Date: Friday, October 09, 2015

To: Lauren Sinatra, Energy Coordinator; Town of Nantucket

From: Solar Technical Assistance Team

Subject: Benefits of Photovoltaics and Energy Storage to the Town of Nantucket and the Nantucket Electric Utility Rate Payers

Ms. Sinatra,

Thank you for your request to the Solar Technical Assistance Team (STAT). STAT is a project of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Solar Balance of System Costs subprogram, and it is implemented by the National Renewable Energy Laboratory (NREL). The purpose of STAT is to provide credible and timely information to inform policy or regulatory discussions around solar technology deployment.

Through the STAT Quick Response program, the Town of Nantucket (Town) requested assistance to evaluate the technical and economic viability of solar photovoltaics (PV) and battery energy storage to cost-effectively reduce the Island's peak electrical demand. This request was prompted by the recent collaboration between the Town of Nantucket Energy Office (NEO) and the electrical distribution company serving Nantucket, National Grid. National Grid is working with the NEO to develop a strategy and implement solutions to manage electrical demand to avoid or defer significant investment in transmission and distribution system upgrades. In response, NREL did the following: 1) reviewed material provided by the NEO regarding the issue of the Nantucket peak electric demand as well as a recently terminated PV project proposed for the Nantucket Memorial Airport as part of the externally-funded "Carbon Neutral Airport Program," 2) conducted an analysis to evaluate the economic viability of PV on Nantucket, and 3) evaluated the technical potential of PV and battery energy storage to reduce the Island's peak demand. National Grid is evaluating a variety of options to address the Island's growing electrical demand to ensure reliable electrical service, but this response focuses on PV and battery energy storage.

Several NREL staff members contributed to the development of this document, including Dan Olis, Tim Tetreault, Kari Burman, Erin Nobler, Sam Booth, and Kate Anderson.

Background

The island County of Nantucket, MA, is located approximately30 miles off the southern coast of Cape Cod, MA. The population of Nantucket varies dramatically throughout the year, with about 10,500 year-round residents; an influx of tourists and seasonal residents during the summer months causes a surge in the population to over 50,000.[1] With this influx comes an increase in electricity demand, which in recent years has pushed the limits of the existing electrical infrastructure. The Island's electricity is supplied by two undersea cables owned and operated by the National Grid utility, funded by a monthly "Cable Facility Surcharge," paid by all Nantucket ratepayers. Figure 1 shows an illustration of the undersea cables serving Nantucket. Cable 1 and Cable 2 have rated capacities of 38 and 36 megawatts (MW), respectively. Each cable serves about half of the electric demand under normal operating conditions. In addition to the two undersea cables, National Grid owns and operates two 3-MW diesel generators at its Bunker Road facility on Nantucket to serve as backup in the event that one of the cables is compromised. If one of the undersea cables were to fail during the peak electric load in the summer months, the other cable would be unable to serve the entire Island's load; the on-Island generators and emergency roll-on generators would be used to compensate for the lost capacity.

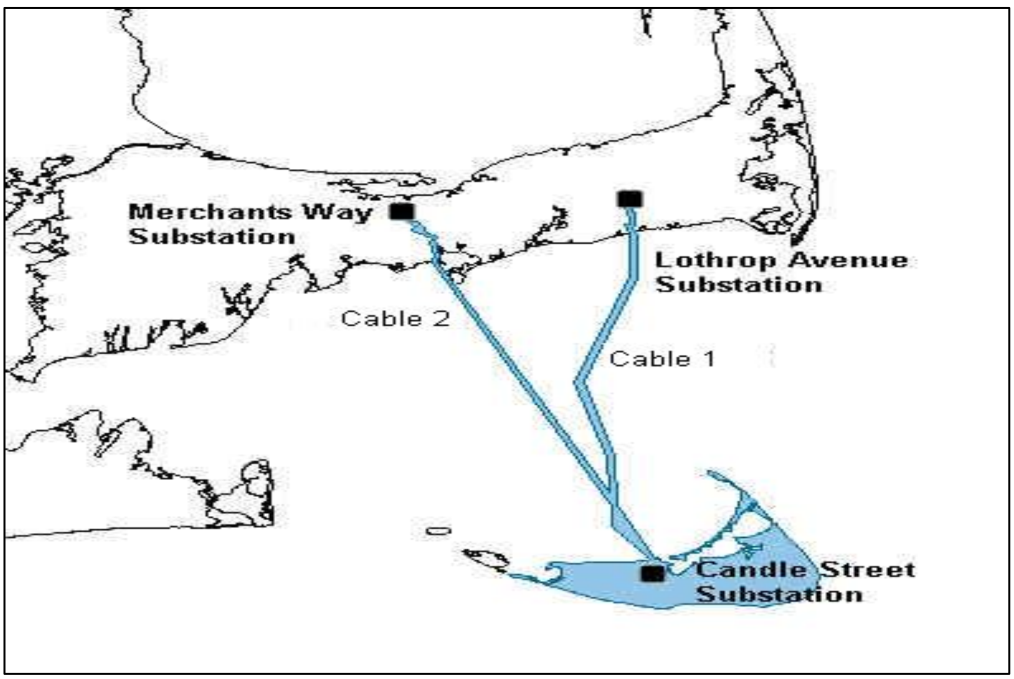

Figure 1. Undersea cables serving Nantucket.
Source: National Grid Energy Forum presentation, September 22, 2014.

