VOTE SOLAR

New England Smart Solar Siting Partnership

Solar is one of our most effective and flexible tools for addressing climate change, the environmental and public health impacts of fossil fuel pollution, and systemic injustices from our existing energy system. It is also critical to making our electric system more efficient and resilient as electric rates climb and climate change threatens the integrity of our system. However, while the flexibility to design solar to solve many of these problems is an important benefit the siting and types of solar project come with very different cost impacts. States must balance the direction they wish the solar market to go with the reality that incentives and compensation will need to take these cost differences into account.

Measuring the Impact of Solar Siting and Design on Project Costs

Through research in partnership with Sustainable Energy Advantage, Vote Solar has found that the type of structure, type of site and size of the project all have differing and matrixed impacts on the total cost of project development. Specifically, existing data was aggregated, and solar developers were surveyed on three types of project – open land or greenfield development, rooftop and canopied projects.

Four key takeaways from the data:

1. **Solar developed on greenfield or undeveloped land, especially in the 2 – 5 megawatt (MW) range, is far and away the lowest cost option.** At this scale, rooftop projects are 14% more expensive and canopied projects are a whopping 96% more expensive.
2. **Finding suitable sites for solar is a major determinant of cost for greenfield and rooftop projects, more specifically identifying sites, permitting and needed repairs to sites.** The siting of projects was listed as the most important factor determining the viability of rooftop projects and the second most important factor for greenfield development.
3. **In addition to siting, interconnection was raised as the first or second most important factor determining project viability and variation in cost for every project type.** Given the number of projects pursued and then abandoned, it is clear that both the high cost of interconnection and the lack of transparency or predictability of those costs are major roadblocks to solar development.
4. **While greenfield solar projects at significant scale are much cheaper, the impacts of scale vary across project types.** For greenfield development, projects in the 2-5 MW range are 74% cheaper than in the 250 – 500 kilowatt (kW) range. However, for rooftop the differential between those ranges is 33% and for canopied systems even smaller at just 3%. This drastic difference between system types is likely a reflection of the different labor and components required for each of the types.

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Policy Recommendations to Expand the Benefits of Solar While Minimizing and Stabilizing Costs

Given these key findings, it seems that policy could be directed to help lower costs overall as well as enable targeted types of projects as a state desires. Vote Solar makes the following recommendations, based on the data in this report:

1. Solar siting is a major factor in the varying costs of solar projects for both greenfield and rooftop solar projects. As such, states can help lower costs by more specifically directing solar projects to desired lands and identifying potential lands or rooftops for development. Encouraging public entities to inventory their lands and encourage solar development on preferential sites is one possible direction for policy. In addition, as rooftop repair is a key cost factor, linking up development, renovation and energy efficiency oversight with solar development could help identify rooftops that are already being built or rebuilt and could be made suitable for solar. One simple solution would be to follow California in directing new building construction, and extending that to deep retrofit of buildings, to include solar or at least be made 'solar ready.'

2. Many states have decided to encourage the development of rooftop solar and canopied systems over parking or agriculture. Our research shows that these systems can be significantly more expensive than greenfield development, but this may be a price worth paying. Solar incentives and compensation should provide a differentiated value for these projects to account for the different costs of development. In addition, greater research and publication of the dual-use or secondary benefits of these types of solar, such as heat reduction for buildings, snow removal for parking and heat reduction on rooftops, could help to balance the higher costs.

3. Finally, significant improvement of interconnection policy for solar development is needed to increase transparency and predictability. Interconnection costs are a very large variable in regard to time and money, and both must be reduced in order to reduce the cost of completed projects and the wasted investment in non-viable projects. Local, distributed solar is a key solution to climate change and a valuable investment in our communities, so it is past time that electric utilities be required to plan for future development of distributed solar, as well as other distributed energy resources, as they repair and upgrade the electric grid. Some interconnection costs may be appropriately paid for by solar developers, and for these investments there should be more transparency into what the grid may require and how much those improvements may cost.

Sustainable Energy Advantage (SEA) Analysis of Project Costs and Factors

Vote Solar partnered with Sustainable Energy Advantage (SEA), a respected energy research and analysis consultancy that has worked for many of the New England states directly, to analyze the different costs of solar projects at different scales, on different sites and with different structures. The analysis included a review of existing data on solar costs from the Massachusetts Department of Energy Resources, the Rhode Island Renewable Energy Growth Program, and other regional sources. After this initial desktop research, SEA surveyed and spoke with regional solar companies to get their cost data and further reflections on the characteristics that impact costs. The research focused on three types of solar project – greenfield, rooftop and canopied projects – as well as three different scales of projects: 250 – 500 kW, 501 kW – 2 MW, and 2 – 5 MW.

