

Memorandum

To: Maggie Downey
From: Doug Hurley
CC: Max Chang
Date: October 5, 2011

Subject: Avoided Cost of Solar PV on Cape Cod

The Cape Light Compact and the Cape and Vineyard Electric Cooperative have installed 802 kilowatts (kW) and are in the process of permitting an additional 16.5 megawatts (MW) of solar photovoltaic (PV) systems on municipal property on both Cape Cod and Martha's Vineyard. They have plans already underway to increase this amount by up to an additional 68.6 MW of maximum output. Together, assuming the proposed PV projects are permitted and installed, the total maximum output would be 85.9 MW. In order to convey the benefits from the installation of these systems to residents of the Cape and Vineyard, the Cape Light Compact requested that Synapse calculate the avoided cost for Cape and Vineyard ratepayers attributable to the installation of these solar PV systems. Synapse has recently completed New England's 2011 Avoided Energy Supply Costs¹ (AESC 2011) report, and we are very familiar with the avoided costs from the installation of energy efficiency programs in New England. For the purposes of this analysis, we have assumed that solar PV systems will have the same effect as daytime (i.e., on peak) energy efficiency measures, and their avoided costs can be calculated in a similar manner.²

Components of Avoided Costs

There are many different components to consider when calculating the cost that one would have paid for electricity service had these PV systems not been installed. Even a quick glance at a monthly electric bill reveals separate charges for supply, distribution, transmission, transition, renewable energy and other charges. Even this list of charges is simplified greatly; in reality the "supply" charge on the typical monthly bill includes a number of different components that have all been collected together by your local utility

¹ The full report is available in PDF format at:
www.synapse-energy.com/Downloads/SynapseReport.2011-07.AESC.AESC-Study-2011.11-014.pdf

² Estimated project output data provided to us supports this assumption.

or energy supply company. The following sections detail the largest components of avoided costs included in this analysis.

Energy

Often the largest component, and the easiest to understand, is the energy portion. If a solar PV system produces 500 kilowatt-hours (kWh) of electricity during a particular month, then 500 kWh were not purchased from the electric grid. This benefit accrues directly to the owner of the system, or the entity that has contracted for its power output. Because this benefit accrues only to that one entity, we have not included it in the avoided costs results below.

Besides energy, there are a number of other components of avoided costs that, together, can equal the cost savings from the avoided energy purchases. These avoided costs accrue to all ratepayers on Cape Cod and Martha's Vineyard.

Infrastructure

In order to deliver power from central station power plants to homes and businesses reliably, the power company must build and maintain a very complicated network of high-voltage and low-voltage power lines, electrical substations, and equipment to connect these pieces together. Every electric customer pays for a portion of the cost to install and maintain this infrastructure. As we build more homes and businesses, and use more power, the electric grid continues to grow in size, and cost. Any action taken to reduce the need to deliver power from a central station power plant across the electric grid to a customer reduces this cost. Such actions can include installing energy efficient products, adding insulation, or installing on-site generation like solar PV.

Capacity

The next avoided cost component to consider is capacity. Central station power plants in New England are paid not just for the energy output they produce, but also for their capacity to produce output during hours where electric loads are very high, such as hot summer afternoons. Like infrastructure, every electric customer pays for a portion of the cost of the total amount of capacity needed to operate the New England electric grid. Any action taken to reduce the amount of one's electricity use during high load hours – for example, the afternoon of Friday, July 22nd of this year – reduces the amount of capacity that all electricity customers in New England must purchase.

Price Impact

The last of the major components of avoided costs is the price impact caused by reducing the amount of power drawn from the electric grid. Because all six of the New England states are closely electrically connected, we all purchase energy and capacity together, and we all purchase it at nearly the same price.

Like any other commodity purchased in a marketplace, if the amount of supply remains constant and the demand from purchasers drops, then the price for that commodity should drop accordingly. This is true with electricity, also. The wholesale cost of electric power is set at the cost of the most expensive central power station that the New England electric system needs to purchase. If we purchase less electricity from the grid, we avoid the need to purchase power from the most expensive power plants, and can purchase at a lower price. Thus, until the owners of power plants react to the change in demand (which takes several years) and/or ratepayers react to the change in price, the installation of solar PV systems that produce power will have an impact of reducing the price paid for electricity for all customers.