In the summer of 2013, Nantucket's electrical demand hit an all-time high—45 MW[2]—a 12.5% increase from the previous record high in the summer of 2012. Nantucket has experienced high electrical load growth in recent years and is expected to continue this trend over the next 15

[1] "Nantucket," Wikipedia, accessed September, 15, 2015, https://en.wikipedia.org/wiki/Nantucket
[2] Early reports of the 2015 peak demand indicate a slight increase over the previous all-time high from in 2013.

years, according to National Grid projections.[3] Table 1 shows the historical and forecasted electrical load growth for Nantucket.

Table 1. Historical and Forecasted Annual Electric Load Growth

Annual Growth	Nantucket (%)	State (%)
Historical 5-Year Average	3.6	0.6
5-Year Forecast	3.2	1.1
15-Year Forecast	2.2	0.8

In Figure 2, the forecasted load growth is shown in terms of peak demand relative to the capacity of the undersea cable and existing generation. The figure is taken from National Grid's presentation cited earlier. The peak demand in 2013 reached the capacity of Cable #1 plus the existing 6 MW of on-Island generation capacity. The current contingency plan in the event of a cable failure is to increase the on-Island generation via roll-on generators. National Grid's forecasted load growth shows a steady increase in peak demand, which requires that additional roll-on generation capacity be available in the event of a cable failure during the summer months of peak demand. National Grid's current contingency plan is to use the existing generators plus up to six additional roll-on generators at the Bunker Road facility and six at the Candle Street substation.

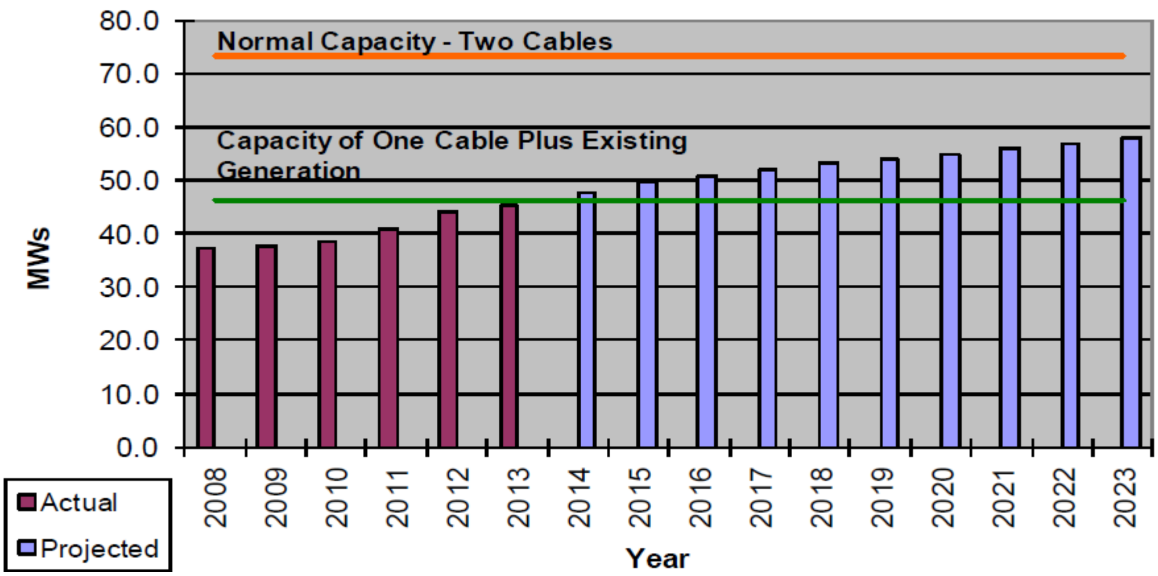

Figure 2. Nantucket Load – Cable #1 failure

Another load metric that National Grid monitors is the frequency and duration that the load exceeds the capacity of a single cable, referred to as the "contingency threshold"—the load

[3] Tim Roughan, Lindsay Foley, Emily Slack, "Working Together Toward a Sound Energy Future: Long Term Energy & Sustainability Planning on Nantucket," Presentation by National Grid to the Nantucket Energy Office, September, 2014.

above which the existing contingency plan would be deployed if one of the cables failed. The calculation assumes that the larger-capacity cable fails, and therefore, the limit of the contingency threshold is 36 MW, which is the capacity of the smaller cable. Figure 3 shows the number of hours that the peak demand is above the contingency threshold, by hour of the day, from 2008 through 2013. This chart recreates a chart from the National Grid presentation to the Town of Nantucket cited earlier and shows the Island's electric demand growth—both in the total number of hours above the contingency threshold and in the hours of the day that the threshold is exceeded. In 2008, the threshold was exceeded for 3 hours only during the hours of 7 pm and 8 pm. In 2013, the threshold was exceeded for 249 hours in total and also during more hours of the day, from 10 am to midnight.

