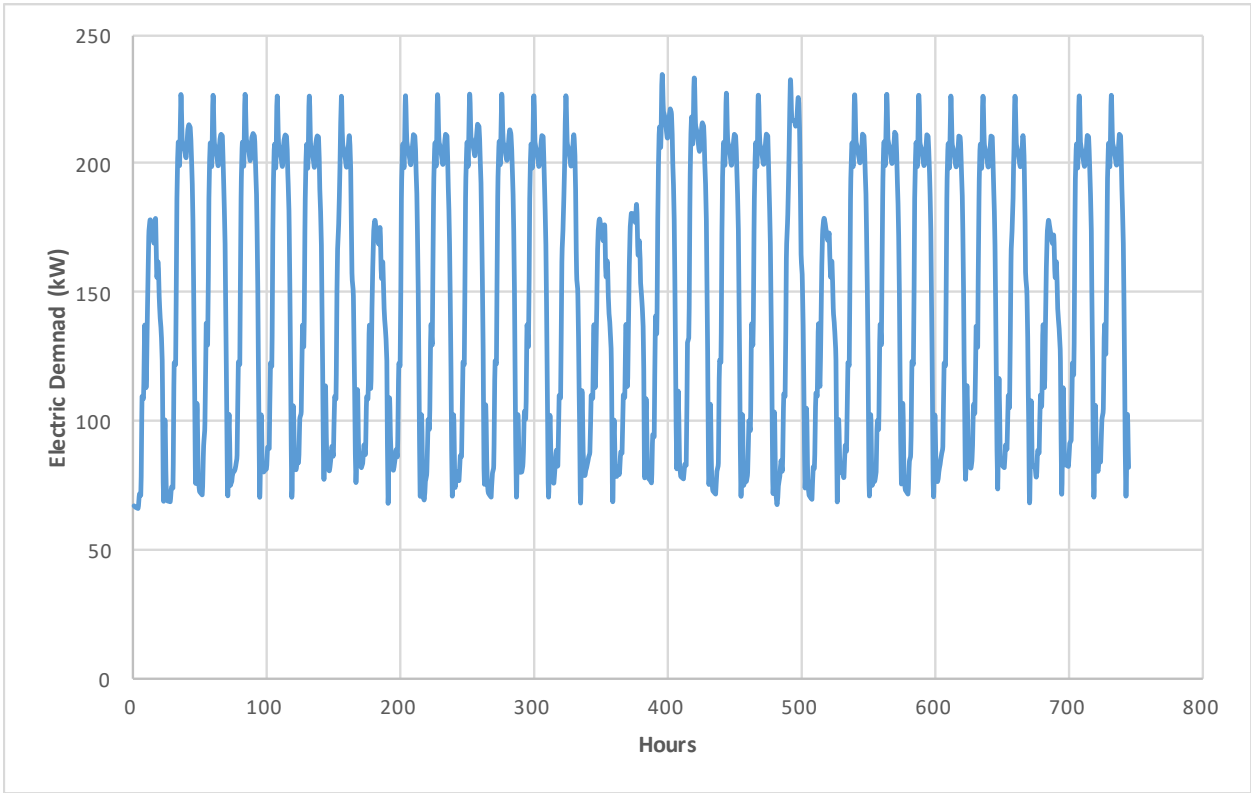

Figure 5: Hourly electric load for January

2. Solar PV System

CEE's initial estimates indicate that the Mason Square building site could accommodate an estimated 1-MW-scale solar PV system, depending on store rooftop design, parking lot configuration, and system design. A system of this scale could potentially be arranged as follows:

- 500-kW PV system array located on the rooftop of the 40,000 ft^2 facility; and
- 500-kW PV system parking canopy array located on approximately 2 acres of parking lot area.

Comparable store rooftop and parking canopy systems are illustrated in **Figures 6 and 7** below.

Figure 6: 363-kW rooftop system located on a Big Y grocery store in Lee, MA

Figure 7: 1,927-kW parking canopy system located on 4.6 acres of parking lot space at UMass Amherst

System modeling using National Renewable Energy Laboratory's PVWatts® Calculator (http://pvwatts.nrel.gov/) indicates that a 1-MW solar PV system at Springfield's latitude would generate approximately 1,171,791 kWh per year. This is approximately 80% of the estimated annual store electric load of 1,476,563 kWh, as described in Section 1 above. **Figure 8** below illustrates the typical monthly electric production from a PV system of this size.