Carbon Dioxide

The installation of solar PV systems will also avoid the need to build or purchase energy produced from burning fossil fuels. The benefit from the displacement of fossil fuel generation translates into reduced carbon dioxide emission since less fossil fuel would be consumed to produce energy. The avoided carbon dioxide emissions associated with the installation of 16.5 MW of PV projects would be approximately equivalent to the carbon dioxide emissions from 2,058 vehicles per year.

We can also evaluate the dollar value of the avoided carbon dioxide emissions, in two ways. All six New England states are members of the Regional Greenhouse Gas Initiative, or RGGI, which requires power plant owners to purchase one allowance for each ton of carbon dioxide they emit from their smoke stacks. Reducing the need for fossil fuel power plants reduces this cost, which in turn reduces the costs in the energy market. The cost of carbon dioxide emission allowances is already included in our avoided cost of energy calculations.

But this is only the near term part of the story. As part of the AESC 2011 study, Synapse also estimated the longer term marginal cost of abating CO₂ emissions to achieve a long-term atmospheric level of CO₂ at 450 parts per million. This is the level that a consensus of climate scientists agree is necessary to avert the worst effects of global climate change. Synapse estimates this cost to be \$80/ton of CO₂ emitted.³ This cost has not been included in the figures here, but doing so would greatly increase the avoided cost numbers presented.

Results – 16.5 MW Scenario⁴

Based upon extensive modeling of the New England electric system performed during the development of the AESC 2011 report, Synapse calculate the estimated avoided costs of electric energy from the installation of 16.5 MW of solar PV systems on Cape Cod and

³ For a detailed description of this calculation and methodology, please see Section 6.6 of the AESC Study referenced in footnote 1.

⁴ All scenarios assume that PV systems have a kWh output weighted average 14.1% capacity factor and are located on Cape Cod or Martha's Vineyard. Results would be identical if systems were located anywhere in southeastern Massachusetts.

Martha's Vineyard. Figure 1, below shows the annual value of expected avoided cost savings from those components that accrues to all ratepayers.

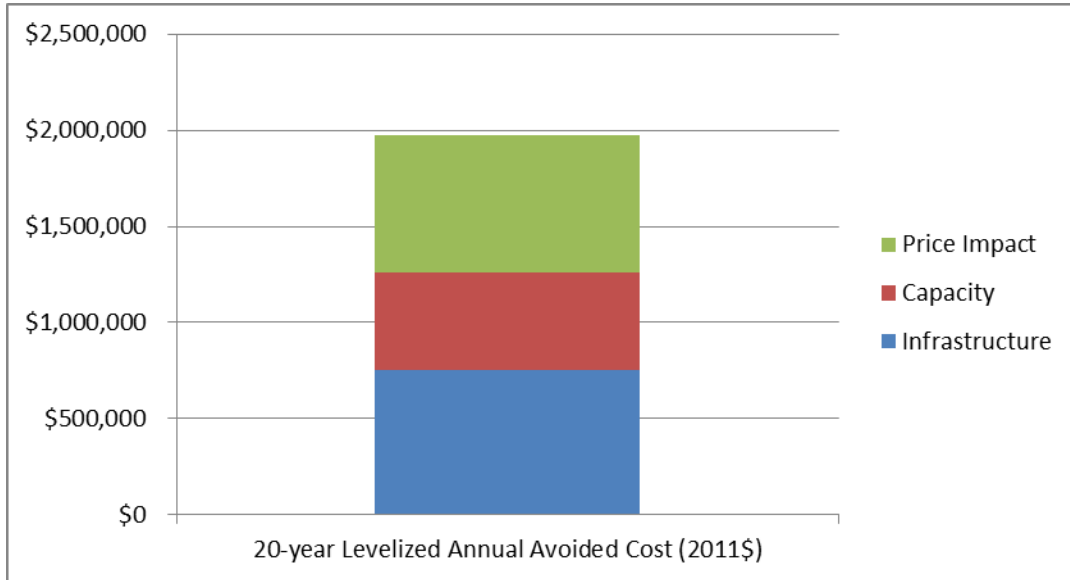


Figure 1. Annual Value of Avoided Costs from 16.5 MW of Solar PV Installations on Cape Cod and Martha's Vineyard

Over the 20-year contract term of these solar PV systems, the annual costs savings are expected to accumulate as shown in Figure 2, below.