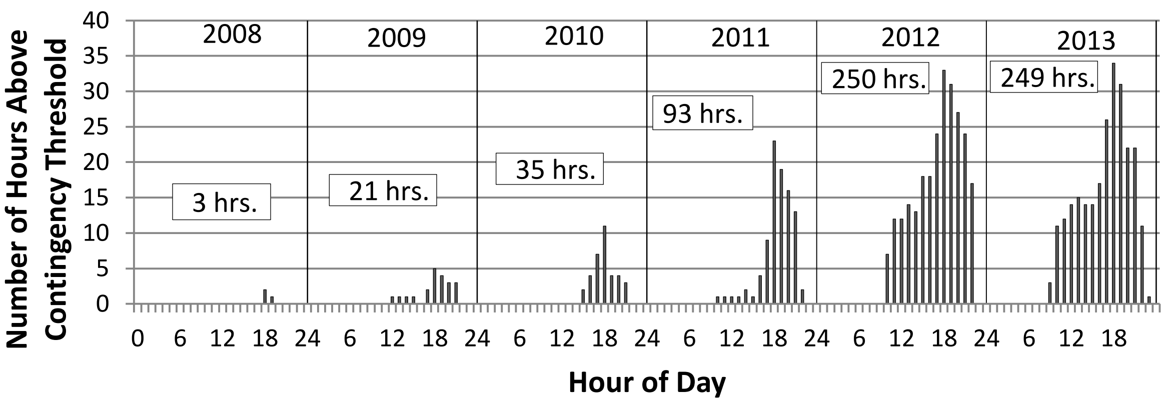

Figure 3. Number of hours above contingency threshold by hour by year

The current and forecasted load profile for Nantucket poses challenges for National Grid to maintain a sufficient level of reliability. The primary concern is maintaining service in the event of a supply cable failure. Although a cable failure is an unlikely event, it is one for which National Grid needs to maintain a contingency plan that will minimize disturbances to its electric service. National Grid and the NEO are working to develop solutions to cost-effectively manage the load growth so as to avoid or defer the costly investment in a third undersea supply cable. National Grid is conducting ongoing analysis to evaluate the impact of current and planned initiatives that will, in turn, inform their long-term planning related to the need and timing of a third cable. Energy efficiency is a main component of the strategy, with additional considerations including renewable energy, grid modernization, load management, additional on-Island diesel generation, rate structures, battery storage, thermal storage, and user-owned generation.

This memo includes an analysis of the economic viability of PV for the Town of Nantucket and evaluation of the technical potential of PV and battery energy storage to reduce the Island's peak demand. National Grid is evaluating a variety of options to address the Island's growing electrical demand to ensure reliable electrical service. However, this technical assistance only focuses on how PV and battery energy storage contribute to the multipronged strategy.

Question One: Is PV Economically Viable on Nantucket?

Regardless of the potential benefit of PV on the Island's peak demand issue, PV is an established technology that is broadly deployed throughout the U.S. and internationally. The state of Massachusetts has one of the more aggressive PV goals within the U.S.—to integrate 1,600 MW of PV by 2020. Accordingly, a combination of incentives exists to encourage development of PV projects throughout the State.

The net-metering rules in Massachusetts limit total installed capacity on a given system to some fraction of the utility's peak load. There are different total installed capacity net-metering limits for "private" and "public" customers. For Nantucket, the total installed capacity allowed for the Town under the public customer category is 2.273 MW. The Town currently has a 0.1-MW (100-kW) wind turbine installed at the Nantucket high school, so the Town could install up to 2.173 MW (2173 kW) of additional net-metering facilities.

The net-metering policy in Massachusetts allows utility customers to install a system that generates more electricity than can be consumed at the site and assign excess generation to other meters not located at the facility. This would allow the town to install a system that is larger than the load at a location if Nantucket has a desire for a larger system and the facility has the space to host it.

In addition to net metering, Massachusetts also has a solar renewable energy credit (SREC) incentive that creates a market for SRECs generated. This market allows PV system owners to sell renewable energy credits generated by their system to make projects more economically attractive. Massachusetts' SREC program, currently call SRECII, is described in detail at this link: http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/. The program defines four project categories (Market Sector A, B, C and Managed Growth) based on several factors including installation type (ground-mount, rooftop, or carport), site (landfill or brownfield), on-site load, and system size. Each category is assigned an SREC factor to apply to the sale price of the SRECs generated by the project.

