SOLAR COST REDUCTION PROCESS EVALUATION

Final Report

Prepared for:

The New York State Energy Research and Development Authority

Albany, New York

Jennifer Phelps

NYSERDA Associate Project Manager

Prepared by:

Industrial Economics, Inc.

Cambridge, Massachusetts

Dan Leistra-Jones, Sarah Armitage, Nick Pittman, and Cynthia Manson

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Executive Summary

As part of NYSERDA's Advanced Clean Power initiative, the Solar Cost Reduction (SCR) program aims to improve the competitiveness of solar-generated electricity in New York State by reducing balance-of-system (BOS) costs of solar photovoltaic (PV) installations. BOS costs of PV systems include everything other than the PV panels themselves, such as non-module hardware, labor, design, permitting interconnection, inspection, financing and customer acquisition. The SCR program is also a component of the NY-Sun initiative, which seeks to significantly expand customer-sited PV capacity across the state, advance PV technologies, and reduce the cost of PV systems.

The primary goal of this process evaluation was to provide a rapid assessment of the effectiveness of SCR's project solicitation processes, to inform the focus and structure of future solicitations. Specific areas of inquiry address program staff's desire for near-term feedback in order to refine processes for the next round of project solicitation. Several recommendations for improving program processes emerged from the findings of this evaluation, as outlined below.

The evaluation is framed around seven evaluation questions that address three key topics of concern: whether the program is addressing the correct barriers to BOS cost reduction; whether the structure of funding awards encourages high-quality project applications; and how the program might target innovative projects and improve processes going forward.

ES.1 Project Scope and Methods

IEc employed a mixed-methods approach for this evaluation that includes the following:

- A targeted literature review on BOS cost reduction barriers, emphasizing information that has emerged since Program Opportunity Notice (PON) 2672 was issued in 2012;[1]
- A review of SCR program documentation;
- A review of program documentation from the Department of Energy (DOE) SunShot Initiative and, to a lesser extent, other comparable programs;[2]
- Key informant interviews with participants in New York's solar industry; and
- A survey of relevant organizations that chose not to apply for funding under previous rounds of the PON.

[1] Program Opportunity Notice 2672, "Photovoltaic Balance-of-System Cost Reduction," is the mechanism by which SCR solicits proposals and funds projects. See http://www.nyserda.ny.gov/nysun-bos.

[2] Other programs included in the review included Rocky Mountain Institute's (RMI) BOS efforts; Google's Little Box Challenge, The SunShot Initiative's Race to 7-Day Solar (evaluated separately from the other SunShot projects included in this evaluation); and the Massachusetts Clean Energy Center's Solarize Mass program.

ES.2 Recommendations

IEc's recommendations for improving program processes include:

1. NYSERDA should carefully target "innovative" projects based on its assessment of New York State's leadership potential in a given area, the maturity of existing solutions, and state-level flexibility. In areas where New York State has leadership potential, NYSERDA should continue its current approach of piloting innovative ideas in the market. Likewise, in areas where existing approaches to reducing BOS costs are relatively immature, SCR's approach of funding a variety of innovative approaches is appropriate.

2. NYSERDA should identify areas where adoption of best practices is a primary barrier, and fund projects that target this particular issue. Areas where replication is the major challenge are likely those where existing solutions are already well established and no longer require proof of concept in a context similar to New York State, but have not yet been widely adopted by the market. NYSERDA may also determine that different project structures than those funded to date are more effective at addressing barriers to replication.

3. NYSERDA should examine its cost recoupment and cost sharing requirements, especially in the context of other programs (outside of NYSERDA) to determine whether these provisions are in line with industry best practices. If SCR's cost recoupment and cost sharing prove atypical, the program should consider amending these program specifications. NYSERDA should examine these issues particularly for different types of applicants and non-module hardware projects, as well as consider alternative program structures.

IEc found that SCR's current marketing channels are generally effective, so IEc does not offer formal recommendations for process improvements in this area. Interviewees and survey respondents provided informal suggestions for additional means of communication and outreach, summarized in Section 4.2. However, none of these communications channels were proposed by more than a handful of individuals and, therefore, may not lead to a meaningful difference in PON awareness or participation by the market.

ES.3 Other Insights

The insights that informed IEc's overarching recommendations are described below. These findings are described in greater detail in Sections 3.1-3.7.

1. Literature indicates that all major cost categories contribute significantly to BOS costs, and opportunities remain for addressing each. Thus the SCR program is targeting significant barriers to BOS cost reduction through its broad-based approach of funding a range of projects that collectively address BOS costs in all main cost categories.

2. Barriers to reducing all categories of BOS costs can be addressed effectively at the state level. Furthermore, compelling arguments support New York State focusing on any of these categories of barriers. However, to be most effective, the nature of New York State's efforts to reduce BOS costs must be designed to address each barrier in the most effective way, by considering New York State's areas of leadership potential, the maturity of existing solutions to BOS costs, and other similar state programs.

3. The SCR program is funding projects in a manner that avoids duplicating efforts of other programs, including but not limited to DOE's SunShot Initiative. Both SCR and SunShot fund a broad range of projects, so it is not feasible to design SCR to focus on "non-SunShot" categories of projects. However, to date SCR has not funded any projects that constitute inefficient duplication of SunShot's efforts. A representative of the SunShot program also participated on the Technical Evaluation Panel (TEP) for the first round of SCR funding, a practice which is useful for coordinating efforts across programs.

4. The results of IEc's analyses diverged over whether the scale of SCR-funded projects is appropriate for generating sustained cost reductions and/or project replication. Some information suggests that SCR could benefit from larger-scale demonstration and hardware projects, but the evidence is not strong enough to be conclusive; more research is needed.

5. Market participants appear to be aware of NYSERDA as a source of funding, and project developers follow the NYSERDA website for funding announcements. No single barrier to applying for program funding appears to have a significant across-the-board effect in deterring potential applicants once they become aware of NYSERDA funding opportunities. However, cost sharing and cost recoupment requirements were identified as relatively more significant than the other barriers listed on the survey, particularly for potential applicants with hardware projects (cost recoupment). Certain types of applicants, such as non-profits and municipalities, may find cost sharing to be particularly burdensome.

From the information analyzed for this evaluation, IEc assembled innovative ideas and promising approaches for reducing BOS costs in all categories. **Section 3.6** presents these potential projects for NYSERDA's consideration. IEc also developed recommendations for improving program processes, as outlined above. **Chapter 4** presents these recommendations in greater detail.

1 Introduction

1.1 Program Overview

As part of NYSERDA's Advanced Clean Power initiative, the Solar Cost Reduction (SCR) program aims to improve the competitiveness of solar-generated electricity in New York State by reducing balance-of-system (BOS) costs of solar photovoltaic (PV) installations. BOS costs of PV systems include everything other than the PV panels themselves, such as non-module hardware, labor, design, permitting interconnection, inspection, financing and customer acquisition. The SCR program is also a component of the NY-Sun initiative, which seeks to significantly expand customer-sited PV capacity across the state, advance PV technologies, and reduce the cost of PV systems.

The SCR program has the following near-term objectives:

- Reduce compliance costs for installation and interconnection;
- Increase market power for consumers;
- Reduce customer acquisition costs and/or other transaction costs;
- Pilot new business and financing models in the market;
- Increase awareness and acceptance of commercial-ready BOS hardware products;
- Move BOS technologies toward commercial readiness, and realize commercial sales for late-stage technologies;
- Secure additional investments for supported products, new business models, and PV deployment; and
- Improve understanding of barriers to BOS cost reduction.

To address these objectives, the SCR program seeks to reduce barriers to BOS cost reduction in five principal cost categories, including:

- Non-module hardware;
- Business costs, including customer acquisition;
- Development costs, including contracting and financing;
- PV system design, installation, and operation; and
- Permitting, zoning, interconnection, and inspection.[3]

SCR acts primarily by funding third-party projects that target one or more of these barriers. SCR funds projects in three distinct categories. Category A includes BOS non-hardware or soft cost projects; Category

[3] Barriers to BOS cost reduction refer to immature market characteristics, inefficiencies, and other impediments to achieving lower BOS costs for solar PV systems in New York State. In this report, IEc also uses the term "barriers" to refer to persistently high BOS costs, as a shorthand for factors underlying those high costs.

B includes BOS product or hardware component projects; and Category C includes demonstration projects. **Appendix A** summarizes projects supported under the first two rounds of funding.

1.2 Purpose and Scope of the Evaluation

SCR program staff expressed interest in receiving near-term feedback on a targeted set of evaluation questions concerning the program's solicitation processes, with the aim of informing the program's anticipated 2015 solicitation. Consequently, the primary goal of this process evaluation is to provide a rapid assessment of the focus and effectiveness of the SCR program's project solicitation processes. The effort also includes a market intelligence component, providing information on the solar PV industry to help program staff focus future efforts.

This evaluation does not address SCR program activities related to coordinating with and assisting funding recipients with project implementation. If undertaken, a second-phase evaluation could potentially both extend the current assessment (through additional data collection) and examine the program's project support and coordination processes.

1.3 Evaluation Questions

IEc developed evaluation questions in coordination with SCR program staff and NYSERDA evaluation staff. Evaluation questions for this process evaluation include the following:

1. Is the SCR program targeting significant barriers to BOS cost reduction?
2. Is the SCR program targeting barriers to BOS cost reduction that can be effectively reduced at the state level?
3. Is the SCR program funding projects in a manner that avoids duplicating efforts of other programs, including but not limited to the Department of Energy (DOE) SunShot Initiative?
4. Is the scale of SCR-funded projects appropriate for generating sustained cost reductions and/or project replication?
    a. How does the level of funding awards for SCR-funded projects compare to:
        i. Funding awards from the SunShot Initiative and other relevant programs?
        ii. The amount of funding that potential applicants indicate would be appropriate to induce them to apply for funding?
5. What barriers hinder potential applicants from applying for program funding, and how can they be reduced?

a. What are the reasons that qualified organizations chose not to apply for funding under previous rounds of the Program Opportunity Notice (PON)?

b. What are the particular barriers hindering potential applicants in under-represented project categories (i.e., hardware projects)?

6. Are there innovative approaches to reducing BOS costs that the SCR program should be aware of when marketing its PON?

   a. If so, what are the best ways to market the PON to the organizations that undertake these types of projects?

7. Are there any recommendations for improving the SCR program's project solicitation processes?

   a. Are there recommendations for improving the SCR program's marketing and publicity processes in order to solicit more high-quality applications for funding?

1.4 Report Organization

The remainder of this report is organized as follows. Chapter 2 provides an overview of the evaluation methodology. Chapter 3 presents analysis and results. Conclusions and recommendations are provided in Chapter 4. Several appendices provide additional methodological and analytical detail.

2 Methodology

IEc employed a mixed-methods approach for this evaluation that includes the following:

- A targeted literature review on BOS cost reduction barriers, emphasizing information that has emerged since PON 2672 was issued in 2012;
- A review of SCR program documentation;
- A review of program documentation from the DOE SunShot Initiative and, to a lesser extent, other comparable programs;[4]
- Key informant interviews with participants in New York's solar industry; and
- A survey of relevant organizations that chose not to apply for funding under previous rounds of the PON.

Table 2-1 aligns these methods with the evaluation questions noted in Chapter 1. **Appendix B** provides a more detailed discussion of each method employed. As part of a rigorous mixed-methods evaluation, each evaluation question was addressed by more than one method. IEc cross-validated its findings by interpreting results from each method in conjunction with data collected from other methods. IEc sought to identify thematic similarities across its results and explored any areas of inconsistency in greater detail.

Table 2-1. Evaluation Questions and Methods Used

Evaluation Question	Methods Used
1. Is the SCR program targeting significant barriers to BOS cost reduction?	Literature review; SCR program documentation review; key informant interviews
2. Is the SCR program targeting barriers to BOS cost reduction that can be effectively addressed at the state level?	Literature review; SCR program documentation review; key informant interviews
3. Is the SCR program funding projects in a manner that avoids duplicating efforts of other programs, including but not limited to DOE's SunShot Initiative?	SCR program documentation review; SunShot program documentation review; key informant interviews
4. Is the scale of SCR-funded projects appropriate for generating sustained cost reductions and/or project replication?	SCR program documentation review; SunShot program documentation review; key informant interviews; survey
5. What barriers hinder potential applicants from applying for program funding, and how can they be reduced?	Survey; SCR program documentation review
6. Are there innovative approaches to reducing BOS costs that the SCR program should be aware of when marketing the PON?	SCR program documentation review; SunShot program documentation review; key informant interviews; survey

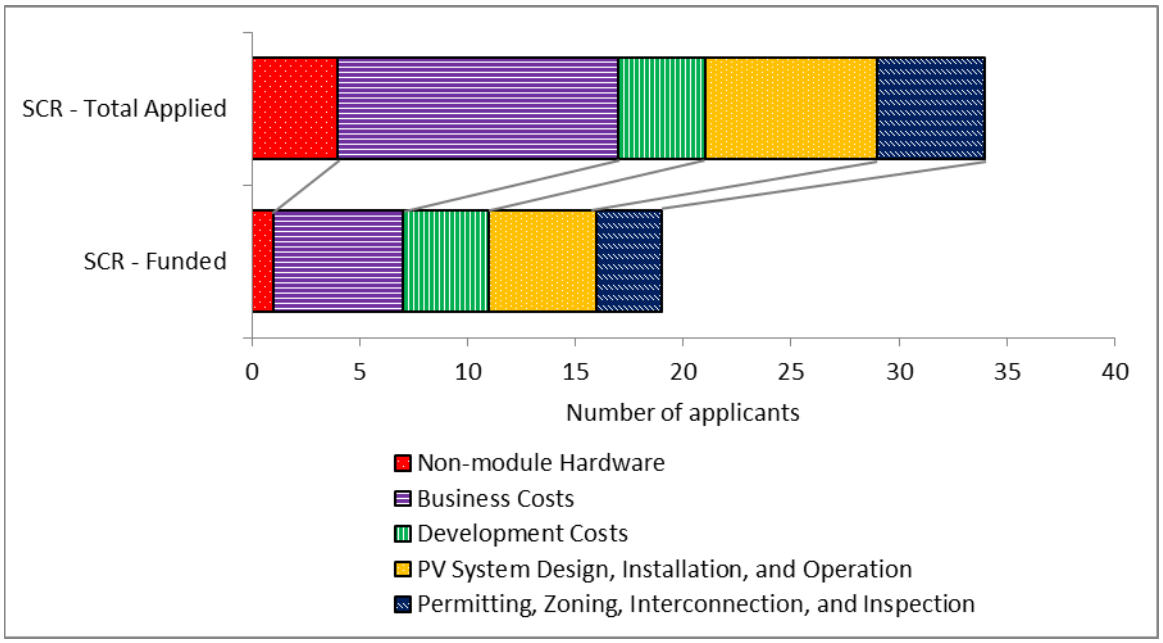
[4] Other programs included in the review included Rocky Mountain Institute's (RMI) BOS efforts; Google's Little Box Challenge, The SunShot Initiative's Race to 7-Day Solar (evaluated separately from the other SunShot projects included in this evaluation); and the Massachusetts Clean Energy Center's Solarize Mass program.

