Guidance Memo for Including Storage in Community Solarize Programs

Introduction

The NYSolar Smart Distributed Generation (DG) Hub is a comprehensive effort to develop a strategic pathway to a more resilient distributed energy system in New York that is supported by the U.S. Department of Energy and the State of New York. This DG Hub fact sheet provides information to communities interested in group purchase or Solarize programs which incorporate storage (i.e. battery back-up). For information on other aspects of the resilient PV market, please see the companion fact sheet on economics and finance and a glossary of terms at: www.nysolarmap.com/resources/reports/.

Background

Solarize campaigns are community-based outreach efforts aimed at encouraging a group of homes and businesses in one geographic area or affinity group to go solar. These coalitions of homes and businesses can qualify for volume-based discounts and reduce customer acquisition costs for local solar developers.

Solarize campaigns may be initiated and organized by individuals within a community, or may be part of broader efforts organized by non-profits, government organizations or businesses. Some Solarize programs offer technical assistance to communities pursuing Solarize campaigns such as request for proposal (RFP) template materials, support for reviewing installer proposals, general marketing templates, and other support as requested. The U.S. Department of Energy's SunShot Initiative also offers resources on developing Solarize programs. These materials can support effective program design, attract qualified installers, and improve RFP response review and installer selection. This memo provides guidance on energy storage that may be incorporated into Solarize program RFPs and other materials.

In recent Solarize campaigns in New York State, some communities requested installers include a storage solution in their proposal responses. Although some installers responded to this request, the information often lacked detail, specificity and consistency, making it difficult for communities to fully understand the proposed storage solution and select a qualified installer.

This issue was brought to the attention of Sustainable CUNY's Smart DG Hub, and the DG Hub team proceeded to review publicly available Solarize template RFP materials to asses where storage guidance could be beneficial. This memo offers storage guidance to improve solar+storage proposals for individual communities or larger programs engaged in Solarize campaigns, with a desire to include a storage element. The focus of this memo is on-site solar+storage solutions.[1] The goal of this document is to provide recommendations that when adopted will result in higher quality proposals and will allow communities to make more informed decisions when selecting an installer that offers a storage component.

1. Solarize Request for Proposals

Using a RFP to select a Solarize installer(s), communities can specify their needs, interests, and qualifications for installers. Currently, most Solarize RFPs do not include language on energy storage, or include limited mention of storage. Communities who aim to generate a more meaningful response from

[1] Off-site or community solar and storage systems are a nascent market; to stay apprised of developments in this area, please reference current and upcoming materials by the Community Solar Value Project.

installers may want to consider including detail on storage throughout the RFP as outlined below. Prior to making adjustments, communities should consult with their local permitting departments or other stakeholders on the current market development of storage in their region.

1.1 Introduction

It is recommended that communities include a statement that explains why the community is including storage in the RFP an introductory section of the RFP, clearly state the rationale for including storage, as well as the goals they hope to achieve as a result. Questions communities could aim to address in this section include:

- Why is the community interested in storage?
- What are their goals for storage?
- What individual or community need are they trying to address or meet?

These may be specific to local context, but could include:

- To provide back-up power and increase preparedness and resilience of a community in the event of a black out or other disaster.
- A premium option for consumers interested in going completely off-grid.
- To provide deeper energy savings for commercial customers through management of demand charges.
- To maximize the environmental benefits of solar or other renewable energy technologies.

Additionally, where possible, attempt to define the target number of storage installations in number of homes and/or installed capacity akin to the projected installation target for solar.

1.2 Proposal Requirements

Installer Qualifications

It is recommended that communities consider adjusting installer qualification requirements when including storage in a Solarize RFP. As of 2016, two-thirds of U.S. solar installers did not offer storage.[2] Thus, solar installers may need to subcontract with storage providers. Organizations like NYSERDA have not yet established a qualified storage installer listing in NY analogous to the one available for solar. However, communities can cross-check the NY-BEST member list or ask that the storage subcontractor disclose their industry associations and relevant experience, such as the number of installed storage projects. It is recommended that the RFP also include qualification criteria for the storage installers such as highlighting the relevant experience, skills and capabilities of the storage installer.

Storage Technology

It is also recommended that the storage provider or installer be provided with the opportunity to include information on the storage technology or technologies being offered. Consider adding a section within the proposal where information on the storage solution is outlined. Request that the installer propose the most appropriate technology given the community's needs as well as the installer's rationale for choosing the particular chemistry or technology[3]. Installers should also include a plan for compliance with state and local codes, and adjustments for historic districts, if applicable.

[22] http://www.pv-magazine.com/news/details/beitrag/two-thirds-of-us-solar-installers-do-not-offer-storage--study-finds_100024123/#axzz45lNtFvdb

[3] For a comparison of commonly used battery technologies, see the DG Hub Resilient PV Hardware Fact Sheet.