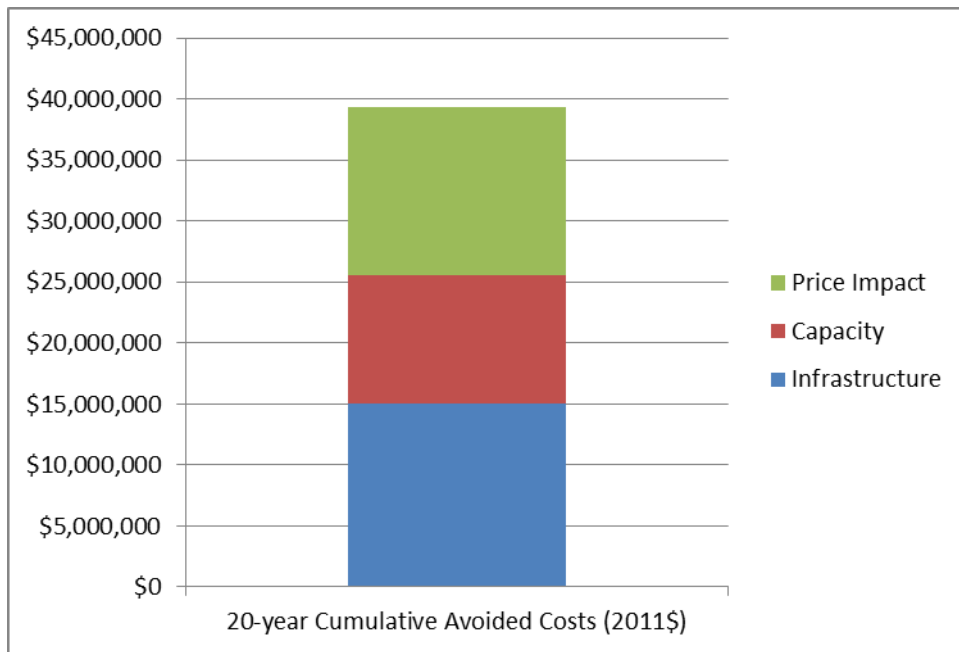


Figure 2. 20-year Cumulative Value of Avoided Costs from 16.5 MW of Solar PV Installations on Cape Cod and Martha's Vineyard

Results - 85.9 MW Scenario

Increasing the amount of installed solar PV systems to 85.9 MW, as planned, would increase the annual and cumulative avoided costs by the expected component values shown in Figures 3 and 4, below.