Evaluation Question	Methods Used
7. Are there any recommendations for improving the SCR program's project solicitation processes?	Synthesis of findings from other evaluation questions.

3 Results

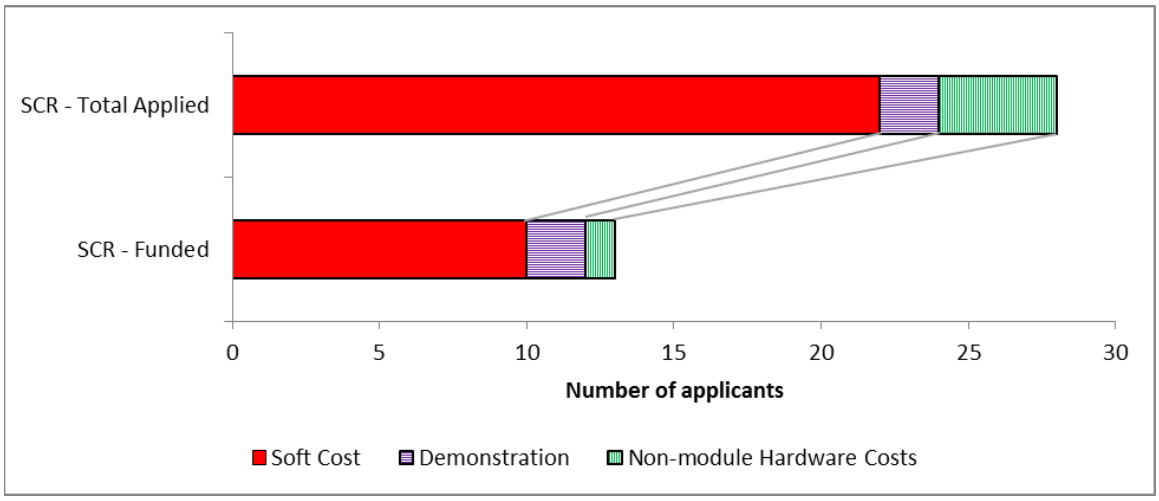
This chapter presents the results of the evaluation, organized by evaluation question. Several of the evaluation questions consider the mix of projects that have been funded by SCR to date; **Figure 3-1** and **Figure 3-2** provide basic context for this discussion, characterizing i) projects that applied for funding from SCR (whether successful or not), and ii) funded projects. The figures show these projects according to the BOS cost category addressed **(Figure 3-1)** and by PON category (**Figure 3-2**). SCR has funded projects addressing all categories of BOS costs, though the program has funded fewer non-module hardware projects than projects targeting each of the "soft costs" categories. Notably, the program received additional applications proposing non-module hardware projects, but did not fund them due to concerns about project quality.

Figure 3-1. SCR Funding Applicants and Recipients by BOS Cost Category Addressed[5]



[5] Applicants addressing more than one BOS cost category were included separately under each category.

Figure 3-2. SCR Project Applicants and Funding Recipients by PON Category



3.1 Evaluation Question 1: Is the SCR Program Targeting Significant Barriers to BOS Cost Reduction?

Based on the review of recent literature and interviews with industry experts, IEc finds that *all* of these five cost categories continue to contribute significantly to BOS costs and that significant opportunities remain for addressing each one. IEc concludes that NYSERDA is targeting significant barriers to BOS cost reduction through its broad-based approach to funding promising projects across all BOS cost categories.

The literature identifies five widely-recognized categories of BOS costs:

- Non-module hardware costs;
- Business costs, including customer acquisition;
- Development costs, including contracting and financing;
- System design and installation costs; and
- Permitting, interconnection, inspection, and zoning costs.[6]

Reflecting its broad-based approach, the SCR program has funded projects that target each of these five categories of BOS costs. **Figure 3-1** above summarizes the projects funded under the first and second rounds of PON 2672 by BOS cost category.

[6] While the literature on BOS costs emphasizes these general cost categories, researchers disagree on how to categorize specific stages in the PV project development process. For example, some researchers have grouped supply chain costs, the costs associated with the procurement of equipment for PV projects, with non-module hardware costs; others have included supply chain costs as a component of business costs.

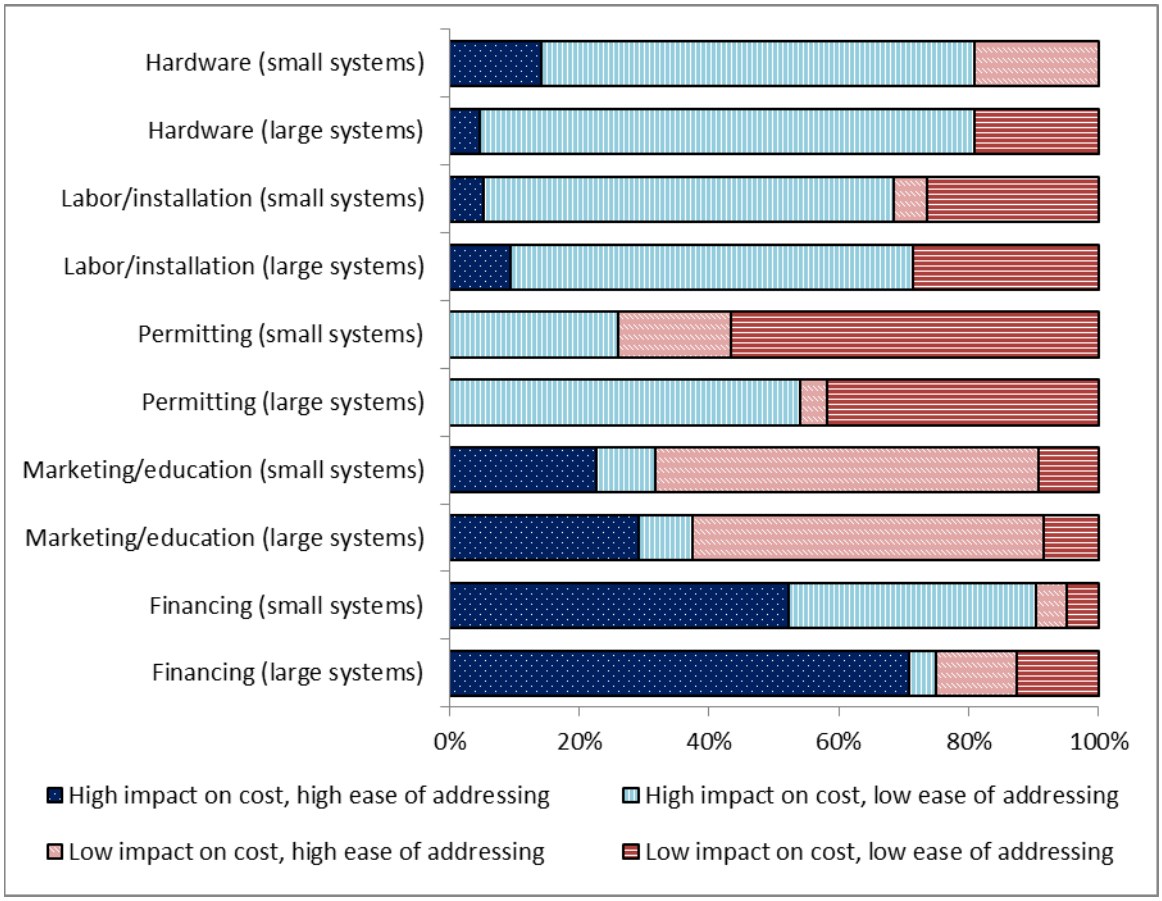
Several recent studies have sought to determine the relative magnitude of individual BOS cost components, thereby providing insight into which of these five cost categories contribute most to total system costs, based on the *direct* expenditures incurred in each category. Most notably, the National Renewable Energy Laboratory (NREL) has published two bottom-up analyses of BOS costs, based on the results of an installer survey and a model of ownership structures for PV systems.[7] **Appendix C** summarizes the results of NREL's second study of BOS cost components, which employed 2012 data. Two high-level observations emerge from the study results. First, the magnitude of direct permitting, interconnection, and inspection (PII) costs and permitting fees is almost inconsequential for residential and commercial systems. Second, business costs associated with PV project development are the largest BOS cost category by overall magnitude of direct cost contributions. Business costs include multiple elements of the project development process: customer acquisition costs, indirect corporate costs, installer profit, and supply chain costs. Note, however, that readers should exercise caution in using these results to understand the primary drivers of BOS costs in New York State specifically.[8]

Stakeholder meetings conducted at the outset of the SCR program complement NREL's national-level data by illuminating the views of industry stakeholders on the most significant opportunities for BOS cost reduction in New York State specifically. As part of the Northeast PV Roundtable Meeting in April 2012, 50 industry experts were asked to sort barriers to BOS cost reduction by their impact on overall system costs (low/high) and the relative ease of addressing each (low/high). Attendees performed this exercise separately for large-scale and small-scale PV systems. **Figure 3-3** summarizes the results of the exercise.

[7] See U.S. DOE, *Benchmarking Non-Hardware Balance of System (Soft) Costs for U.S. Photovoltaic Systems Using a Data-Driven Analysis form PV Installer Survey Results*, by Kristen Ardani, et al, November 2012, and NREL, *Benchmarking Non-Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems, Using a Bottom-Up Approach and Installer Survey – Second Edition*, by Barry Friedman et al, October 2013. In a separate 2013 NREL study, researchers examined in greater detail the contributions to BOS costs from financing, overhead, and profit for third-party-owned systems. Rocky Mountain Institute has also conducted several studies examining the cost contributions from different stages of the installation process. Lawrence Berkeley National Laboratory (LBNL) has estimated cost components in somewhat less detail, relying on actual installed system prices rather than conducting a bottom-up analysis.

[8] Because NREL's study drew from a nationwide sample, the results are heavily influenced by cost drivers in California, the largest PV market in the United States. As one of the interview subjects noted, even a cursory effort to compare costs in New York State to those observed in this study reveals certain discrepancies. IEc reviewed the results from the small number of New York installers included in NREL's study (n=14 for residential installers and n=3 for commercial installers). This review revealed that both residential and commercial PV installations in New York State had larger customer acquisition costs than the national average, and that commercial installations in New York also had larger PII costs than the national averages. Notably, residential installations in New York had lower PII costs than the national average. A bottom-up cost analysis using more extensive New York data would prove invaluable in analyzing BOS cost drivers in a New York-specific context. Notably, one of the SCR-funded projects aims to do just that.

Figure 3-3. Relative Impact and Ease of Addressing BOS Cost Components (Results from Stakeholder Meeting)



The perceived impact and ease of addressing PV financing costs are notable results from this exercise. Some discrepancy exists between the high importance of financing costs and the moderate magnitude of direct financing costs obtained in NREL's bottom-up analysis. This contrast might stem from actual differences between the New York PV market, which was the focus of the roundtable exercise, and the national PV market analyzed in the NREL study; alternatively, this discrepancy might reflect variations in research questions. Stakeholders also noted the high impact of addressing hardware and labor/installation costs, combined with the low ease of addressing these issues; this result holds for both small and large PV installations. Finally, consistent with NREL's cost analysis, SCR stakeholders found permitting to have a low direct impact on system costs.

While these cost component rankings provide useful context, they consider only the direct cost contributions of each of the five types of barriers in isolation. The literature review revealed that specific barriers in each of the five categories often interact with other barriers and contribute to costs in other categories. For instance, as noted above, the direct costs associated with permitting, interconnection, inspection, and zoning processes for residential and small commercial systems are small relative to overall

BOS costs. Direct permitting and interconnection costs are the labor costs and fees associated with regulatory compliance. However, permitting and interconnection are lengthy processes and contribute to the time from project initiation to completion. As a result, these processes can create uncertainty and increase customer acquisition costs, one of the largest components of overall BOS costs. Thus, even if the direct costs associated with permitting and interconnection processes are small, the processes themselves can represent significant barriers. One interviewee suggested that these regulatory processes are the most important barrier that the SCR program can address in subsequent funding rounds. Likewise, over half of survey respondents suggested a project related to streamlining regulatory processes as the best opportunity for reducing BOS costs (excluding their own projects). These additional data sources provide a fuller picture of existing barriers to BOS cost reduction than would be possible from the NREL analysis alone.