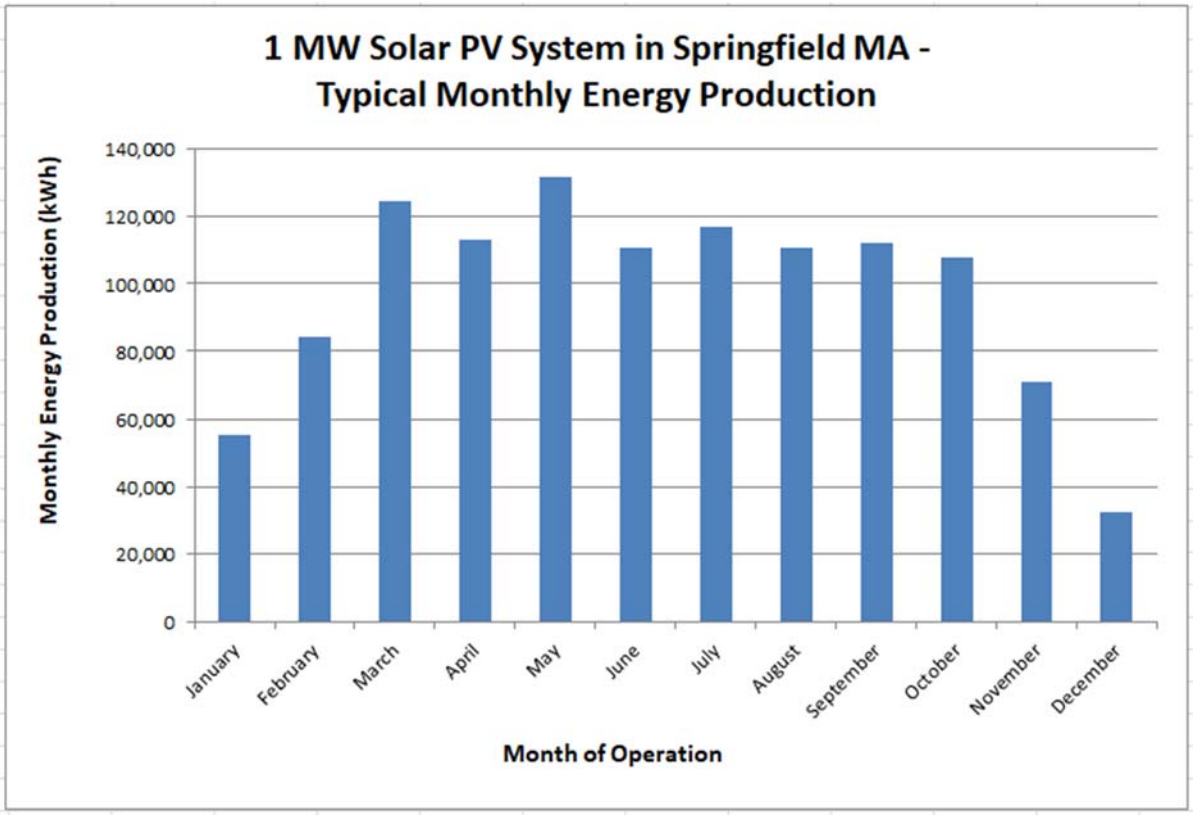

Figure 8: Typical monthly electric production from a 1-MW solar PV system in Springfield, MA

Installed costs for in solar in Massachusetts currently range from approximately $2.50 to $4.00/Watt, depending on system design and configuration. Parking canopy systems, for example, typically have higher installation costs than rooftop systems due to the additional infrastructure needed to support the panels. For a 1-MW system, installed costs will likely range from $2.5 - $4 million prior to any incentives.

When federal and state incentives are considered, installed costs can be significantly reduced. Additional information relating to incentives for solar PV photovoltaic systems can be found on the MassCEC website, http://www.masscec.com/solar-incentives-and-programs

In addition, the Massachusetts Department of Energy Resources is launching its new Solar Massachusetts Renewable Target (SMART) program (http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/development-of-the-next-solar-incentive.html) in 2018 to continue to advance the solar PV market in Massachusetts. This program will likely be an important incentive to consider for a solar PV system at Mason Square.

In addition to incentives, there are several options for financing commercial solar PV installations, including direct purchase, loans, power purchase agreements, and solar leasing. Additional information relating to incentives for solar PV systems can be found on the MassCEC website, http://www.masscec.com/solar-financing-options.

Solar PV installers experienced with commercial installations should be contacted for more detailed information regarding system design, pricing, and financing options.

3. Next Steps

CEE is grateful for the opportunity to assist PVPC and Develop Springfield as they consider the development of the Mason Square grocery store as a critical community resource. As a next step, CEE would be glad to further discuss the findings in this memo and other clean energy strategies of interest – and work with PVPC and its partners to develop a path forward for this important project. Please do not hesitate to contact us to schedule a follow-up meeting – or with any questions or comments regarding this analysis (413.545.8510, energyextension@umass.edu).