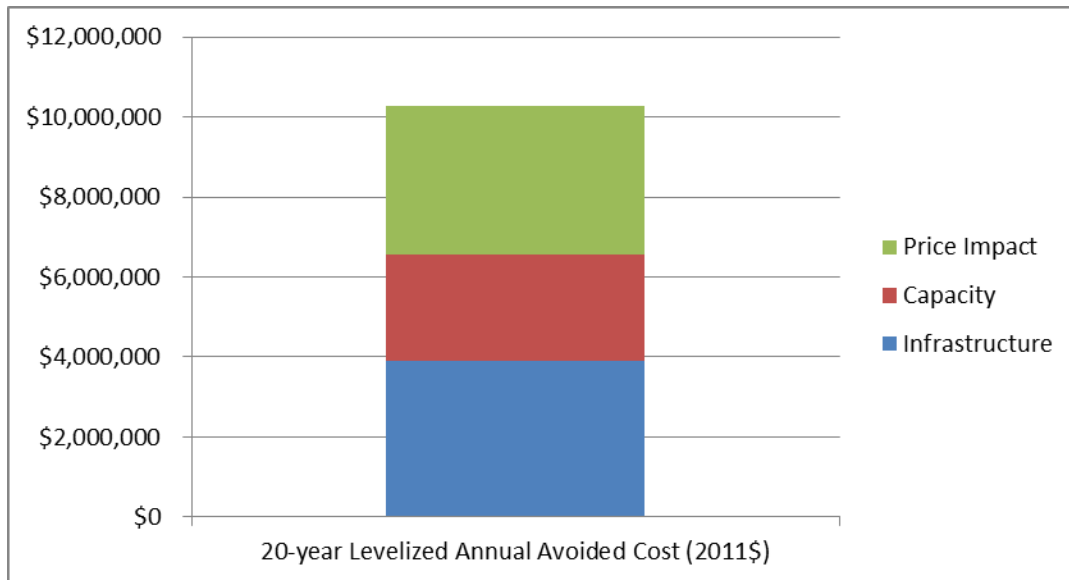


Figure 3. Annual Value of Avoided Costs from 85.9 MW of Solar PV Installations on Cape Cod and Martha's Vineyard

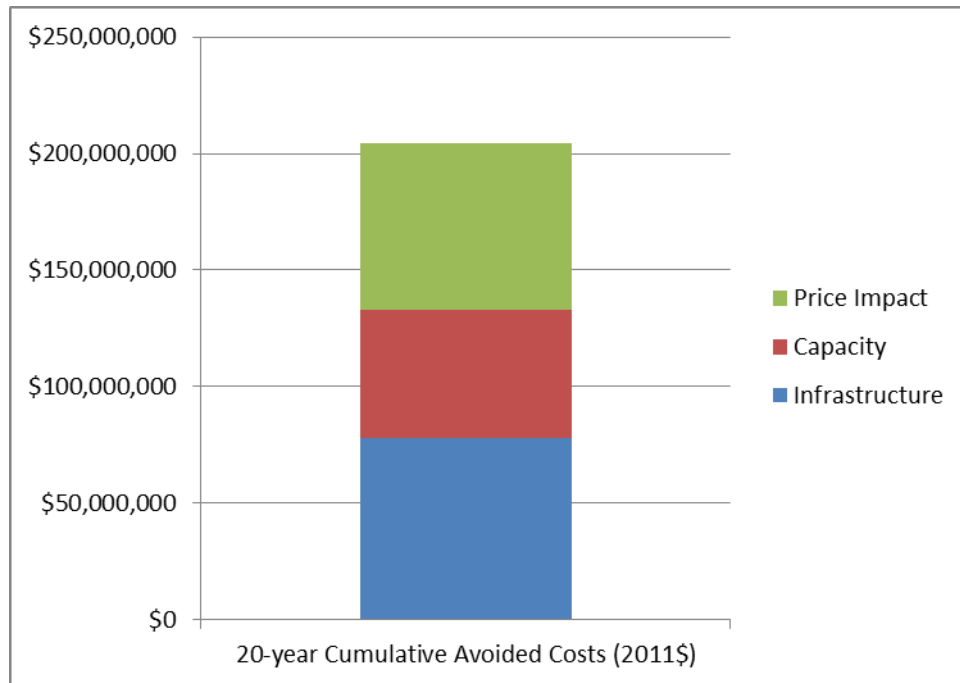


Figure 4. 20-year Cumulative Value of Avoided Costs from 85.9 MW of Solar PV Installations on Cape Cod and Martha’s Vineyard

Rationale for Relying Upon 2011 Avoided Cost Report

This analysis relies upon the consensus projections produced in the AESC 2011 report. These projections are the components of the marginal energy supply costs that would be avoided due to reductions in electricity, natural gas and other fuels resulting from energy efficiency programs offered to customers. The AESC 2011 report provides projections of avoided costs of electricity and natural gas by year from 2012 through 2026 with extrapolations through 2041. In addition to projecting the costs of energy and capacity avoided directly by program participants, the report provides estimates of the price impact of efficiency programs on wholesale market prices for electric energy and capacity. The AESC 2011 Study was sponsored by a group representing all of the major electric and gas utilities in New England as well as efficiency program administrators, state energy offices and state regulatory agencies.

Conclusions

The installation of solar PV systems – or any project that reduces the amount of electricity purchased from the New England grid – not only saves money for the owner of the system, but for all ratepayers on Cape Cod and Martha’s Vineyard. 16.5 MW of solar PV is expected to save ratepayers nearly \$40 million in avoided costs over the 20-year term of the contract. Increasing this amount to 85.9 MW would be expected to save \$204 million in avoided costs over the same period.