By combining data from the literature with insights from the expert interviews, IEc found that all five categories of BOS costs continue to contribute significantly to overall PV system costs. Furthermore, IEc's interview subjects provided examples of promising approaches to reducing costs in all categories, suggesting that meaningful opportunities remain in each area.[9] This finding comports with NYSERDA program staff's understanding at the outset of the SCR program that no "silver bullet" exists for reducing BOS costs by targeting one or two cost categories. Several interviewees also explicitly agreed that NYSERDA should continue its portfolio approach of supporting a range of BOS cost reduction efforts. IEc concludes that NYSERDA's broad-based approach to funding projects across all categories of BOS costs does targets significant barriers to BOS cost reduction, as all cost categories remain significant. However, it is also important to ask whether the program is targeting each of these cost categories *in the right way*. The next section and the final chapter of the report address this issue.

3.2 Evaluation Question 2: Is the SCR Program Targeting Barriers to BOS Cost Reduction that Can Be Effectively Addressed at the State Level?

Through the literature review and key informant interviews, IEc found that each of the five categories of barriers to BOS cost reduction, all of which SCR is currently targeting, can be addressed effectively at the state level. Furthermore, compelling arguments exist for New York State in particular to focus on any of these cost categories, but the specific arguments vary across categories. IEc found several cross-cutting ideas that could be applied to each of the five categories in order to address barriers to BOS cost reduction most effectively:

- **Focusing on a state's particular areas of leadership potential can be useful for developing innovative solutions to BOS costs at the state level;**

[9] Examples of promising approaches identified in the expert interviews are provided in Section 3.6.

- **Considering the maturity of existing solutions to each type of BOS cost can help the program identify areas in which to focus on implementation rather than innovation; and**

- **States often have greater flexibility in developing solutions to BOS costs than do national-level efforts.**

The literature review and key informant interviews broadly suggested that all of the BOS cost categories that the program is currently targeting can be addressed effectively at the state level, and in New York State in particular. However, these sources also suggested that certain approaches are likely to be more effective at reducing particular types of barriers. The interviews and literature review together provided dozens of insights about promising initiatives and especially significant barriers to reducing BOS costs in New York State. These insights are provided later in this report in **Table 3.2**. However, because IEc interviewed experts from diverse fields and tailored its questions to each interviewee's specific area of expertise, these insights were often unique to their particular source and therefore cannot be validated by comparing across multiple sources. Instead, IEc identified three cross-cutting ideas from interview responses and literature related to effective approaches for addressing different types of barriers at the state level. The remainder of this section discusses these three approaches.

3.2.1 Funding Projects Based on State Leadership Potential

First, focusing on a state's particular areas of leadership potential can be useful for developing innovative solutions to BOS costs at the state level. One of the industry experts interviewed noted that it is challenging to identify and fund *truly* innovative cost reduction efforts at the state level, as states risk duplicating or overlapping with innovative projects piloted elsewhere.[10] The interviewee suggested that to support innovative ideas effectively, SCR should focus on cost categories in which New York State's unique resources provide NYSERDA with a leadership position in developing innovative strategies and technologies for reducing BOS costs. The interviewee specifically recommended that the SCR program focus on PV financing and hardware projects, to take advantage of the talent and creativity of New York's financial services industry and the presence of large-scale PV manufacturing in the state.[11] This interviewee mentioned that high-quality project proposals in these areas might stem from renewable energy professionals collaborating with financiers who have not previously specialized in renewable energy or

[10] Here IEc uses the term "innovative" to refer to projects that focus on testing novel ideas in the market, or on testing existing ideas in new and substantively different markets, rather than on implementing already-proven projects at greater scale. A more extensive definition of innovative projects is provided in Section 3.6.

[11] One of the attendees at the Northeast PV Roundtable noted that the Department of Energy (DOE) has funded numerous hardware projects on the national level, and that state and local governments should focus instead on customer acquisition costs, other installer business costs, financing costs, and permitting and interconnection costs that are specific to New York State. In spite of this general recommendation, New York State's potential for leadership in PV module manufacturing, particularly after SolarCity's gigawatt-scale module manufacturing facility begins operating in Buffalo, provides a rationale for New York to explore leadership opportunities related to non-module hardware as well.

from PV hardware component and materials manufacturers collaborating with installers. For cost categories in which New York does not have a strong comparative advantage, several individuals interviewed by IEc emphasized the importance of devoting attention and resources to ensuring that replication effects and market-wide implementation actually occur. For example, one interviewee suggested that NYSERDA could play a crucial role in rationalizing local efforts to streamline permitting processes by developing one centralized permitting platform that is fast, intuitive, and available to all users in the state.[12] Furthermore, multiple interview subjects noted that NYSERDA should devote greater time and attention to developing information dissemination channels through which innovative practices could spread efficiently through the market. Several interviewees commented that successful information dissemination channels often depend on careful configuration more than any particular "breakthrough technology" given the challenge of connecting individuals and organizations at the local level. One interview subject also noted that successful networks are well-configured and depend on a coordinated effort to bring the right people together in a manner that is attentive to particular regional needs.

Other interviewees emphasized the importance of network formation and relationship development for disseminating information and encouraging the adoption of new practices and technologies. Another interviewee mentioned several examples of projects where organizations have developed strong, long-term relationships with jurisdictions to streamline solar processes, such as the newly institutionalized solar ombudsman in New York City and the Sustainable Westchester group. However, these major players generally work on scattered projects across the state, with no centralizing force to support a statewide network, ensure that these major players are communicating with each other, and prevent duplication of effort. The interviewee suggested that NYSERDA could play an important role in connecting the individuals and organizations across the state that have developed these relationships in their respective local areas. In this vein, multiple interviewees implied that when a project's long-term goal is not to test out a new idea but rather to adapt an idea to a new context, NYSERDA should not assume that the mechanisms for broader market uptake are already in place.

3.2.2 Funding Projects Based on Maturity of Existing BOS Solutions

Second, differences in the maturity of existing solutions have implications for the effectiveness of efforts to reduce BOS costs. Multiple interviewees suggested that existing efforts to reduce BOS costs are better developed and tested for some cost components than for others. For example, one interviewee noted that relatively few approaches to PV financing have been tested in the market, so financing mechanisms for PV projects are relatively immature. One interview subject noted that the solar lease helped to increase

[12] The interviewee suggested that this centralized permitting portal would further develop the unified solar permit recently launched in New York State. The portal would supplant rather than supplement local permitting applications, allow users to access and submit permitting applications electronically, and provide additional services such as information about application status.

customers' comfort with financial products for solar PV systems and that now the market needs to test out a wider range of interesting products. Thus, solar financing is an area where SCR's current approach of funding a wide variety of projects could be particularly useful in exploring many new options. Conversely, extensive efforts to reduce permitting, interconnection, and other local regulatory barriers have been tested over the last four years, both in New York State and nationwide.[13] One interviewee noted that there are now "about 800 different ways to reduce permitting and interconnection costs." Therefore, rather than continuing to develop and pilot new solutions to permitting costs, the interviewee suggested that SCR "pick one and go with it," focusing more on adapting an existing idea to the New York State market and implementing the chosen approach on a broader scale.

Another interview subject expressed the opinion that during the initial launch of NYSERDA's funding for BOS cost reduction, the prevailing attitude was "let's put this [funding opportunity] out and see what comes back." However, this interviewee explained, efforts to work with jurisdictions, code officials, and certain other groups in New York State are now sufficiently mature that NYSERDA should "talk more about what the vision is for New York State" and ask potential applicants to "fit into that vision," rather than simply asking potential projects to "give us all your best ideas." In these areas where more developed solutions already exist, the interviewee suggested that NYSERDA should think more from a "future-state perspective," determine how best to reach that future-state, explicitly communicate that vision to applicants, and fund projects accordingly.

This distinction between more and less mature approaches to reducing BOS costs also exists *within* certain cost categories. Multiple interviewees noted that shared (community) solar programs currently face more barriers than group purchasing programs do. One interview subject suggested that most barriers to group purchasing programs have now been addressed; what remains is the work of actually organizing solarizing programs on a large scale. Shared solar, by contrast, is "still sprouting up," and issues such as the relative involvement of utilities versus developers and specific customer acquisition strategies for these types of projects have yet to be resolved. These differences in the maturity of shared solar and group purchasing in New York State will affect the success of NYSERDA's efforts to reduce customer acquisition costs by supporting these types of projects.

3.2.3 Funding Projects Based on Advantages of State-Level Programs

Several interviewees noted that the flexibility of state-level efforts to reduce BOS costs can often provide an advantage that national programs do not have. One interviewee mentioned PACE financing and the New

[13] In their comparison of PV prices in the U.S. versus Germany, Seel, Barbose, and Wiser noted: "Since the assessment of U.S. permitting time requirements in 2010 (Ardani et al., 2012), substantial efforts have been made across many jurisdictions to streamline processes and make reporting requirements more transparent. See Galen L. Barbose, Joachim Seel, and Ryan H. Wiser, "An Analysis of Residential PV System Price Differences Between the United States and Germany," Energy Policy 69: June 2014, 216-226.

York Green Bank as examples of cost reduction efforts that are viable at the state level; another highlighted community solar and the surrounding regulatory regime. Interview subjects also commented that effective state-level efforts can play a seminal role in achieving low-cost solar nationwide; one interviewee emphasized that market developments in New York State, with six percent of the U.S. population, will likely have national impacts.

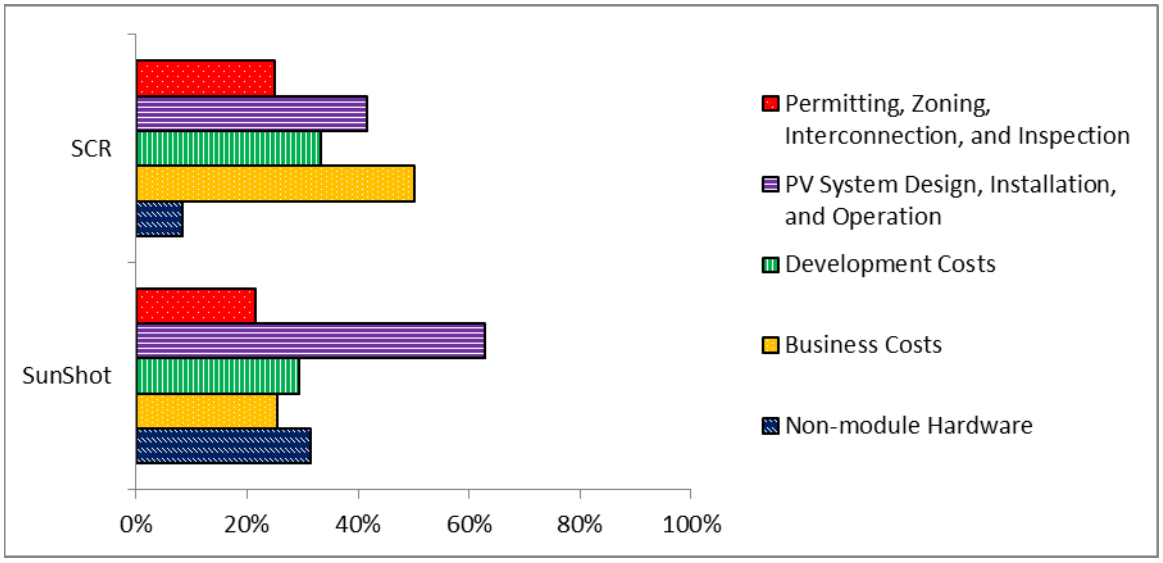
3.3 Evaluation Question 3: Is the SCR Program Funding Projects in a Manner that Avoids Duplicating Efforts of Other Programs?

To evaluate whether SCR has avoided duplicating efforts with similar programs, the evaluation focused primarily on DOE's SunShot Initiative, the largest program in the U.S. addressing BOS costs and the clearest point of comparison with SCR. Since both programs fund a broad range of projects, it is not feasible for SCR to focus on "non-SunShot" categories of projects. Overall, however, IEc finds that SCR is not duplicating SunShot's efforts. Across 51 SunShot-funded projects and 12 SCR-funded projects, four organizations have received funding from both SCR and SunShot; however, project features and inter-program coordination limited overlap in each case.

IEc found that both programs use a broad-based approach to project selection, though SCR has funded only one hardware-related project applicant.[14] As **Figure 3-4** shows, SunShot does not concentrate funding in one area; thus, there is room for SCR to address the same broad cost areas without funding overlapping projects. In and of itself, this does not suggest that SCR *should* take a broad-based approach, only that it *can* do so; that is, it is not necessary or feasible for SCR to avoid entire categories of projects to avoid duplicating SunShot funding. In fact, it could be beneficial for SCR to adapt the approaches pioneered through the national SunShot Initiative to New York State-specific contexts. SCR has deliberately funded several projects initially developed through SunShot in order to further develop and implement those ideas in New York State. One interviewee was complimentary of this practice, calling it "huge leverage."

[14] SCR has struggled to attract hardware applications, and has funded only one of four hardware-related projects that applied in rounds one and two.