Requested information about the specific storage technology could include:

- Rationale for recommending the specific technology or chemistry
- Specification sheets for the storage option that would include the storage specification sheets and the smart inverter specification sheets
- Equipment warranty information
- Testing results, where available
- Clarity on O&M schedules
- Disposal requirements
- Replacement schedules

1.3 Cost Information

The rationale for including storage in a RFP can impact the technology, solution and pricing offered by the installer. It is suggested that Solarize campaigns add a dedicated section for detailed, storage-specific cost information. The additional information provided could include:

- Information on any preferred locations for storage systems such as:
  - Average loads and critical loads, in order to help installers make estimates about storage system capacity. Residential storage systems tend to range from 5 – 25 kWh, and commercial storage systems tend to range from 25 kWh to several hundred kWh.
  - The desired duration of the battery (in hours) for the particular location
  - Information on the specific electricity tariff rate structure for the preferred locations, so the installer can estimate potential savings

1.4 Solar Installer and Profile Pricing Form

It is recommended that RFP templates include an Excel sheet requesting and requiring information on the design specifications of the storage product.

Within the pricing proposals, communities ideally should ask for additional information to understand the capability of storage options including:

- Chemistry of the storage system (e.g. lead-acid, lithium ion, etc.)
- The totaled installed price in $/kW and in $/kWh which offers information about the capacity and the power of the storage system and supporting components
- The system capacity in kWh and system power in kW (installers may offer multiple system sizes)
- Details on the brand and manufacturer of sub-components, where different, such as the inverter, storage system, battery management system, etc. Specifications for these components should be included in the full RFP package, if they are not integrated within the solar and storage specifications sheets.
- The fraction of the total facility load that will be deemed critical, and the estimated duration (in hours) that the critical load will be served in off grid or emergency mode.

A proposal for information to be included in the pricing template is included in the following Table. This information can be included as part of the adders section beyond the base price for solar PV under the Solarize campaign.

Table 1 – Suggested Items for Inclusion in Pricing Proposal Sheet of RFP

Pricing Template Category	Unit
Total Installed Battery Costs	$/kW, $/kWh
Battery Operations and Maintenance Costs	$/kW, $/kWh
Battery Brand	N/A
Nameplate Capacity	kW
Rating	kWh or Ah
System Configuration	Either AC-Coupled, DC-Coupled or Site Dependent/TBD
Chemistry	N/A
Battery Warranty	Years
Roundtrip efficiency	%

Conclusion

This memo proposes preliminary measures communities can take to improve the quality of Solarize proposals and responses, and enable installers to respond more readily to requests for storage in Solarize campaigns. It is recommended that communities seriously consider requesting the additional information and questions as described above and seek clarification about storage offerings during interviews with installers. The Smart DG Hub based out of CUNY is also available to provide assistance as needed.

Additionally, communities organizing campaigns may want to consider incorporating storage into the educational and training aspects into future rounds of Solarize campaigns. The educational components of such campaigns have proved to be very useful in helping campaign participants feel more comfortable with the technology and in turn potentially increasing their success. Campaigns may want to consider including a "Storage 101" session or materials that provides information on the basics of storage and the different types of technologies and chemistries. The bibliography is a starting place for the type of information that could be provided in a training or webinar.

Relevant Resources

- Community Solar NY Template Materials: The NYSERDA Community Solar NY program has developed templates and materials to assist New York State communities interested in pursuing group purchase programs.
- The Smart DG Hub Website: The Smart DG Hub is a DOE funded initiative spearheaded by Sustainable CUNY out of the City University of New York, in partnership with the National Renewable Energy Laboratory and Meister Consultants Group. In the wake of Hurricane Sandy, the Smart DG Hub is creating a pathway to integrating resilient PV systems into NYC's infrastructure by creating a Smart DG Roadmap for Resilient Solar and by adding resiliency analysis to the NY Solar Calculator.
- The DG Hub Finance Fact Sheet: Economics and Finance of Solar+Storage: This fact sheet provides an overview of the economics of solar photovoltaic projects that include battery storage systems (solar+storage) in New York City.