Based on a review of the criteria for SREC II price-factor eligibility, for this economic analysis, we assume the system will qualify for Massachusetts' SREC II Market Sector B incentive with a 0.9 SREC factor. We based this determination on the assumption that the Town has one or more sites with available land to host a PV array and on-site electrical demand is equal to at least 67% of the PV system output on an annual basis. Otherwise, to qualify for the SREC II program, projects would either need to be developed as a Community Shared Solar (CSS) program; have a capacity of less than 650kW; or qualify as part of the Mass DOER's Managed Growth program.

Based on its high on-site electrical demand, one potential Town facility to host a PV project is the Surfside wastewater treatment plant (WWTP). A recent WWTP utility bill shows that the electricity consumption at the facility was 2,360 MWh for the 12-month period from September of 2014 through August of 2015. We assumed that 1 MW_{DC} of PV will generate 1,225 MWh of electricity in its first year of operation (estimated using NREL's PVWatts tool and Nantucket Memorial Airport weather file). After applying the 67% rule, a 2.87-MW_{DC} system could be installed at the facility and still qualify for SRECII as Market Sector B. Because this exceeds the available capacity of the net-metering limit, the system size at the treatment plant is capped at

2.17 MW. This would produce about 2,658 MWh in the first year and about 89% would be consumed by the WWTP facility and the rest would be credited to other Town of Nantucket electricity bills. If there is insufficient land to host a large PV array at the WWTP, the Town could consider a project that combines smaller PV systems developed on multiple Town properties. This approach could benefit from economy of scale and efficiency of effort by conducting a single procurement for multiple PV systems while maximizing the incentives from the SREC II program. A review of satellite images and information provided by the NEO indicate land area may be available for PV development at the Airport, landfill and water company property.

The cost-benefit analysis assumes that the Town of Nantucket would procure PV-generated electricity through a power purchase agreement (PPA) with an independent power producer (IPP), rather than the Town owning and operating the system itself. Contractual agreements such as these are common and preferred by some people for the following reasons:

- The beneficiary, or off-taker of the system, does not need to make a large capital outlay as investment.
- System performance and SREC price risk is on the IPP, the system owner, not the off-taker, which, in this case, is the Town of Nantucket.
- Operations and maintenance are the responsibility of the owner and the owner is motivated to maximize system performance to maximize revenue of electricity sales.
- Third-party ownership allows the PV project to take advantage of tax deductions and tax credits that the town would not be able to take if Nantucket were the system owner. The investment tax credit (ITC) is 30% of capital costs for projects with commercial operation dates by December, 31 2016. After this date, the ITC drops to 10%.

The cost-benefit analysis for the Town of Nantucket was done in two parts:

1. The project is evaluated from the IPP's perspective to estimate the price that the IPP needs to charge Nantucket for the electricity produced by the system so that the IPP is able to recover all costs of ownership as well as earn a return on investment over term of the power purchasing contract.
2. The project is evaluated from the Town of Nantucket's point of view. Given the price of electricity that the IPP needs to charge for the project, is it a "good deal" for Nantucket? That is, will Nantucket save money by buying some of its electricity from an IPP that owns a PV system on Nantucket?

PPA contracts are typically 20 to 25 years. This analysis assumes that the PPA has a 25-year term and the IPP earns 8% on the project, which is a reasonable return for these types of projects. The analysis also assumes that the IPP monetizes the SRECs. Further, it assumes that the Town of Nantucket does not charge the IPP for use of the land that the system would occupy. If there were land lease costs, they would be recovered by the developer in the PPA price, inflating the cost of energy to Nantucket.

The analysis projects a PPA price in the range of $0.103/kWh to $0.135/kWh, with no cost escalator over the 25-year term. The analysis assumes an installed cost of $\$2.55/W_{DC}$, which is conservative for large utility-scale projects on the U.S. mainland. Cost adders for working on Nantucket were not specifically estimated and modeled. Instead, we assumed a less aggressive (i.e., less optimistic) cost for the system.

The key assumptions for estimating the PPA price are as follows:[4]

- Production model: PVWatts
- PV nameplate capacity: 2200 kW_{DC}
- Inverter: 2000 kW capacity, 96% efficiency
- Array type: ground-mount, fixed orientation, facing due south, 20-degree tilt
- System losses: 14%
- Annual performance degradation rate: 0.5%/year
- Weather file: Nantucket Memorial Airport (TMY3)
- 25-year term
- Weighted Average Cost of Capital (WACC): 8%
- Installed cost: $2.55/$W_{DC}$
- Operations and maintenance (O&M): $20/$kW_{DC}$/year with 2.5%/year inflation rate
- No-cost land lease between the Town of Nantucket and the IPP
- Federal tax rate: 28%
- Sales tax: 5%
- Insurance rate: 0.5%/year
- Property tax rate: 2%/year of assessed value
- Federal depreciation: 5-year modified accelerated cost-recovery system (MACRS)
- State depreciation: 5-year MACRS
- Investment tax credit (ITC): 10% (if installed after end of 2016), 30% (if installed before end of 2016). Results are presented with both ITC values to show the impact on the projected PPA rate.
- SREC: $0.1935/kWh for 5 years
- SREC program: Massachusetts RPS Solar Carve-Out II program. Assumes that the project earns 90% SREC value based on SREC II Market Sector B category. Eligibility based on ground-mounted system with greater than 67% on-site consumption (http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/solar/rps-solar-carve-out-2/about-solar-carve-out-ii.html)
- SREC price estimate per the following reference for 2017: http://www.srectrade.com/blog/wp-content/uploads/2015/04/2015_04_02_SRECTrade_SREC_Markets.jpg