Figure 3-4. SCR and SunShot projects by BOS Cost Reduction Barrier Addressed



IEc identified four organizations that received funding from both SunShot and SCR, but did not find significant duplication at the project level. The funded organizations and projects were:

- **Sunvestment Group.** SCR funded Sunvestment Group's community power purchase agreement (under both rounds of the PON) before SunShot did.
- **Energy Sage.** SCR and SunShot funded Energy Sage's reverse auction marketplace at roughly the same time. SCR included a DOE representative on the Technical Evaluation Panel (TEP) for this funding around, so funding decisions were coordinated across the two programs.
- **Clean Energy Collective.** SCR and SunShot supported substantially different projects from this organization – an online National Community Solar platform under SunShot, and a New York-based community solar demonstration project under SCR.
- **Solar Census.** SCR funded a project supporting Solar Census's shade tool after SunShot did, but at a different project stage. SunShot funded prototype development, and SCR funded later-stage product development and New York-specific implementation. Documentation indicates that SCR was aware of SunShot's prior support and SCR decided that this project did not represent redundant funding.

IEc also compared SunShot- and SCR-funded projects undertaken by different companies and organizations, but with potentially overlapping cost reduction efforts. Numerous SCR-funded projects addressed the same types of issues and sometimes used similar approaches as previously-funded SunShot projects. However, in IEc's judgment, the SCR projects had key differentiating characteristics in each case. As a result, none of these were so similar as to constitute an inefficient duplication of effort. **Appendix A** describes SCR-funded projects in detail; **Appendix D** provides a complete list of in-progress projects

funded by SunShot**. Appendix E** summarizes the project-by-project comparison that investigated areas of potential overlap.

Aside from avoiding duplicating efforts, IEc asked how SCR might best leverage the efforts of DOE and the SunShot Initiative. In response, one interviewee noted the importance of ensuring that state programs are "plugged into national work." To that end, one interviewee mentioned that effective networks are useful not only to ensure that a program achieves the desired replication and spillover effects, but also to ensure that the program itself leverages rather than duplicates existing efforts in the market. Involving representatives from other programs in funding decisions is also an effective method of coordinating between programs; for example, the TEP for SCR's first funding round included a representative from DOE.

3.4 Evaluation Question 4: Is the Scale of SCR-Funded Projects Appropriate for Generating Sustained Cost Reductions and/or Project Replication?

To address this evaluation question, IEc surveyed potential applicants about appropriate funding levels, benchmarked the size of SCR's funding awards with those of SunShot, and solicited interview subjects' views on the project scale necessary to achieve market impacts. Since these methods yielded conflicting results, the information developed for this evaluation does not fully determine whether the scale of SCR-funded projects is sufficient to attract high-quality applicants and achieve sustained cost reductions and/or project replication.

- **Survey respondents generally indicate that current levels of funding are sufficient, particularly for soft cost projects. The small set of survey respondents indicating that funding of $1.5 million or greater would make them more likely to apply for funding in the future consisted entirely of demonstration and hardware projects.**
- **IEc also found that SCR's average funding is higher than SunShot's in hardware and demonstration projects, but substantially lower in soft costs.**
- **Interviewees generally agreed that SCR's current funding levels are sufficient, though multiple interviewees expressed skepticism about the potential of single demonstration projects to achieve lasting market impacts. Interviewees recommend more extensive (i.e., repeated) projects (demonstration projects) and a larger number of participants (hardware projects) with higher levels of funding (both).**

Given the divergent findings of these evaluation methods and the relatively small number of survey respondents and interviewees, IEc recommends further analysis on project scale.

In this evaluation, IEc addresses this question in part by examining three related indicators:

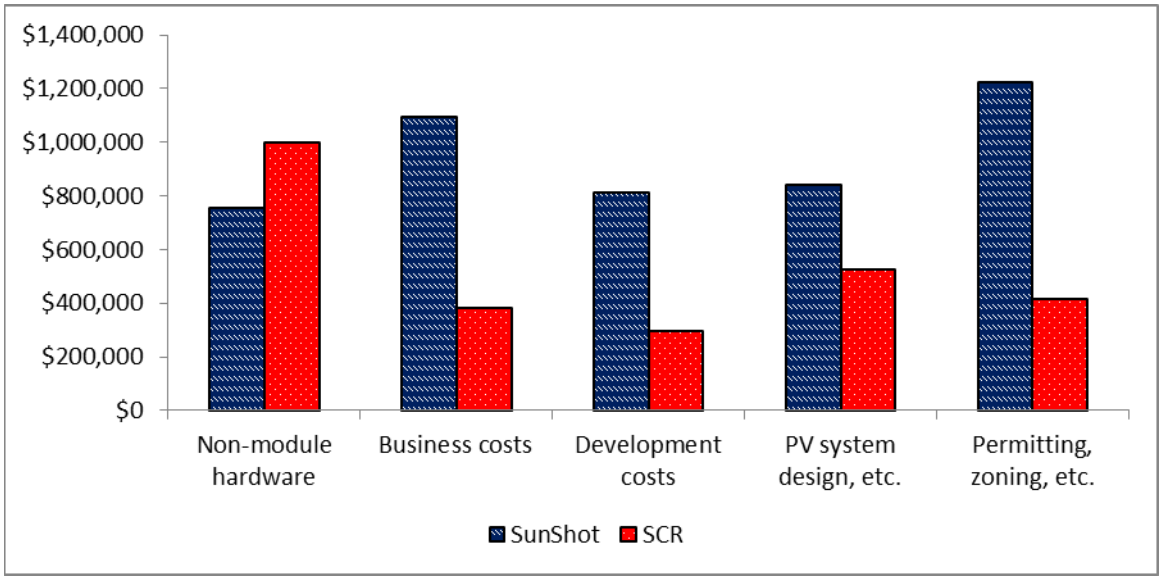
- How the scale of SCR's funding awards compares to SunShot Initiative awards;
- Feedback from survey respondents on the appropriateness of SCR's funding awards for encouraging potential applicants to apply for funding; and
- Information from interviewees on the appropriateness of SCR's funding awards for generating sustained cost reductions and/or project replication and spillover effects.

The results from these lines of inquiry point in different directions. As a result, while SCR could potentially benefit from larger hardware and demonstration projects, IEc cannot reach a firm conclusion regarding whether the scale of SCR-funded projects is appropriately calibrated to specific project types so as to attract high-quality applicants. A final determination of whether SCR-funded projects are sufficiently large to achieve sustained cost reductions and/or replication will require sufficient elapsed time to assess their long-term effects.

3.4.1 Funding Award Levels for Solar Cost Reduction vs. the SunShot Initiative

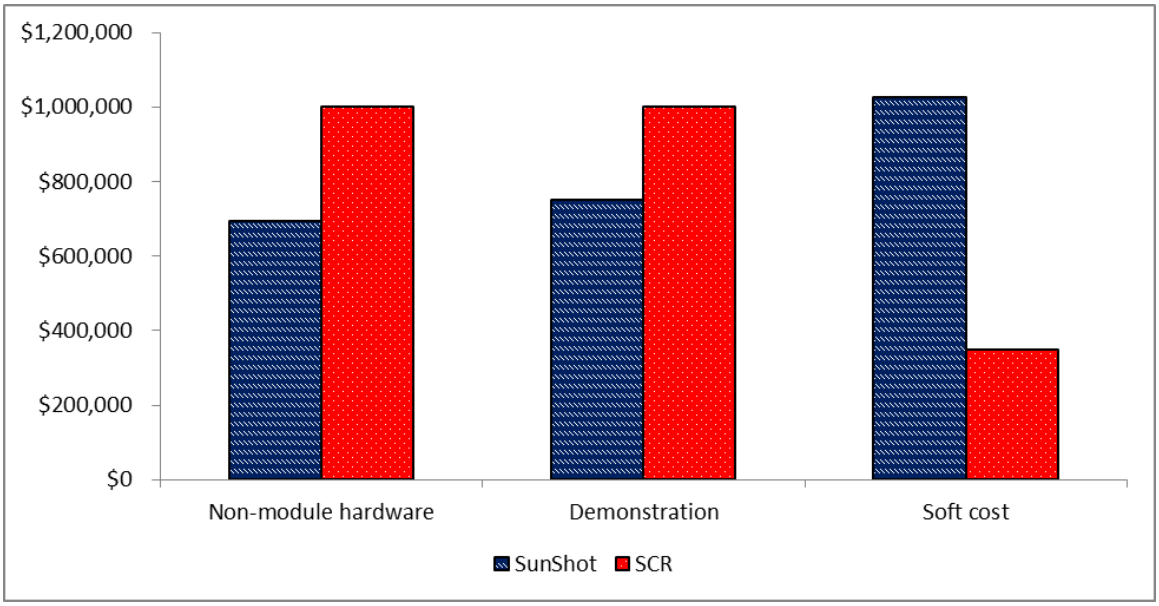
IEc first compared the scale of funding awards for SCR projects to those awarded by SunShot. Projects funded by SCR are limited to a maximum of $1,000,000 in NYSERDA funding for demonstration projects, and $500,000 for all other projects. Projects funded under the first two rounds of PON 2672 received an average of $458,500. In comparison, projects currently in progress funded by the SunShot Initiative under Incubators 6 through 10 averaged funding roughly twice as high, at $969,456. This funding pattern is fairly consistent with funding levels for projects addressing different types of cost categories (**Figure 3-5**). SCR's single hardware project is funded at a higher level than average SunShot hardware projects, but IEc cannot draw general conclusions from a single project.

Figure 3-5. Average Funding Award by Cost Category Addressed



When viewed by PON category a different pattern emerges (**Figure 3-6)**. SCR's funding levels are somewhat higher on average than Sunshot's for both hardware and demonstration projects, whereas SCR's funding levels are substantially lower (about 1/3 of SunShot's) for soft cost projects.[15]

Figure 3-6. Average Funding Award by PON Category



IEc also compared SCR funding levels to funding requests from rejected SCR applicants. **Figure 3-7** shows the comparison by PON category; **Figure 3-8** shows the breakdown by BOS category. For hardware projects and projects addressing PV system design, installation, and operation, successful applicants sought and were awarded far more funding than unsuccessful applicants sought; in other cases the comparison was more even. It is worth noting that the average funding level for demonstration projects was $1,000,000, more than double the overall average (there were no unsuccessful applicants for demonstration projects). In short, at least for certain project types, larger projects were more likely to be awarded funding; however, sample sizes were extremely small. While not conclusive, this suggests that, at least in the opinion of the TEP evaluating proposals, these larger projects were more viable, more likely to have a larger impact, or more likely to have a long-term impact in the New York market.

These comparisons do not demonstrate on their own that SCR's funding levels are too low to have long-term impacts, but one possible inference is that the program may be better served by pursuing larger soft cost projects.[16] Further study is needed to reach a more definitive conclusion. If a subsequent impact

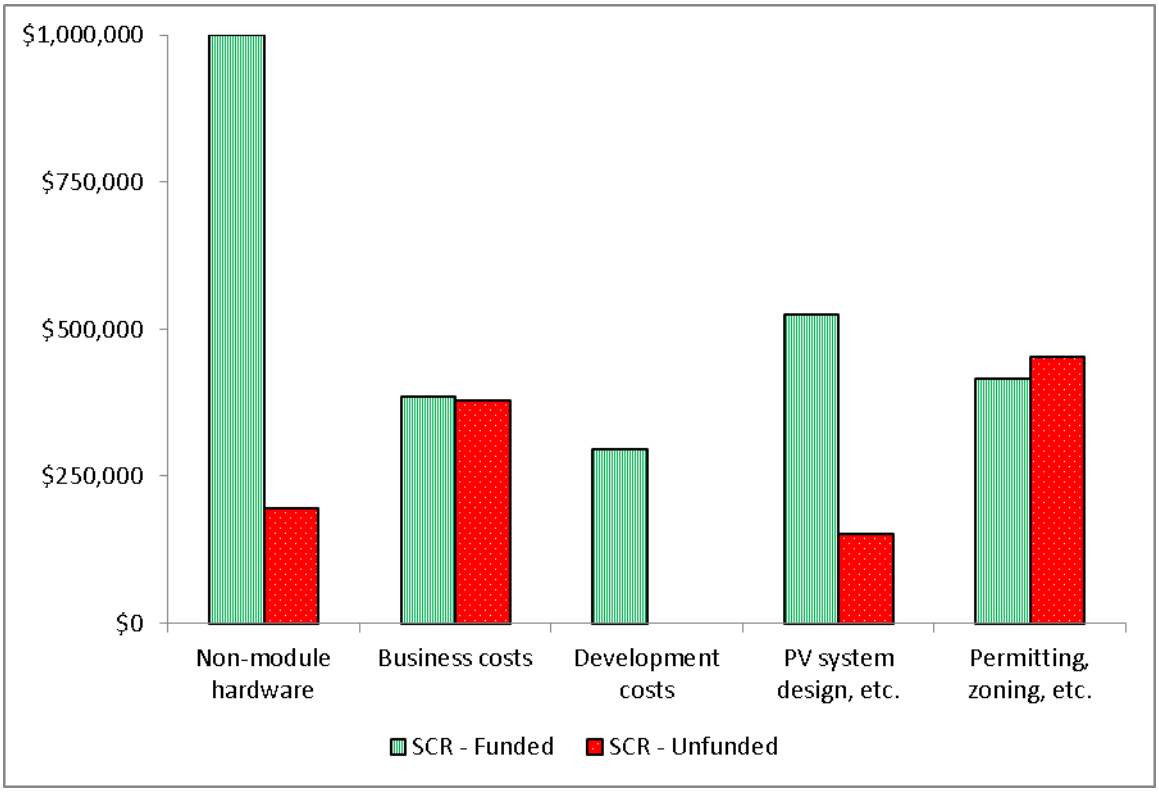
[15] Soft costs are non-hardware costs such as business costs; development costs; system design and engineering; permitting, interconnection, and inspection; installation labor; and operation and maintenance.