The desktop research of existing data was analyzed to create a benchmark per watt all-in cost, and then a survey of developers provided reactions to those benchmarks as well as their own average costs. From this, we looked at both the average and median cost. This benchmark analysis allowed us to use real numbers from substantial amounts of data to ensure realistic responses, while the survey allowed us to access more current circumstances as well as to ground in experience the aggregated results of the existing data. The benchmarks were on the whole quite accurate with a few exceptions. In some cases, such as for canopies, the results may be skewed due to a smaller pool of examples.

	Greenfield			Rooftop				Solar Canopy			
Project Size	Benchmark	Average	Median	Benchmark	Average	Median	% of Med. Greenfield	Benchmark	Average	Median	% of Med. Greenfield
250 – 500 kW	$2.36	$2.78	$2.78	$2.42	$2.42	$2.42	87%	$3.23	$3.54	$3.23	116%
501 kW – 2 MW	$1.98	$2.04	$1.98	$2.20	$2.21	$2.20	111%	$3.08	$3.48	$3.35	168%
2 MW – 5 MW	$1.60	$1.72	$1.60	$1.82	$1.85	$1.82	114%	$3.14	$3.08	$3.14	196%

Aside from the conclusions reached above, one interesting thing to note from the data is the fact that small rooftop projects are lower cost than small greenfield projects. While we did not ask for more data on this particular point, one might assume that there are some costs for greenfield project development, such as pole drivers, cement mixers and fencing, that may not vary substantially with size and therefore drive up the cost of smaller systems.

Not included in the Sustainable Energy Advantage research, but available through the Massachusetts Clean Energy Center, is the cost of residential rooftop solar systems. Residential systems provide many benefits based on their proximity to electric demand, minimal use of the electric distribution system, significant job creation and flow of benefits to local citizens. However, the cost of these systems is substantially higher. From 2017 to 2019, the Clean Energy Center has data from 21,733 residential rooftop solar systems, and the average cost of these systems was $4.00 per watt, or 250% of the cost of a 2-5 MW greenfield project.[i]

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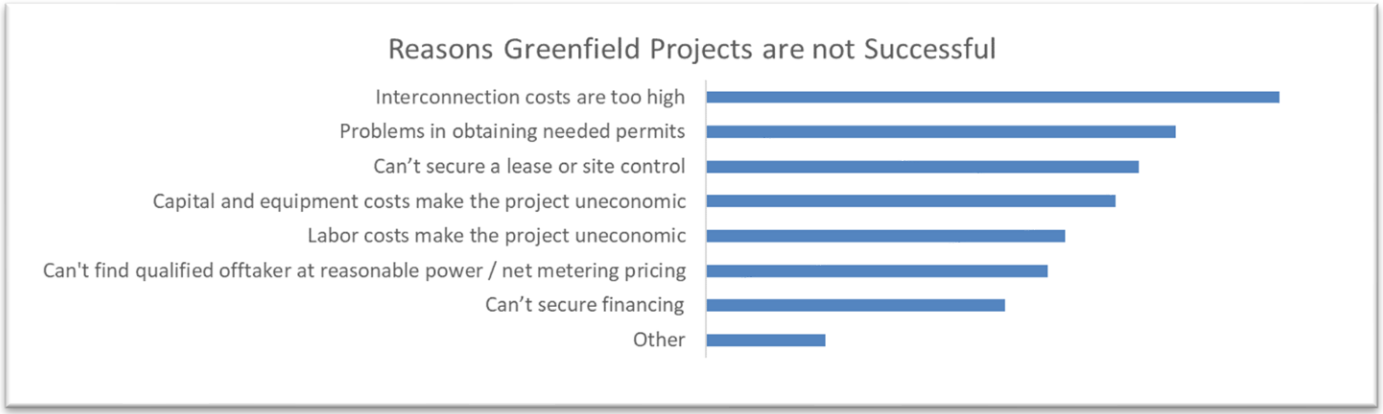
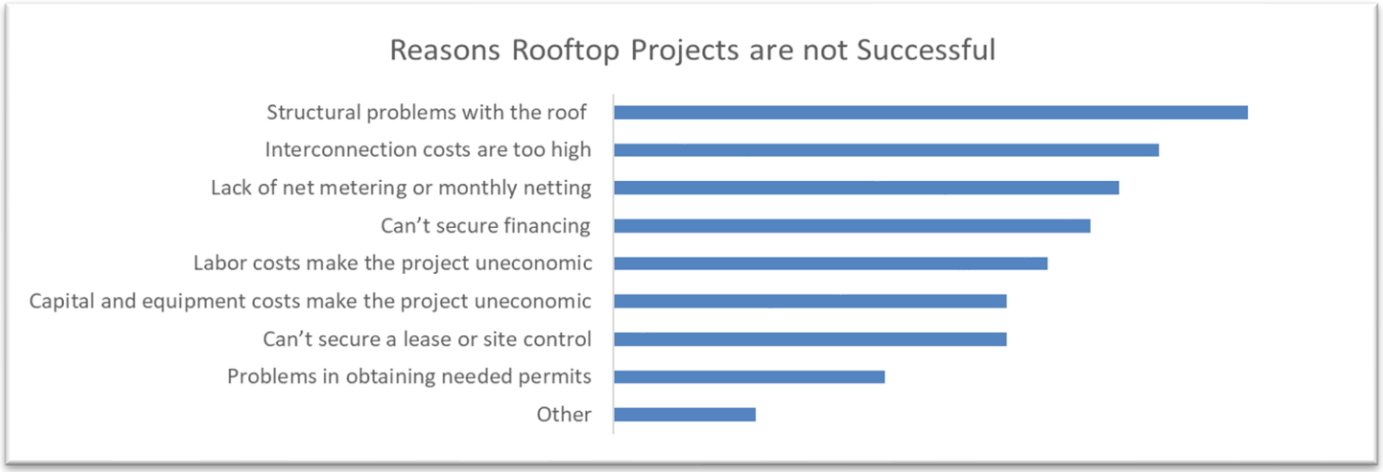
In addition to cost data, the survey asked developers to rank different factors for their impact on the viability of projects and the variability of costs. The results highlighted the impact of siting and interconnection on greenfield and rooftop projects, as well as the more substantial labor and structural costs of canopied solar projects. The graphs below represent the weighted average of the survey responses, based on number of responses weighted by the priority level of the response.