The second part of the analysis estimates what the net impact of the PPA is on the Town of Nantucket's operating costs for electricity. Current costs of electricity delivered by National Grid were taken from a utility bill provided by Nantucket for the Town's Surfside waste-water treatment plant. Utility-purchased electricity costs are assumed to increase 1% per year over the 25-year analysis period, slightly above the 0.8% rate projected by the U.S. Energy Information

[4] The techno-economic analysis was done using NREL's System Advisor Model (SAM). Documentation on the model and resources for SAM are provided here: https://sam.nrel.gov/

Agency for New England. Cost escalation rates are difficult to predict, but the value was rounded to the nearest whole value because costs on Nantucket may rise at a faster rate due to the utility's needs to address capacity issues described earlier in this report.

The results are shown in Table 2. The analysis shows that for the projected PPA price range of $0.103 to $0.135/kWh, the Town of Nantucket would save between $32,000 and $118,000 per year on total electricity costs (utility costs net PPA costs). Over the assumed 25-year contract term, the Town would save about $1 million to $2 million in present-value terms assuming a 5% discount rate.

Table 2. PV PPA Cost-Benefit Analysis

PPA price case	Low (30% ITC)	High (10% ITC)
PPA rate	$0.103/kWh	$0.135/kWh
Purchased PV electricity, Year 1	2,695,438 kWh	
Avoided utility costs, Year 1	$395,434	
PPA expenditures, Year 1	$277,630	$363,884
Utility savings, Year 1	$117,804	$31,550
Net-present value over 25 years	$2,112,000	$952,590

The assumptions in the cost-benefit analysis are as follows:

- PPA price escalation rate: 0% per year (no annual escalation rate)
- PPA term: 25 years
- Discount rate: 5% nominal
- Electric utility rate tariff: National Grid Time-of-Use G3
- Utility electricity costs: $0.149/kWh on-peak, $0.142/kWh off-peak
- On-peak hours: Weekdays, 8 am to 9 pm
- Demand charges not considered
- Utility cost escalation rate: 1%/year
- Net metering: Yes. Site load is at least 67% of total PV system annual production (policy requirement)

The analysis shows that the price of electricity from a third-party-owned PV project is expected to be below the current and forecasted price of utility-provided electricity for the Town. Additionally, the analysis shows that the impact of the ITC reduction from 30% to 10% equates to an increase of about $0.03/kWh in the price of electricity from a third-party-owned PV project.

Question Two: How Would PV and Battery Energy Storage Contribute to the Reduction of Nantucket's Peak Demand?

To answer this question, we collected and analyzed hourly electrical demand data for the Island and established a baseline load profile for 2013. From the baseline, we developed a projected load profile for 2028 based on National Grid's 15-year forecasted annual load growth rate for the Island of 2.2%. The projected nominal load profile for 2028 was generated by assuming a 2.2%

annual growth rate applied equally to each hour of the day. We developed a model using the SAM tool and conducted scenario analyses to calculate the Island's projected electric demand assuming the integration of large-scale PV and battery energy storage. The projected nominal load profile for 2028 was compared to the modeled load profile with PV and battery energy storage to illustrate the relative impact of these technologies on the Island's peak electricity demand.

Load Profile

The Island's load profile is characterized by dramatic daily and seasonal fluctuations. Figure 4 shows Nantucket's average daily load profile and peak demand by month for 2013. July and August show a significant increase in demand that coincides with the influx of summer travelers and seasonal residents. The contingency threshold is exceeded in July and August, with peak demand of about 43 MW and 37 MW, respectively.