[16] Alternative conclusions are also possible. It could simply be a coincidence that NYSERDA did not choose the smaller projects for funding, especially given the relatively small number of applicants (29 in total). NYSERDA could

Continued…

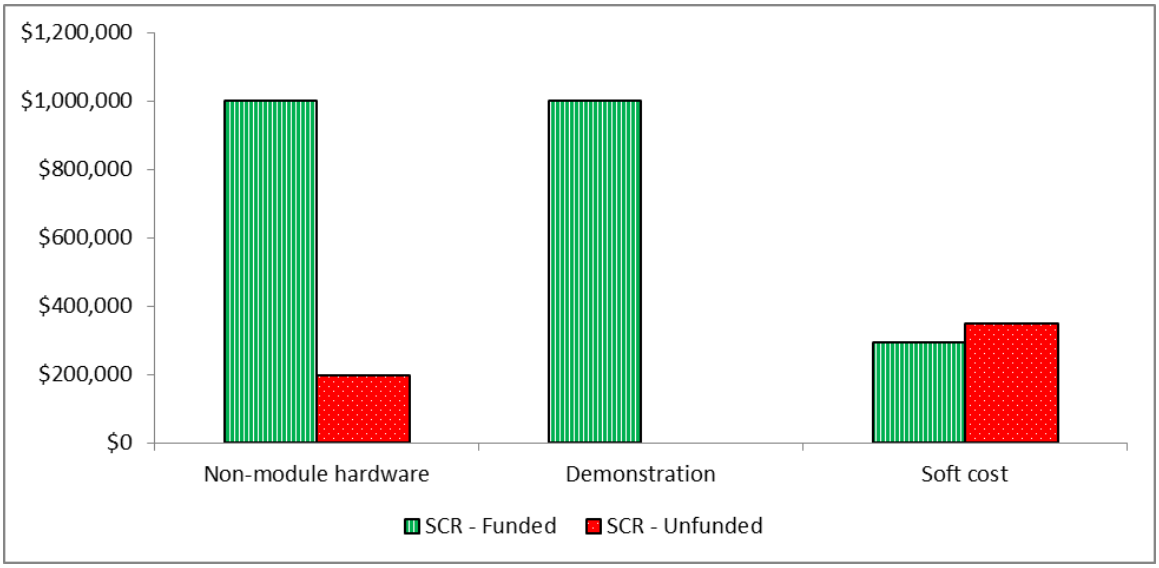
evaluation demonstrates that significant barriers to BOS cost reduction persist in New York, then a more in-depth comparison to the impacts of successful projects funded by SunShot or other comparable programs would be useful to examine funding levels or other characteristics that may affect outcomes.

Figure 3-7. Average Funding Awards/Requests by Barrier Addressed, Funded vs. Unfunded Projects



be favoring larger projects even though the smaller projects present strong opportunities for BOS cost reduction. Because IEc cannot make a clear determination as to which of these effects may be occurring, IEc have not made a firm recommendation regarding funding award levels at this time.

Figure 3-8. Average Funding Awards/Requests by PON Category, Funded vs. Unfunded Projects

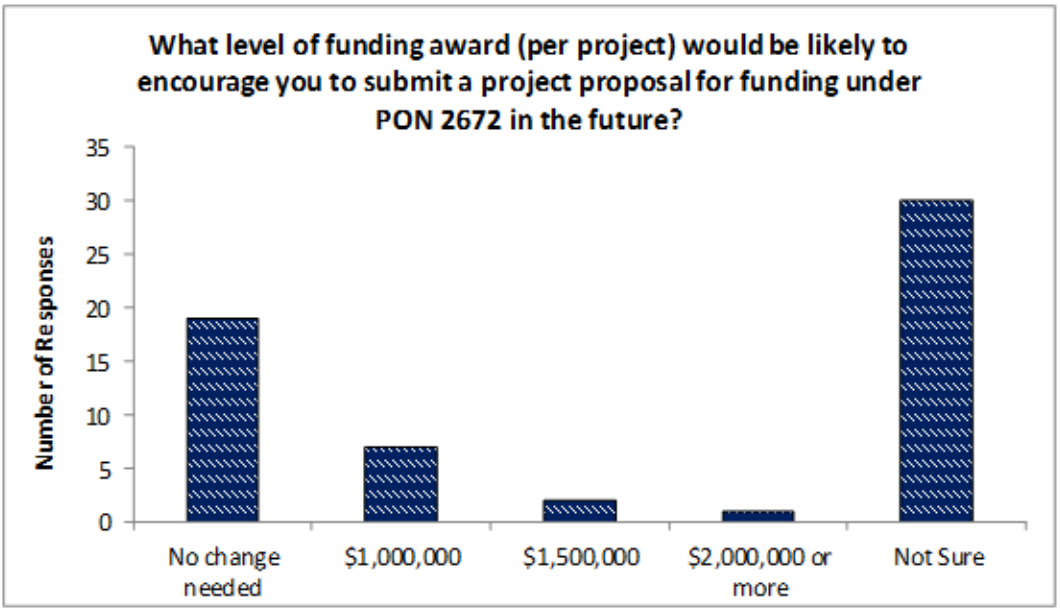


3.4.2 Feedback from Survey Respondents on Funding Levels

Second, IEc's survey asked solar PV market participants what level of project funding would be likely to encourage them to submit a project proposal for funding in the future, assuming respondents were not bound by SCR's current funding caps. **Figure 3-9** summarizes their responses.

- The results suggest that higher funding awards might not have an appreciable impact on increasing the number of project applications among survey respondents. Half of respondents could not estimate the level of funding needed to encourage them to apply, while most of the rest indicated that no change would be needed. Only 10 out of 59 respondents recommended a higher funding level, with seven suggesting a cap of $1 million, two recommending $1.5 million, and one seeking $2 million or more. The three respondents seeking the highest dollar amounts included two potential hardware projects and one demonstration project.
- This is consistent with responses to another survey question, in which only 10 percent of respondents (six individuals) identified insufficient funding as a somewhat or very important factor in the decision not to apply for NYSERDA funding (i.e., a 4 or 5 rating on a 5-point scale).
- Note that these responses do not provide insight into the relative quality of potential projects at different funding levels, nor do they provide any information regarding the views of non-respondents, including potential "nontraditional" applicants outside of the survey population.

Figure 3-9. Survey Responses on Funding Levels



3.4.3 Feedback from Interviewees on Funding Levels

Finally, IEc's key informant interviews examined whether the scale of SCR-funded projects was appropriate for generating sustained cost reductions and/or project replication and spillover effects. IEc provided interviewees with information on SCR's funding levels.

In general, interviewees believed that the current funding levels were sufficient, but this was not true for all project categories. For demonstration projects in particular, interviewees expressed skepticism that "one-off" projects would lead to replication or spillover effects, stating that benefits would be likely to accrue only to the direct project participants. Several interviewees commented that demonstration projects are expensive and must be truly innovative to ensure that the program is doing more than "just buying another system for a town somewhere." One interviewee recommended that NYSERDA increase its funding level and support initial pilot projects to be followed by a series of similar demonstrations, applying lessons learned from the initial project and starting the replication process. Similarly, another interviewee recommended that demonstration projects be designed with the provision that funding recipients are expected to continue to engage in similar projects without NYSERDA funding; this approach would accomplish the same aim without requiring increased funding from NYSERDA.

Interviewees also expressed skepticism regarding the potential for sustained cost reductions or spillover effects on hardware projects at SCR's current funding level. One interviewee recommended that rather than funding a single entity at the relatively modest level of $500,000, NYSERDA should fund a consortium of manufacturers to address a major issue with about $5,000,000. The respondent felt that the consortium

approach would be an important mechanism to disseminate new technologies and best practices that would otherwise be held by a single entity, which limits opportunities for broader market uptake.

For soft cost projects, interviewees emphasized that significant resources are often required for statewide *implementation* of best practices. One interviewee suggested that the funding levels that SCR currently offers for soft cost projects are sufficient to fund a project team to prove a concept in a given region, but additional resources might be required to successfully implement that concept more broadly. Several interviewees suggested that software projects could address soft costs in a cost-effective manner on a larger scale. For example, while it might be cost prohibitive for municipalities to develop their own online permitting software, the same result of streamlining the permitting process could be achieved by developing a customizable software package for which municipalities can purchase a license.

3.5 Evaluation Question 5: What Barriers Hinder Potential Applicants from Applying for Program Funding, and How Can They Be Reduced?

Based on feedback from industry experts and potential applicants, IEc found that SCR's current marketing channels are generally effective in raising awareness of funding opportunities. IEc also assessed barriers to applying for funding once potential applicants become aware of opportunities.

- **Survey respondents identified NYSERDA's cost sharing requirements (for all projects) and cost recoupment requirements (for product development projects with products reaching commercialization) as the most significant barriers to applying for funding.**
- **Survey respondents with potential hardware projects, a category in which SCR has struggled to attract qualified applicants, reported that the cost recoupment policy was especially onerous, with 50 percent calling it a very or somewhat important consideration.**
- **During IEc's key informant interviews, several industry experts also mentioned that certain types of applicants, such as non-profits and municipalities, might find cost sharing to be especially burdensome. However, one industry expert interviewed also noted that cost sharing requirements can enable larger-scale project impacts.**

IEc assessed the effectiveness of SCR's current marketing channels to determine whether potential applicants are made aware of program funding opportunities. The consensus among interviewees is that market participants are aware of NYSERDA as a source of funding, and those with potential projects will monitor the NYSERDA website for funding announcements. Tellingly, survey respondents most consistently listed the NYSERDA website as a source of industry information.

One interviewee suggested that SCR might benefit from reaching out to individuals and companies that have not previously operated in the solar industry but that might have innovative ideas, such as finance professionals (through finance industry publications and conferences) or software developers (at "hackathons," events in which computer programmers work intensively to develop new software applications over a limited time period). However, that individual did not provide any more specific

suggestions for marketing channels to reach these nontraditional solar market actors. The same interviewee indicated that NYSERDA could also benefit from increased outreach efforts aimed at code officials, architects, and engineers, as well as more consistent (and coordinated) communications with local jurisdictions. These suggestions are broadly consistent with the findings about effective project selection outlined elsewhere in this report.

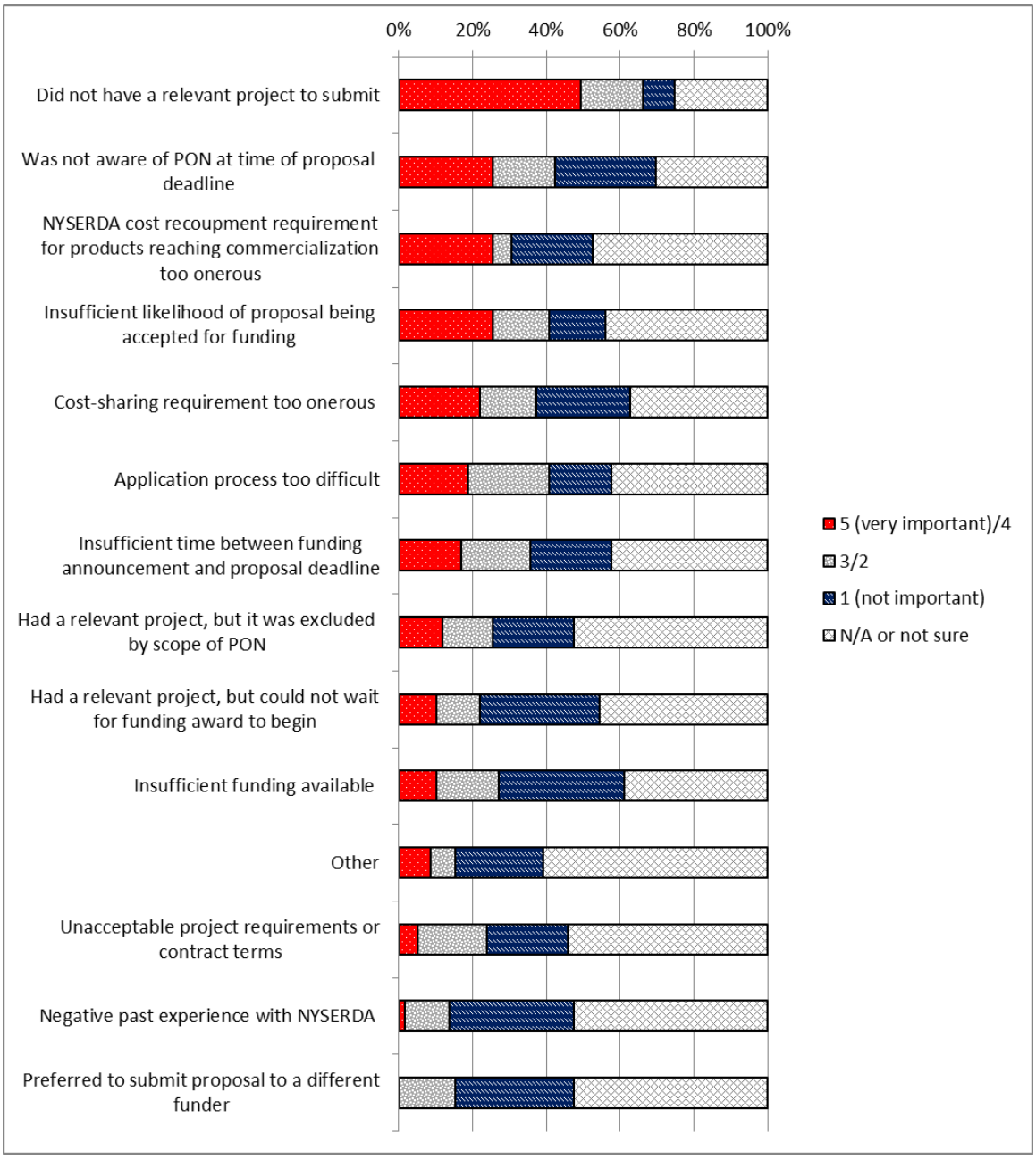
Interviewees and survey respondents did provide a few concrete suggestions for additional means of communication and outreach more generally. **Table 3-1** summarizes these suggestions. Note that none of the individual communications channels were proposed by more than a handful of individuals.