- The DG Hub Hardware Fact Sheet: Resilient Solar Photovoltaics (PV) Systems: This fact sheet provides information on resilient PV hardware and design. Resilient PV is solar energy that is coupled with technology that allows it to continue to provide power during grid outages.
- The DG Hub Software Fact Sheet: Smart Grid Communications: This fact sheet provides an overview of the software needs and capabilities for resilient PV systems and microgrids, including smart inverter functionality and communication architecture.
- DG Hub Resilient PV Retrofit and Storage Ready Guidelines: Communities that are not ready to install storage, but want solar PV systems that are storage ready should consult these guidelines.
- The Energy Storage Systems Permitting and Interconnection Process Guide For New York City: This guide covers permitting and interconnection requirements and processes for commercial-scale energy storage systems in NYC that are used for purposes other than uninterruptible power supply (UPS). These other purposes may include, but are not limited to peak shaving, load shifting, demand response, and ancillary services like frequency regulation.
- San Francisco's Solar+Energy Storage for Resiliency: The City of San Francisco's Department of Environment is running a project on solar and energy storage. The project is trying to better understand the resiliency, economic, environmental and energy benefits of solar and energy storage systems. This includes developing a calculator that will estimate solar and storage system size and the back-up power needs based on building location and data. The final calculator will be available online before the end of the year.

Appendix I: Additional Guidance – Battery Chemistries

Below is an excerpt from the DG Hub hardware fact sheet comparing the benefits and applications of various battery chemistries. These chemistries may appear in RFP responses from installers. To support the interpretation of this chart, a glossary is also available from DG Hub with concise explanations of commonly-used terminology.

Battery Comparison Table

Specifications	Battery Chemistries						
	Lead Acid	Lithium-Ion					Flow Batteries
	VRLA (Deep-Cycle)	LFP	NMC	NCA	LTO	LMO	Redox
Usage[1]	Resiliency, Grid Support, Peak load shifting, Intermittent energy smoothing, UPS	Resiliency, Grid Support, Peak load shifting, Intermittent energy smoothing, UPS					Resiliency, Grid Support, Peak load shifting, Intermittent energy smoothing, UPS, Bulk power management
Energy density (Wh/kg)	30-50	90-120	150-220	200-260	70-80	100-150	10-20
Lifetime cycles (80% depth of discharge)	50-100[2]	1000-2000	1000-2000	500	3000-7000	300-700	10,000+
Efficiency (%)	85-90[3]	90-95	90-95	90-95	90-95	90-95	65-85
Charge rate	8-16 hrs[1]	2-4 hrs	2-4 hrs	2-4 hrs	1-2 hrs	1-2 hrs	Depends on size of tanks & cell stack[5]
Cost	$150-300/kWh[4, 7]	$400/kWh[7]	$428-750/kWh[3, 6]	$240-$380/kWh[3, 6]	$2,000/kWh[7]	$250-300/kWh[7]	$680-800/kWh[6, 7]
Advantages	Well-known and reliable technology, able to withstand deep discharges, relatively low cost, and ease of manufacturing.	High energy density, able to withstand deep discharges, and long cycle lives.					Relatively safe, well suited for bulk storage, long cycle life (claim 10,000-20,000 cycles), and easy to scale up the amount of energy stored by simply making the tanks larger.
Disadvantages	Relatively low number of life cycles (must be replaced more often) and lower energy density (larger size for less energy storage).	More expensive than lead acid systems and may become thermally unstable. Overheating or short circuits in Li-ion cells may cause thermal run-away—a phenomenon where the internal heat generation in a battery increases faster than it can dissipate. This heat can damage or destroy the cells and is a potential source for fires. Electronic protection circuits are added to the battery pack to prevent thermal run-away.					Relatively high cost, low efficiency (less than 70%) and low energy density; high maintenance with pumps that often leak and precipitate out.
Safety (Thermal Run-away)[8]	Considered thermally safe	High thermal stability	Increased thermal stability	Thermal instability	Highest thermal stability	Increased thermal stability	Very safe since storage of electrolyte is separate from power generation unit

Sources: All information from Battery University unless otherwise noted.

[1] GridMarket. (2012). Technology Matrix. http://www.gridmarket.com/intelligence-2/technology-matrix/.

[2] Sandia National Laboratories. A Study of Lead-Acid Battery Efficiency Near Top-of-Charge and the Impact on the PV System Design. http://www.otherpower.com/images/scimages/7427/Lead_Acid_Battery_Efficiency.pdf.

[3] Fortune. (May 2015). Why Tesla's Grid Batteries Will Use Two Different Chemistries. http://fortune.com/2015/05/18/tesla-grid-batteries-chemistry/.

[4] ESJ. (2015). Lead Acid and Grid Storage. http://www.energystoragejournal.com/lead-acid-and-grid-storage/.

[5] Pacific Northwest National Laboratory. (2012). Vanadium Redox Flow Batteries. http://www.kigeit.org.pl/FTP/PRCIP/Literatura/081_Vanadium_Redox_Batteries.pdf.

[6] Navigant Consulting. (2014). Advanced Batteries for Utility-Scale Energy Storage. http://www.navigantresearch.com/research/advanced-batteries-for-utility-scale-energy-storage.

[7] Email exchanges with Sam Jaffe, Cairn ERA

[8] Thermal run-away refers to the internal heat generation in a battery that increases faster than it can dissipate, which can lead to fire.

ABOUT

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