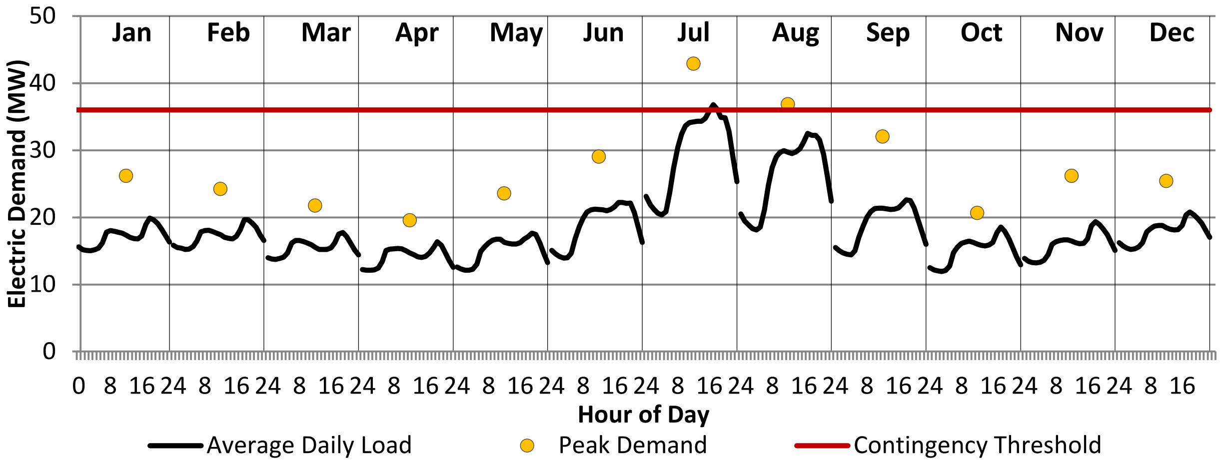

Figure 4. 2013 average daily load profile and peak demand by month

In addition to the dramatic increase in load between months, the summer months show a dramatic increase in the fluctuation in the daily average minimum and maximum demand. The difference between the average minimum and average maximum demand for March is about 4 MW, but about 16.5 MW for July.

As described above, the projected load profile for 2028 was generated using National Grid's annual load growth rates for the next 15 years. Figure 5 shows the projected average daily load profile and peak demand by month for 2028. This forecast shows that the peak demand (yellow dots in the figure) is predicted to exceed the contingency threshold in January, June, July, August, September, November, and December.

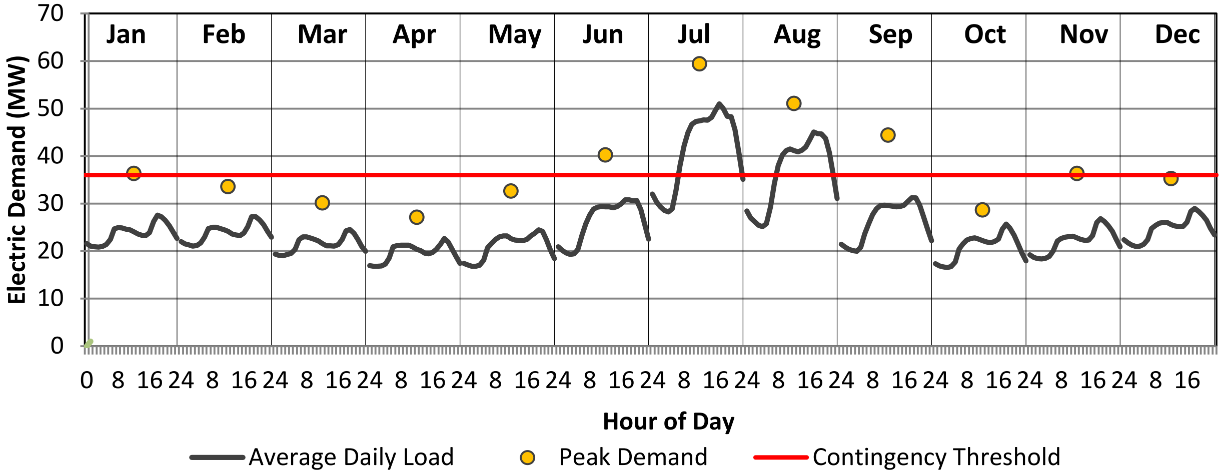

Figure 5. 2028 Average daily load profile and peak demand by month

Impact of PV on Island's Peak Demand

For this analysis, we selected a 10-MW_{DC} PV system to demonstrate the impact of large-scale PV on the Island's load profile and peak demand. It is possible that the Nantucket electrical system could accommodate more PV, but we selected 10 MW as a reasonable system size to illustrate the contribution of PV on peak demand reduction. (System impact studies would be needed to determine if, in fact, the power system could accept 10 MW of PV, or what system upgrades might be necessary to ensure that power reliability and quality are not adversely impacted.) Figure 6 shows the impact of 10 MW of PV on the forecasted 2028 average daily load and peak demand. The area between the solid lines and dotted lines is the average daily electricity (MWh) provided by PV. The 10 MW of PV provides a noticeable portion of the Island's total electricity. Over the course of a year, 10 MW of PV generates about 12,500 MWh, which is nearly 8% of the Island's projected electricity use in 2028. However, the peak electricity demand is virtually unaffected by the PV system. There is a slight reduction in peak demand in May, June, July, and September; but even these reductions are insignificant relative to the magnitude of the demand reductions necessary to avoid additional contingency capacity. PV has little impact on the peak demand because the peak PV output occurs between the hours of 6 am and 4 pm, whereas the peak electricity demand in the summer months occurs between 4 pm and 8 pm. Additionally, even if the PV output and peak demand were coincident, the PV system output depends on weather, which is inherently volatile due to the impacts of passing clouds. As a result, PV systems alone cannot be relied on to reduce peak demand on a regular basis. However, PV combined with battery storage can provide power that can be dispatched as needed to reduce peak demand.