Table 3-1. Suggested Channels for PON Marketing

Suggested by two or more respondents	Suggested by one respondent
Dsireusa.org website	Alliance for Solar Choice
Greentech Media	Bloomberg
IAEI code meetings and other outreach to code officials, architects, and PEs	Building Performance Institute (BPI)
Local governments	Clean Energy States Alliance
Renewable Energy World	CleanTechnica
State SEIA newsletter	[New York State] Contract Reporter
SolarPro Magazine	Department of Energy
U.S. Green Building Council (including continuing education sessions at local USGBC offices)	EnerG
	EQ Research
	Facebook
	Home Power Magazine
	National League of Cities
	Navigant Research
	Nextstar
	PV America conference
	PV Magazine
	Solar Roundup
	Sustainability Directors Network
	Sustainable Tompkins
	Syracuse Center of Excellence
	Twitter
	U.S. Conference of Mayors

In addition to considering whether the program effectively markets its funding opportunities, IEc also evaluated barriers hindering potential applicants from applying for funding once they are aware of the funding opportunity. IEc asked survey respondents, drawn from the population of e-mail recipients of SCR's PON announcement, to rate several possible barriers to applying for funding on a scale of 1 (not at all important) to 5 (very important). **Figure 3-10** shows survey respondents' reasons for not submitting a funding proposal under prior rounds of PON 2672. While no single barrier dominated the responses, approximately 25 percent of respondents labeled "Cost-sharing requirements too onerous" and "NYSERDA cost recoupment for products reaching commercialization too onerous" as important. Half of respondents indicated that "Did not have a relevant project to submit" was an important reason for their not applying for funding; it is not clear whether these respondents did not have any projects related to BOS cost reduction or whether the PON did not convey to them that their projects might be relevant. Similarly, 25 percent of respondents listed "Was not aware of PON at time of proposal deadline" as an important consideration, but given that all of the survey respondents received SCR's PON announcement, this likely represents faulty recollection by the survey takers. The only other option listed as important by more than 25 percent of survey respondents was "Insufficient likelihood of proposal being accepted for funding."

Figure 3-10. Relative Importance of Factors for Survey Respondents' Decision Not to Submit a Funding Proposal under PON 2672[17]



As discussed in Section 3.3, to date SCR has funded only one non-module hardware effort, making this an underrepresented category in the program's portfolio. Notably, half of the eight survey respondents who had a potential hardware project noted that NYSERDA's cost recoupment requirement for projects

[17] "Other" barriers listed as important included: quickly changing industry economics with respect to design of proposed project; company technical staff and proposal writer did not have enough time to complete proposal; and PON too narrowly designed.

reaching commercialization was too onerous. Apart from this category, respondents with hardware projects cited barriers as important at the same approximate rates as the full population.

Interviewees provided additional insight into NYSERDA's cost-sharing requirement. One expert noted that the requirement would be problematic for non-profit organizations, as it can be difficult to find the other sources of funding needed to meet the requirement. Another stated that cost sharing would not be a problem for installers. Several interviewees agreed that SCR might want to consider the *types of applicants* that it seeks to attract in determining appropriate cost-sharing requirements; in the first two SCR funding rounds, the *type of project* was the primary driver of cost-sharing amounts. An interviewee noted that the SunShot Initiative has achieved successful outcomes with commercial software projects and 50 percent cost-share requirements. On the other hand, SunShot has lowered cost-share requirements to zero in certain cases for non-profit applicants, recognizing that these entities are not profit-motivated and might encounter greater difficulties in leveraging other sources of capital. For local government applicants, SunShot has traditionally required some cost share; DOE's Rooftop Solar Challenge, for example, included a 20 percent cost-sharing requirement for municipalities. At the same time, interviewees also noted that leveraging program funds through cost-share requirements can be an important determinant of successful program outcomes. One interviewee thought that SCR's funding levels would generally be adequate as seed money for cost reduction efforts but could serve as a "huge enabler" if used to leverage other resources.

3.6 Evaluation Question 6: Are There Innovative Approaches to Reducing BOS Costs that the SCR Program Should Be Aware of When Marketing the PON?

Within the framework of the broader findings presented earlier in this report and the recommendations in Chapter 4, IEc has gathered examples of innovative approaches to reducing BOS costs through its expert interviews, survey of potential applicants, and review of SunShot and other programs' materials. Examples include: funding software programs to accelerate customer acquisition processes; using "pay for success" program structures to address multi-faceted cost reduction challenges; and adopting the best practices of successful networks and associations in the industry. These ideas for promising projects are offered here for SCR's consideration.

IEc reviewed the available information describing SunShot projects to identify innovative approaches to reducing BOS costs. IEc used the following criteria to classify projects as "innovative":

- Based on the literature review, key informant interviews, and IEc's knowledge of the solar PV market, the project's approach to BOS cost reduction appears not to have been widely attempted or adopted to date, and/or the project's approach was specifically identified by one or more of these information sources as being underutilized and potentially significant;
- The project appears substantially different from any of the projects currently funded by SCR;
- The project appears to have the potential for substantial cost reductions;

- The project's anticipated innovations could be widely adopted in the market; and
- The project's focus is within the scope of SCR's efforts (i.e., excluding concentrated solar power or other unrelated technologies).

In two cases, IEc also identified projects as innovative because they addressed issues that are likely to be increasingly important to NYSERDA in the future due to New York's Reforming the Energy Vision (REV) process.

Using these criteria, IEc identified 10 out of 51 current SunShot projects (20 percent) as innovative (**Appendix F)**. All five categories of BOS cost reduction barriers and all three PON categories were represented, reinforcing the findings from Evaluation Questions 1 and 2 that potential remains for substantial cost reductions across the entire range of BOS cost components. IEc's classification of innovative projects is also broadly consistent with the project selection recommendations set forth in Section 3.2, although, as noted there, it may be more important for SCR to promote innovations in certain areas than in others.

IEc's classification of projects is necessarily subjective, a difficulty compounded by the limited information available for these projects within the time and resource constraints of this evaluation (IEc was not able to solicit input from outside experts regarding these projects). **Appendix D** provides a complete list of the projects currently being funded by SunShot. Readers may also wish to review **Appendix A**, which describes SCR-funded projects, and **Appendix E**, which examines potential overlap between SCR and SunShot projects.

In addition to reviewing ongoing projects, IEc developed a survey question to elicit descriptions of potential projects for which respondents might apply for SCR funding in the future. A complete list of responses is included in the summary of responses to open-ended survey questions and has been provided to NYSERDA, but is omitted here to preserve confidentiality. While respondents provided only a very brief description of their project ideas, two hardware projects met IEc's criteria as innovative and were noted in the submission to NYSERDA.

IEc also integrated findings from the expert interviews and literature on promising approaches and innovative ideas for reducing BOS costs in each category. These insights are detailed in **Table 3-2** below.

Table 3-2. Feedback from Interviewees and Insights from Literature on Promising Approaches for Reducing BOS Costs in New York State

Non-Module Hardware	

Promising Approaches Identified in Interviews and Literature	• Projects that leverage the presence of solar manufacturers in New York State, especially projects that encourage manufacturers to work collaboratively with installers and others involved in the PV project development process.
	• Projects that better integrate power electronics into the PV system to drive overall system efficiencies.
	  • Multiple studies suggested that plug-and-play systems could have a dramatic impact on PV costs, though such systems are not yet commercially available. Plug-and-play systems would also reduce electrical labor requirements.
	• Projects that create labor efficiencies, especially by standardizing hardware components and/or by reducing the amount of electrical labor required for installation.
	• Projects that reduce the hardware required for a PV installation (e.g., the size of the racking system, number of junction boxes, or amount of wiring).
	  • One study named integrated racking systems as the single most significant opportunity to reduce costs by removing non-value-add hardware components, and noted that currently available integrated rail-less racking solutions decrease overall installation time. One of SCR's current projects demonstrates a rackless thin-film PV system.
	  • Lighter systems can be installed on a wider range of roofs. The PV Manufacturing Consortium at SUNY Polytechnic Institute is studying the structural weight that can be borne by different roof types.

Lower Priority Approaches	• An interviewee noted that the power electronics market is already quite saturated, and power electronics as individual hardware components are already quite inexpensive. • Cost analyses in the literature indicate that direct system design costs are a much smaller component of BOS costs than are direct installation labor costs, so standardization efforts targeting system design may not achieve the same magnitude of cost reduction as efforts targeting efficiencies in installation labor.
Business Costs, including Customer Acquisition Costs	

Promising Approaches Identified in Interviews and Literature	• Projects that target customer acquisition costs to realize significant cost reductions.
	  • An interviewee mentioned behavioral science programs as a new frontier for understanding issues surrounding customer acquisition.
	• Projects that target underserved customer groups such as renters, other individuals without access to roofs suitable for solar installations, and public and non-profit institutions.
	  • An interviewee suggested that NYSERDA should help to develop a standardized RFP for non-profit and government sector institutions seeking to procure solar PV systems, analogous to the state's procurement process for vehicles. The aggregated solar procurement for New York State schools participating in the K-Solar program should help to realize process efficiencies and other economies of scale.
	  • An interviewee suggested that the market could support projects that seamlessly connect customers unable to install to PV systems on their own roofs to shared (community) solar opportunities. Another interviewee predicted that developer-led shared solar projects may be more innovative than utility-led efforts, though utility support would be critical in both instances. This interviewee noted that barriers to the scale-up of shared solar projects are greater than barriers to the scale-up of group purchasing projects in New York State. Innovative financing options and continued consumer education and engagement could help expand the shared solar market. Regulatory barriers to the continued expansion of shared solar markets in New York State also persist.
	  • An interviewee suggested that shared solar projects in the context of microgrids represent an emerging frontier. Another suggested that even as dominant models of shared solar projects emerge across the country, there will still be opportunity for niche products.
	• Areas which SunShot's BOS Cost Reduction Roadmap identified as requiring further intervention include: remote assessment plus on-location bid prep on initial site visit, lead qualification and generation programs, referral programs, and consumer-awareness campaigns (for residential systems), as well as innovative financing to open new markets coupled with customer acquisition advancements (for commercial systems).

	• Several interviewees particularly highlighted software programs as a promising and cost-effective approach for driving efficiencies in customer acquisition processes. One interviewee noted that there are still only a few companies in the U.S. working to develop these types of software programs.
Lower Priority Approaches	• Cost analyses in the literature indicate that system design costs are a much less important component of business costs than are customer acquisition costs. • Since solarize programs are already sufficiently developed in the market, one-off tests or pilot projects have limited utility. It would be more useful to direct resources to a rapid scale-up of solarizing programs across the state, which the NY-Sun's Community Solar program may serve to accomplish.
Development Costs, including Contracting and Financing Costs	

Promising Approaches Identified in Interviews and Literature	• Projects that pilot different approaches to solar financing, since solar finance is a relatively immature industry, albeit one that is gaining momentum through the New York Green Bank and other initiatives.
	  • One interviewee noted that the lack of PACE financing options for residential systems is a missed opportunity in the market.
	• Projects to educate consumers about financing options.
	  • Multiple interviewees noted that customers often have little information to compare different financing options in a way that addresses their concerns and uncertainties. One interviewee also noted that many existing solar customers overpaid for solar leases because installers were able to exaggerate project risk.
	  • One interviewee suggested that having a wide variety of financing options, suitable for all types of customers, would be beneficial – so long as customers are sufficiently well informed about what those options are.
	• Projects that work with utilities to develop more utility financing options for residential and commercial PV installations – could have impact on the national level.
	• Projects that connect disparate groups or "unlikely bedfellows" to reach common understanding, make interactions more efficient, or develop novel approaches.
	  • Multiple interviewees mentioned project finance as an area in which connecting disparate groups or "unlikely bedfellows" might be particularly useful. One interviewee mentioned that working with finance professionals without previous experience in the renewable energy industry might be one way of achieving innovations in solar finance.
	  • An interviewee mentioned SunShot's work with homebuilders and appraisers as an example of "getting everyone on the same page" about the methodologies underlying financing decisions. SunShot worked with builders to better understand home appraisal methodologies and with finance institutions to develop products that incorporate solar PV systems into mortgages.
	• Projects that provide access to finance for renters seeking to participate in shared solar models and other groups that are particularly underserved by existing financing options.
	  • Multiple interview subjects suggested that innovative financing options for shared solar will help to expand the size of this potentially enormous market. One interviewee suggested that the model for free community solar developed by Clean Energy Collective (CEC), one of SCR's current funding recipients, is worth investigating further.
	• Areas which SunShot's BOS Cost Reduction Roadmap identified as requiring further interventions to achieve the 2020 targets for residential systems include: corporate on-balance sheet financing, solar loans, and mortgage (new build) financing.

Lower Priority Approaches	• Certain public financing vehicles are currently stymied by national regulations (e.g., the IRS not classifying solar PV systems as real property precludes the development of solar REITs). Many of these financing options would need to be launched on the national rather than the state level.
System Design, Installation, and Operations & Maintenance Costs	

Promising Approaches Identified in Interviews and Literature	• Projects driving efficiencies in installation labor, and particularly electrical labor, through improved hardware components, integrated systems, or standardization.
	  • Because of the substantial direct costs associated with installation labor, standardization efforts that specifically target installation labor requirements might be particularly effective in reducing costs.
	  • Labor costs are especially high in New York City, so labor efficiencies would achieve higher magnitude reductions in BOS costs in this part of the state.