For greenfield projects, interconnection and siting related factors topped the list:



For rooftop projects, interconnection and siting related factors again topped the list, followed by caps on the most effective compensation mechanism for rooftop solar projects, net metering:



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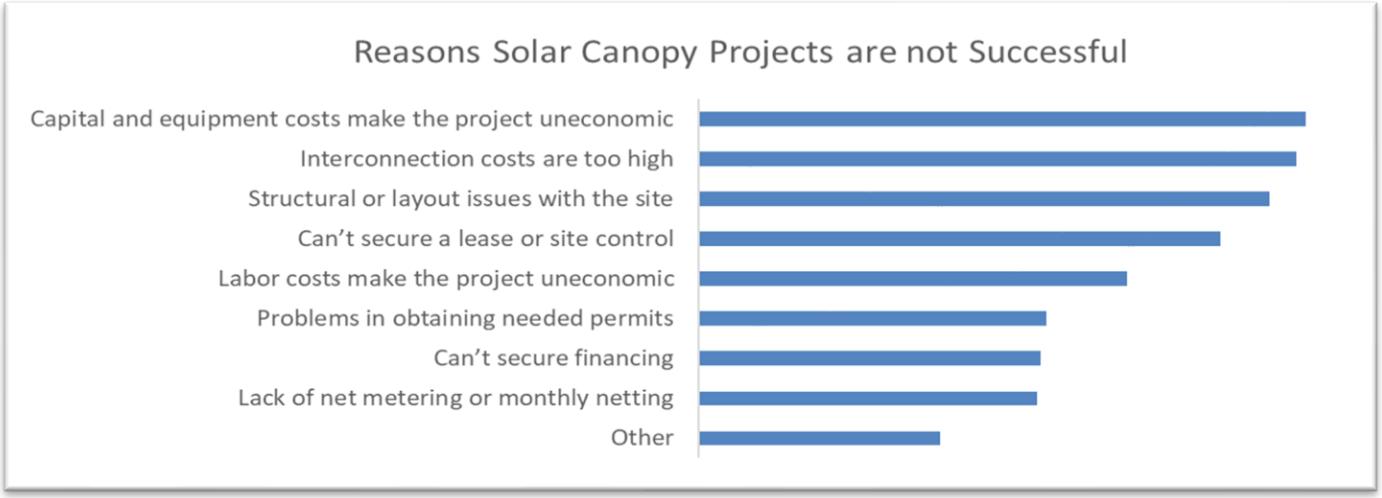
Finally, for canopied solar projects, interconnection and siting concerns were joined by structural issues at the top:



[i] *Solar Electricity: Cost and Performance*. Massachusetts Clean Energy Center, 2020, https://www.masscec.com/solar-costs-performance. Accessed 6 Mar. 20202.