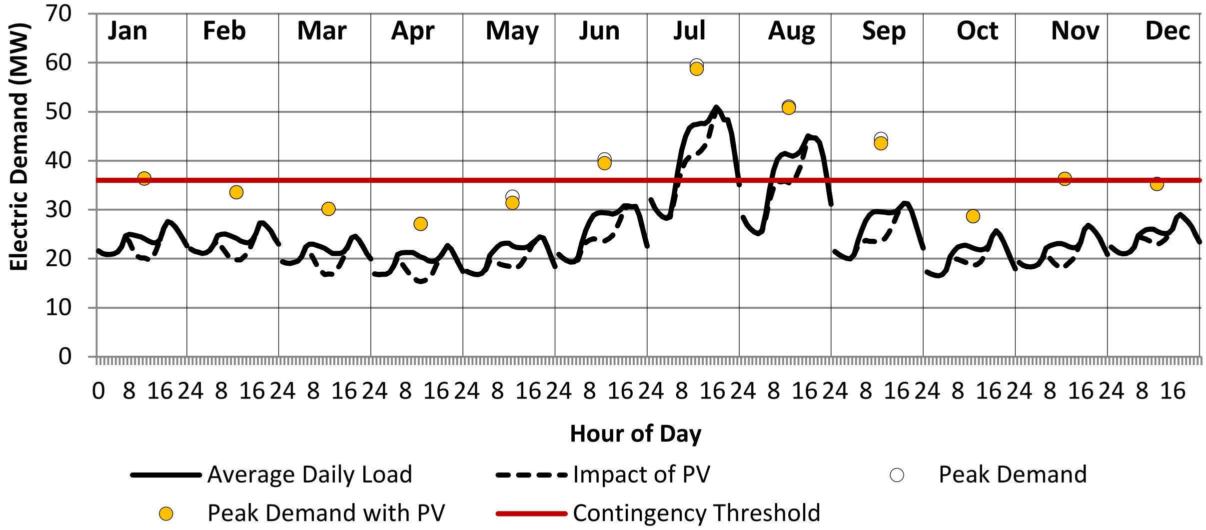

Figure 6. Impact of 10 MW PV on the Island's projected load profile and peak demand in Year 2028

Impact of PV and Battery Energy Storage on Island's Peak Demand

Battery energy storage technology and application for utility-scale demand reduction and bulk energy storage is an area of active research and development. Hawaii and California are pioneering the integration of battery energy storage at the utility transmission and distribution level. A recently announced project[5] in Kauai, HI, combines a 52 MWh battery with a 13-MW PV array to allow the power to be dispatched to coincide with the utility's peak demand during the evening hours from 5 pm to 10 pm. The Kauai Island Utility Cooperative will purchase the power through a 20-year contract for 14.5 cents/kWh. It is expected that technology and economic performance for utility-scale projects such as this will become better understood in the near future with potential application to the Nantucket peak demand issue.

Overview of Battery Technology

A number of different types of battery chemistries are appropriate for utility bulk-energy applications, such as: 1) advanced flow batteries, 2) lead-acid batteries, 3) lithium-ion (Li-ion) batteries, and 4) sodium sulfur (NaS) batteries. The performance of the different battery technologies are generally measured by power capacity (kW), energy density (kWh/kg), lifetime cycles, efficiency, and safety. The performance varies greatly between technologies and affects longevity of the batteries, safety, and cost. For example, the properties of flow batteries are suited for bulk storage because they are safe, easy to scale up, and have a long cycle life. However, they are very large and thus have a very low energy density, as well as high maintenance costs associated with mechanical pumps. Lead-acid batteries are well established

[5] Gavin Bade, "Hawaii co-op, SolarCity ink deal for dispatchable power from solar-storage project," *UtilityDive*, September 10, 2015, http://www.utilitydive.com/news/hawaii-co-op-solarcity-ink-deal-for-dispatchable-power-from-solar-storage/405408/

and are a reliable, well-characterized technology able to withstand deep discharges at a relatively low cost. Lead-acid batteries have the disadvantage of having a low energy density and low number of cycle lives. Li-ion batteries are used where light weight and high energy density are of prime importance. They can withstand deep discharges and have long cycle lives.

By looking at trends on which battery technologies are being deployed, we can often determine the technology that is favored for the stationary energy-storage market. However, data for 2007–2013 from Navigant Research Energy Storage Tracker of installed battery projects show no clear winners.[6] The market appears to be shifting since the 2015 announcement by Tesla's CEO, Elon Musk, that Tesla will be using the high-energy Li-ion battery for its new utility backup battery at reduced cost.[7]

For this analysis, we selected a 50-MWh Li-ion battery system to demonstrate the combined impact of large-scale PV and battery energy storage on the Island's load profile and peak demand. The battery size was selected based simply on the scale of the forecasted peak demand issue. Figure 7 shows the impact of 10 MW of PV and 50 MWh of battery energy storage on the forecasted 2028 average daily load and peak demand. A simple charging/discharging strategy was used in the model whereby the battery was charged during hours where demand was lowest and discharged during hours of highest demand, taking into consideration the impacts on demand from the 10-MW PV array. For this analysis, we modeled the battery to charge from 11 pm to 10 am at a rate sufficient to achieve full charge and to discharge at a constant rate from 3 pm to 10 pm.