	• Projects that help remove non-value-added installation activities. • To remove non-value add activities from the installation process, one study suggested targeting site set-up during each day of installation, which could be eliminated through one-day installations; pre-installation preparation requirements, which could be reduced by using more universally applicable designs and integrated racking systems; and certain electrical processes, which could be eliminated by using self-grounding systems and racking systems that integrate wire management. • Areas which SunShot's BOS Cost Reduction Roadmap identified as requiring further interventions to achieve the 2020 targets include: first generation plug-and-play systems (AC module with integrated racking), second generation plug-and-play systems (fully inclusive off-the-shelf system, respectively), equipment standardization, reduced through-roof penetration, and experience gains (for residential systems); and integrated racking (for commercial systems).
Lower Priority Approaches	• Cost analyses in the literature indicate that system design costs are a much smaller component of BOS costs than are installation labor costs; standardization efforts targeting system design may not achieve the same magnitude of direct cost reduction as efforts targeting efficiencies in installation labor. • Non-electrical labor tends to be cheaper than electrical labor, so the opportunity for large magnitude cost reductions is proportionally lower with efficiencies in non-electrical installation activities.
Permitting, Inspection, Interconnection, and Zoning Costs	

Promising Approaches Identified in Interviews and Literature	• Projects that focus on reducing the time required for processing permitting and interconnection applications (especially for residential and small commercial systems). Time is an important factor in customer attrition, and the costs of projects that are canceled midway through the project development process must ultimately be recovered through higher charges on completed projects.
	  • One interviewee noted that the New York Unified Solar Permit has had limited utility in practice, as local jurisdictions have often added standardized application forms to existing forms (or only marginally altered existing forms).
	  • The Town of Brookhaven, on Long Island, has recently released a plan for digitally submitting permit applications. Denver and San Jose also have online permitting portals. One interviewee noted that this approach has the potential to realize significant local efficiencies and suggested that NYSERDA should develop a centralized online portal available to all jurisdictions in the state, similar to the RFP recently issued in Maryland for a comprehensive online application portal for solar permits.
	  • Since New York is a "home rule" state, the state government cannot mandate that local governments adopt the unified solar permit or use an online permitting portal, as the state of California has done. Instead, the permit and portal must be designed to reflect jurisdictions' needs, which might entail, for example, including in the portal other types of permitting applications which jurisdictions receive (e.g., for decks or building additions). One interviewee noted that streamlined PV permitting processes can serve as an opportunity for local building directors to modernize all of their permitting processes, not just those related to solar PV; another interviewee noted that streamlined permitting should be framed as an economic development opportunity for towns and counties.
	  • Several interviewees noted that software programs can drive efficiencies in permitting and other processes that would otherwise be too expensive for local governments to realize; for example, jurisdictions could simply buy a license for existing online permitting software, which would be cost prohibitive for them to develop on their own. One interviewee noted that there are still only a few companies in the U.S. working to develop these types of software programs.
	  • One interviewee recommended projects that increase the transparency of permitting and interconnection processes. Greater transparency would allow installers to keep customers apprised of developments and expected timelines, minimizing customer attrition due to lengthy approval processes.
	• Projects that reduce direct costs associated with interconnecting larger systems.
	  • One interviewee suggested that NYSERDA should work with utilities to make the interconnection study process more efficient for larger systems.
	  • One interviewee noted that California utilities have developed a system for identifying the existing load on a given circuit, which helps reduce large-system costs by providing a preliminary screening of projects likely to trigger lengthy interconnection review processes.
	• Projects that facilitate communication among local jurisdictions, code officials, architects, and engineers. While NYSERDA has recently expanded its efforts to communicate with jurisdictions, one interviewee noted that NYSERDA should coordinate and tailor messages carefully. Portraying streamlined building permitting processes as a local economic development opportunity would be

	useful in securing support from local officials.
	• Projects that help to build a network between local actors.
	  • One interviewee noted that New York City's solar ombudsmen and the Sustainable Westchester group are both examples of actors with deep local roots who benefit from connecting with each other through such a network. These two particular actors have already been connected, however.
	  • One interviewee highlighted the Midwest Renewable Energy Association and the Mid-America Regional Council as examples of successful networks operating on different geographic scales.

Lower Priority Approaches	• Projects that focus on reducing the direct costs associated with permitting, interconnection, and other local regulatory processes (rather than targeting specifically the length of time required for these processes) are not a high priority for residential and small commercial systems. • One interviewee noted that NYSERDA already communicates regularly with installers and should be careful not to overload this group with too much information.

Sources: key informant interviews; National Renewable Energy Laboratory, Benchmarking Non-Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems Using a Bottom-Up Approach and Installer Survey – Second Edition; Rocky Mountain Institute, Lessons from Australia: Reducing Solar PV Costs Through Installation Labor Efficiency; Rocky Mountain Institute, Reducing Solar PV Soft Costs: A Focus on Installation Labor; National Renewable Energy Laboratory, Why Are Residential PV Prices in Germany So Much Lower Than in the United States? A Scoping Analysis; National Renewable Energy Laboratory, Non-Hardware ("Soft") Cost-Reduction Roadmap for Residential and Small Commercial Solar Photovoltaics, 2013-2020; National Renewable Energy Laboratory, Financing U.S. Renewable Energy Projects Through Public Capital Vehicles: Qualitative and Quantitative Benefits; National Renewable Energy Laboratory, Financing, Overhead, and Profit: An In-Depth Discussion of Costs Associated with Third-Party Financing of Residential and Commercial Photovoltaic Systems; and Department of Energy, SunShot Vision Study.

Beyond these specific projects and potential project ideas, IEc also identified program structures that differ substantially from SCR's current approach. Google's Little Box Challenge, which focuses on inverter hardware, and SunShot's Race to 7-Day Solar (a separate effort from the SunShot projects described above), which focuses on permitting, inspection, and interconnection, both use a competitive, prize-based approach (see text box). IEc also reviewed the Solarize Mass program, in which the Massachusetts Clean Energy Center (MassCEC) provides technical assistance to communities throughout the state to pursue solarizing efforts. While this is very different from the SCR's project-based strategy, it is similar to the approach envisioned by the New York's nascent Community Solar NY program, a new effort under NY-Sun. As such, it would represent inefficient duplication of effort for SCR to consider a similar approach itself, if done independently from Community Solar NY.

Google Little Box Challenge

Google's Little Box Challenge is a competition to design an inverter at approximately one-tenth the size of those currently in use without sacrificing performance. The competition's goal equates to a kilowatt-scale inverter with power density greater than 50 watts per cubic inch.

The Little Box Challenge uses a prize approach in which, with the exception of some relatively small awards to academics, Google's entire investment will be awarded to a single successful project: the project that demonstrates the highest power density (i.e., smallest size) while still demonstrating acceptable performance will be declared the winner and awarded $1 million. If no projects succeed, Google pays nothing. This is in contrast to SCR's approach of funding a wider variety of smaller projects with the recognition that not all will ultimately prove successful. In using the prize structure, Google has shifted the risk away from itself and onto the project developers, but has offset this increase in risk to the project teams by offering a proportionally greater award.

A Forbes columnist summarized the financial advantages to Google of this approach:

> "The argument here is that offering a million as a prize encourages many groups to go out and spend a hundred thousand…on trying to win the prize. Thus the amount of capital that will be spent on trying to win the prize, overall, will be much greater than the amount of the prize itself. It wouldn't be a surprise at all to find that $10 million, or $20 million, was addressed to trying to solve this problem in the hopes of winning that $1 million prize…The economic effect of running this as a competition is therefore the leverage it gives to the original sum of money offered as the prize."

1. Jeff St. John, "Google's $1M Challenge: A Laptop-Sized Solar Inverter," GreenTech Media, July 23, 2014, accessed December 9, 2014, http://www.greentechmedia.com/articles/read/googles-1m-challenge-a-laptop-sized-solar-inverter; "Little Box Challenge," Google Inc., accessed December 9, 2014, https://www.littleboxchallenge.com; "Little Box Challenge – High Power Density Inverter Award Program," Research at Google, accessed December 9, 2014, https://research.google.com/university/relations/littlebox.html; and Tim Worstall, "Google's Little Box Challenge; A $1 Million Prize For Creating a Better, Smaller, Solar Power Inverter," Forbes.com, May 10, 2014, accessed December 9, 2014, http://www.forbes.com/sites/timworstall/2014/05/10/googles-little-box-challenge-a-1-million-prize-for-creating-a-better-smaller-solar-power-inverter.

SunShot Prize: Race to 7-Day Solar

In addition to the more conventional funding procedure discussed elsewhere in this report, SunShot is also utilizing a prize structure very similar to the Little Box Challenge in its "Race to 7-Day Solar."[1] This competition aims to reduce the time "required to travel from 'permit to plug-in,' including permitting, inspection, and grid interconnection" (the "total time"). Similar to the Little Box Challenge, projects must address a variety of criteria, but there is a clear overarching consideration, namely, reducing total time.

SunShot anticipates two related competitions, one for small systems and another for large systems. For small systems, the goal is to achieve total permit-to-plug-in-time of seven days; for large systems, the target is seven weeks. However, points are also awarded (at a discount) for longer total times. Both will offer a grand prize of $4 million and smaller "change prizes" of up to $100,000 for applicants that make incremental progress towards advancing the competition's goals. Because the change prizes also offer a reward for incremental progress, the competition is not strictly "all or nothing." This lowers the risk to applicants by providing a greater likelihood of recouping at least part of their investment. That lower risk, in turn, presumably broadens the base of potential participants.

It is worth noting that SunShot anticipates that collaboration among a variety of stakeholders will be required for a project to succeed: "DOE envisions solar developers, local jurisdictions, communities, and utility companies forming teams to purse the goals of this competition. To win, close coordination among communities, cities, installers, customers, and utility companies is critical. No one entity can achieve the goal of improving the going solar customer experience single-handedly. With this prize competition DOE hopes to create the right conditions and opportunities for collaboration among all stakeholders."

Similar to Google, SunShot could realize several key benefits by utilizing a "pay for success" structure to address a multi-faceted challenge in the solar PV market:

- First, it eliminates the risk of SunShot paying for unsuccessful projects.
- Second, it leverages the money contributed by SunShot by encouraging numerous applicants to use their own resources in the hopes of winning the prize.
- Third, it forces disparate groups to work together, on a large scale, to compete successfully.

1. SunShot had initially established a prize competition aimed simply at lowering the cost of solar PV; however, it changed the rules in September 2014 to focus on installation time due to the fact that only three years into the decade-long SunShot initiative, the solar industry had already progressed 60 percent of the way towards SunShot's target of $0.06/kWh utility-scale PV. See https://www.federalregister.gov/articles/2014/09/19/2014-22372/the-sunshot-prize-race-to-the-rooftops.
2. "SunShot Prize: The Race to 7-Day Solar," U.S. Department of Energy, accessed December 5, 2014, http://energy.gov/eere/sunshot/sunshot-prize-race-7-day-solar, and "SunShot Prize: Race to 7-Day Solar, Draft Rules for Public Comments," U.S. Department of Energy, accessed December 5, 2014, http://energy.gov/sites/prod/files/2014/10/f18/SunShot%20Prize%20Draft%20Rules%20Final%20 Release%2010202014_0.pdf.

3.7 Are There any Recommendations For Improving the SCR Program's Project Solicitation Processes?

IEc developed recommendations based on a synthesis of the findings from the other evaluation questions. These recommendations relate to guidelines for identifying "innovative" projects based on existing BOS solutions and New York-specific market characteristics; the importance of targeting project replication as a barrier to sustained BOS cost reduction; and an examination of NYSERDA's cost recoupment and cost sharing requirements. These recommendations are discussed in the final chapter of this report.

4 Conclusions and Recommendations

In the final chapter of the report, IEc presents its conclusions and recommendations from the process evaluation. To recap, IEc's overall findings by evaluation question can be summarized as follows:

1. **Is the SCR program targeting significant barriers to BOS cost reduction?** The SCR program is targeting significant barriers to BOS cost reduction through its broad-based approach to funding projects that address all types of BOS costs, as all five BOS categories identified continue to contribute significantly to overall system costs.

2. **Is the SCR program targeting barriers to BOS cost reduction that can be effectively reduced at the state level?** Each of the five BOS cost categories, all of which SCR is currently targeting, can be addressed in some form at the state level. However, several cross-cutting ideas emerged about how the program could target each of these barriers most effectively in New York State. Considering the areas in which New York State has particular leadership potential, the maturity of existing solutions, and state-level flexibility might help NYSERDA to identify the most effective approaches for reducing BOS costs, either by testing innovative approaches or by implementing best practices.

3. **Is the SCR program funding projects in a manner that avoids duplicating efforts of other programs, including but not limited to DOE's SunShot Initiative?** SCR is funding projects in a manner that largely avoids duplicating the efforts of DOE's SunShot Initiative, though it may be useful to consider methods of consistently ensuring coordination between the two programs during their review of applications.

4. **Is the scale of SCR-funded projects appropriate for generating sustained cost reductions and/or project replication?** IEc found incomplete and conflicting information regarding the appropriateness of the scale of SCR's funding awards for generating sustained cost reductions and/or project replication. Further comparison of the funding levels of successful and unsuccessful projects may be useful as part of a future impact evaluation. Demonstration projects in particular may need to employ larger-scale or different project structures in order to achieve market impacts.