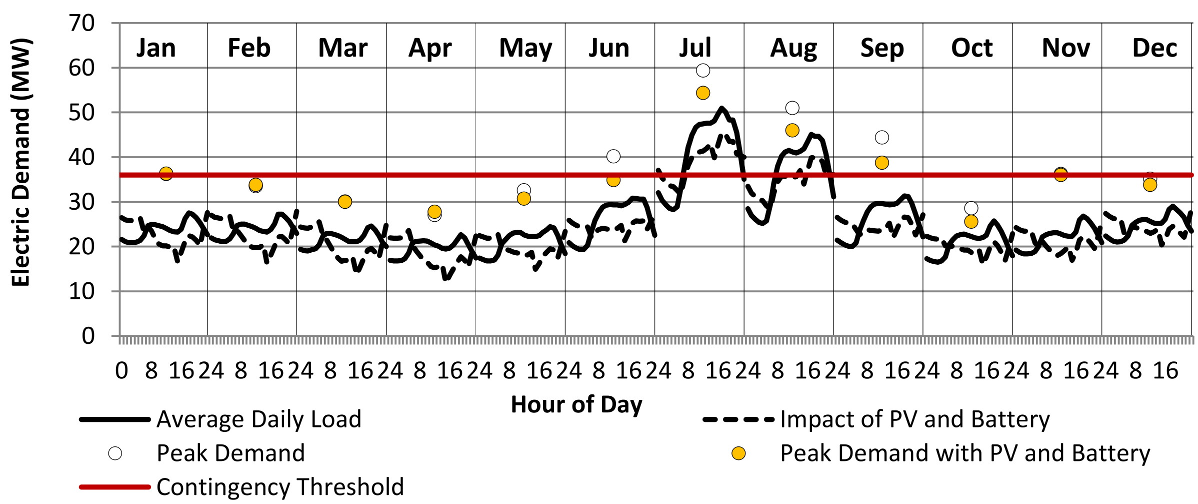

Figure 7. Impact of 10 MW PV and 50 MWh battery on the Island's projected load profile and peak demand in Year 2028

The dotted lines show the average daily load for the PV and battery scenario, and the solid lines show the projected 2028 business-as-usual average daily load. The addition of a 50-MWh battery significantly improved the peak demand reduction compared to the PV-only scenario,

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[6] Navigant Research Report, Energy Storage for the Grid and Ancillary Services, 2014

[7] http://fortune.com/2015/05/18/tesla-grid-batteries-chemistry/

with demand reduction of more than 5 MW for June, July, August, and September. With more sophisticated charge/discharge controls, it may be possible to reduce the peak demand further with a battery of this size. But these results provide a basic understanding of the demand reduction potential from large-scale PV and battery energy storage.

Conclusion – Next Steps

The growing demand for electricity on Nantucket is nearing the capacity of a single supply cable and is expected to exceed the contingency threshold in the coming years. Large-scale deployment of PV alone will not have a significant impact on Nantucket's peak electrical demand. However, PV combined with battery energy storage can contribute to a reduction in the peak demand. Additionally, a smaller-scale PV project could provide the Town of Nantucket with between $1 million and $2 million net present value of avoided utility costs.

The Town of Nantucket may want to consider a PV project through a PPA with an independent power producer due to the projected favorable economics. The most economically viable project would combine net metering with SREC II incentives. A possible configuration would include multiple project sites on Town property that are less than 650 kW, or where on-site electricity demand is equal to or greater than 67% of the PV array output. Otherwise, if targeting a remote, "Greenfield" site, a Community Shared Solar project may offer the Town the benefit of developing a larger site, eligible for SREC II incentives, for which it would subscribe to half of the system's output, with the other half for sale to local residents and businesses via net-metering credits, typically at discounted electric rates. This model may also serve as an attractive solution to the many island residents who wish for solar power, but cannot develop their own systems due to strict Historic District Commission (HDC) guidelines or limited available land or roof area.

Although large-scale PV and battery energy storage show technical promise for reducing peak demand, this analysis did not evaluate the business case. Another possible next-step that Nantucket might consider is for a more-detailed techno-economic analysis to be performed to determine the optimal amount of energy storage considering multiple value streams from peak reduction, demand response and power-quality services. The Town may also wish to pursue energy storage grants or demonstration pilot project opportunities, such as the *Energy Storage Initiative* (ESI) currently being investigated by the Massachusetts Department of Energy Resources (DOER) and the Massachusetts Clean Energy Center (MassCEC).