5. **What barriers hinder potential applicants from applying for program funding, and how can they be reduced?** None of the potential deterrents to applying for NYSERDA funding that IEc evaluated appear to have a significant and consistent effect in preventing potential funding applicants from submitting project proposals. However, potential applicants with hardware projects, an area where SCR has struggled to attract high-quality proposals, identified NYSERDA's cost sharing and cost recoupment requirements as significant issues. Industry experts also suggested that certain types of applicants, such as non-profits and municipalities,

might find cost sharing to be especially burdensome. However, industry experts also indicated that cost sharing in general can enable larger-scale project impacts by leveraging additional resources.

6. **Are there innovative approaches to reducing BOS costs that the SCR program should be aware of when marketing its PON?** Several innovative approaches to reducing BOS costs are being tested by SunShot and other organizations. These efforts address BOS cost components across all categories, using a variety of program structures.

7. **Are there any recommendations for improving the program's project solicitation processes?** Based on its analysis, IEc developed several recommendations for the SCR program to improve program processes. IEc presents these recommendations below.

4.1 Recommendations

Based on the findings of this evaluation, IEc offers three recommendations for improving SCR program processes:

1. NYSERDA should carefully target "innovative" projects based on its assessment of New York State's leadership potential in a given area, the maturity of existing solutions, and state-level flexibility. In areas where New York State has leadership potential, NYSERDA should continue its current approach of piloting innovative ideas in the market. Likewise, in areas where existing approaches to reducing BOS costs are relatively immature, SCR's approach of funding a variety of innovative approaches projects is appropriate.

   IEc collected insights from multiple sources about promising approaches and innovative ideas for reducing BOS costs in this report; NYSERDA should consider these approaches in the context of these guiding principles and its vision for the future of solar PV in New York State.

2. NYSERDA should identify areas where adoption of best practices is a primary barrier to cost reduction, and fund projects and/or implementation activities that target this particular issue. Adoption is likely to be the major challenge in areas where existing solutions are already well established and no longer require proof of concept in a context similar to New York State.

   NYSERDA may determine that different project structures than those funded to date are more effective at addressing barriers to replication. For example, demonstration projects would likely need to be more expansive than one-time efforts to achieve the desired market effects; repeated demonstration projects or demonstration paired with broader implementation would likely be better positioned to meet this goal.

   Developing channels to disseminate information about successful projects and strong networks to bring together disparate groups across the state will also be essential to reducing barriers to

replication. The SCR program already requires funding applicants to propose an outreach strategy, and the caliber of that outreach strategy informs funding decisions. The program should continue its focus on outreach for successful project implementation, while ensuring that outreach aimed at future project replication also occurs in a meaningful way.

3. NYSERDA should examine its cost recoupment and cost sharing specifications, especially in the context of other programs (outside of NYSERDA) to determine whether these provisions are in line with industry best practices. Potential applicants identified these requirements as the two most important barriers to submitting funding proposals, and multiple sources indicated that the type of applicant (in addition to the type of project) can affect the burden that these requirements create. NYSERDA should also consider the advantages of using alternative project funding structures to target certain types of barriers, such as the "pay for success" model employed by Google's "Little Box Challenge" or SunShot's "Race to 7-Day Solar."

   If SCR's cost recoupment proves atypical, the program should consider amending it, e.g., by lowering the percentage of revenues paid to NYSERDA, reducing the timeframe over which payments are required, or setting a higher bar for when recoupment is required. Similarly, SCR may find that lowering cost-sharing requirements for specific types of applicants may be appropriate if organizational structure and mission do not support cost-sharing (e.g., among non-profit groups and local governments).

   NYSERDA should particularly examine these issues for non-module hardware projects. The program struggled to attract high-quality applicants in this area during the previous two rounds of the PON, and the survey also suggested that hardware applicants might find the cost recoupment requirement particularly onerous and/or might prefer to work on larger-scale projects. If NYSERDA finds through further investigation that project scale or cost recoupment requirements are preventing the program from attracting high-quality hardware proposals, the program should consider either adjusting these program specifications or pursuing an alternative program structure for this type of project.

4.2 Areas for Further Study

This process evaluation excluded SCR's activities relating to coordination and implementation assistance for funded projects. It could be valuable for SCR to undertake a Phase 2 process evaluation to assess these processes. Interviews with funding recipients would be the primary means of data collection. If undertaken, this Phase 2 process evaluation could also potentially extend the current analysis by gathering additional information on the same issues discussed in this report. This could be done by conducting a wider range of interviews with industry experts; conducting follow-up interviews with survey respondents; and performing a more in-depth analysis to identify innovative projects and determine how best to encourage innovators to apply for SCR funding.

Appendix A: Projects Funded to Date by SCR

Project Title	Project Proposer and Team Members	Project Description	PON Category[1]	Activity Categories
NYC Grid Ready Solar	City University of New York (CUNY), Con Edison, NREL	For buildings with large-scale PV potential, CUNY, Con Edison, and NREL will analyze the technical risk factors for grid interconnection and create public resources to allow developers to make informed decisions about project location and cost, including a layer on the NYC Solar Map showing where buildings may face interconnection issues.	A	Facilitate adoption of streamlined permitting, zoning, and interconnection processes Improve access to information for market actors
Sunvestment Group Community Power Purchase Agreement (PPA)	Sunvestment Group, Keegan Associates, Phillips Lytle	The project team will design a web-based platform to post projects soliciting investment, refine the legal documentation necessary to complete several demonstration projects for community PPAs, and prepare to scale the service to a wider audience.	A	Facilitate new business and financing models Improve access to information for market actors
2 – Sunvestment Group Community Power Purchase Agreement (PPA)	Sunvestment Group	As a continuation of Sunvestment Group's activities funded in round one, this project will create the back-end capability required to transform their website into a transaction-based investment platform and tracking service.	A	Facilitate new business and financing models Improve access to information for market actors
Westchester Solar Initiative	Energy Improvement Corp. (EIC), Pace Land Use Law Center, SmartPower, Sustainable Westchester (formerly Northern Westchester Energy Action Consortium, Southern Westchester Action Consortium), Abundant Efficiency, Croton Energy Group	The project team will work directly with the building departments of 40 local governments to address permitting and zoning barriers, and will establish two waves of group-purchasing ("solarizing") programs in four municipalities.	A	Facilitate adoption of streamlined permitting, zoning, and interconnection processes Facilitate new business models to reduce customer acquisition costs

Project Title	Project Proposer and Team Members	Project Description	PON Category[1]	Activity Categories
Stimulate and Streamline NY Solar Sales by Promoting Novel Online Comparison-Shopping Marketplace	Energy Sage	Energy Sage will tailor its online education and shopping platform for solar PV systems to the New York State market and promote the platform through several consumer channels. Similar to Amazon or Expedia, Energy Sage's online Marketplace provides comparison-shopping functionality and impartial customer advisory services for solar PV systems.	A	Facilitate new business and financing models Improve access to information for market actors
New York Affordable Housing Program	GRID Alternatives	Combining philanthropy, industry partnerships and innovative tax strategies, GRID Alternatives will develop and implement a sustainable financing model to reduce the cost of solar for low-income homeowners in New York State by eliminating all up-front customer expenses and most ongoing customer expenses.	A	Facilitate new business and financing models
Solar One Community Initiative	Solar One, Sustainable CUNY	Solar One will evaluate and identify best practices for customer aggregation pilot projects and implement this model in 2-3 new residential purchasing projects and 2-3 non-profit purchasing projects.	A	Facilitate new business and financing models
Central New York Solar Initiative	Central New York Planning Board, Optony	The project team will establish a collaborative procurement program for local government, institutional, and non-profit customers in central New York, providing a wide range of technical assistance.	A	Facilitate new business and financing models Improve access to information for market actors
NYSolar Smart: SunShares	Vote Solar Initiative (VSI), Sustainable CUNY	The project team will offer a customer aggregation program using targeted outreach to existing affinity groups such as employers, local governments, universities, and non-profit organizations.	A	Facilitate new business and financing models
New York Solar Soft Cost Survey	Meister Consultants Group	Meister Consultants Group will administer an online soft cost survey to major players in the New York PV market, hold a series of regional workshops, and report on findings.	A	Improve access to information for market actors

Project Title	Project Proposer and Team Members	Project Description	PON Category[1]	Activity Categories
Remote Rooftop Shade Tool for Installers and Financiers	Solar Census	Solar Census has developed the first commercial-grade automated rooftop shade analysis tool and will deploy this software across most of urban New York State.	B	Improve access to information for market actors Develop emergent BOS technologies
Roof-Integrated Lightweight PV Systems	The Research Foundation for SUNY, Johns Mansville, Solar Frontier, Tecta Solar, College of Nanoscale Science and Engineering at SUNY	The project team will install a prototype system to demonstrate the commercial viability of thin-film PV modules combined with rack-less roof integration methods and hardware, to create a reliable, lower-cost fully integrated PV product.	C	Hold demonstration projects for commercial-ready BOS hardware products
Community Solar for New York	Clean Energy Collective	Clean Energy Collective will build a large-scale, grid-connected PV array in New York City and allow utility customers to receive on-bill credits by purchasing individual panels.	C	Facilitate new business and financing models

1. A = soft cost (non-hardware); B = product or hardware component; C = demonstration

Appendix B: Evaluation Methods

IEc employed a mixed-methods approach for this evaluation. Methods included: a targeted literature review on BOS cost reduction barriers; a review of SCR program documentation; a review of documentation from other comparable programs; key informant interviews; and a survey of relevant organizations and potential funding applicants. Additional detail about each of the methods employed is provided below.

B.1.1 Literature Review

IEc conducted a targeted review of literature on barriers to BOS cost reduction, focusing on literature published since the SCR program's inception and the initial release of PON 2672 in 2012. The review investigated whether recent literature suggests that the SCR program should target particular BOS cost reduction barriers. IEc searched for research identifying new or emerging barriers, and for evidence that any barriers are becoming less important. The literature review informed IEc's response to Evaluation Questions 1 and 2, which examine whether the SCR program is targeting significant barriers to BOS cost reduction that can be effectively addressed on the state level. **Appendix G** provides a bibliography of sources consulted during the literature review.

B.1.2 Program Documentation Review

IEc reviewed descriptions of currently-funded SCR projects and summary data on projects that applied for funding from SCR but were rejected. IEc also reviewed information on current SunShot Incubator projects from the DOE website, and examined documentation on seven non-Incubator projects focused on reducing BOS costs.[18,19] Finally, IEc reviewed websites of specific projects and companies, although these provided limited information. This review aimed to characterize and compare the types of projects that received funding from the SCR and SunShot programs. A second objective was to identify and classify innovative projects being funded by SunShot. This review of SCR program documentation addressed Evaluation Questions 1, 2, 3, 4, and 5; the review of other program documentation addressed Evaluation Questions 3, 4, and 6.

IEc used NYSERDA's classification data for each SCR-funded project identifying specific barriers targeted and PON category, and also used this set of parameters to code each SunShot project based on project descriptions. Both programs' documentation included funding amounts and approximate funding dates.

[18] Department of Energy. "Current SunShot Incubator Projects." Accessed October 27, 2014. http://energy.gov/eere/sunshot/current-sunshot-incubator-projects.

[19] Department of Energy. "Solar Projects to Reduce Non-Hardware Balance of System Costs." Accessed October 28, 2014. http://energy.gov/eere/sunshot/solar-projects-reduce-non-hardware-balance-system-costs.

Appendix D summarizes the available information on these SunShot projects; **Appendix E** compares SCR and SunShot projects to examine potential overlap.

IEc also conducted a limited review of other programs addressing BOS costs to identify innovative BOS cost reduction projects and program approaches (see Evaluation Question 6). These other programs included Google's "Little Box Challenge," the SunShot Initiative's "Race to 7-Day Solar," and the Massachusetts Clean Energy Center's "Solarize Mass" program.[20]

B.1.3 Key Informant Interviews

To address Evaluation Questions 2, 3, 4, and 6, IEc conducted eight in-depth interviews with key industry stakeholders, including experts on PV permitting and interconnection processes; representatives of a major solar installer; experts on innovative project structures such as group purchasing and community solar; an engineer involved in developing innovative PV hardware solutions; and representatives from DOE's SunShot Initiative. IEc identified these interview subjects in collaboration with NYSERDA program staff. IEc conducted all interviews with industry experts individually, with two exceptions.

Interviews were semi-structured, with some standard questions across interview subjects, but most questions were tailored to individual interviewees' areas of interest and expertise. The interview questions elicited information on outstanding barriers to BOS cost reduction; the appropriateness of the funding levels available for SCR-funded projects; the potential for SCR-funded projects to achieve replication effects; and innovative approaches to reducing BOS costs in each of the cost categories. Following the completion of the interviews, IEc sought to identify patterns in the responses received, and to interpret interview responses in conjunction with data collected through other methods. Due to the small number of interviews conducted and the decision to tailor interview questions to individual interviewees, IEc did not conduct a formal coding analysis of interview responses but instead sought to identify thematic similarities across interview responses and other data collected.

Interviews occurred by telephone, with a duration of 45 minutes to one hour. All interview subjects were provided the opportunity to review interview questions in advance. **Appendix H** provides the general interview guide that was used to develop questions tailored to specific interview subjects.

B.1.4 Survey

With its subcontractor APPRISE, IEc surveyed potential applicants for SCR funding. The survey population consisted of the individuals who received the SCR PON announcement directly from program staff (approximately 1,300 people); SCR program staff provided this list to IEc. The survey was designed

[20] We also reviewed Rocky Mountain Institute's BOS efforts, but available information was too limited to support analysis of innovative projects.

to: 1) collect basic background information about respondents' organizations; 2) determine reasons why non-applicants did not previously apply for SCR funding; 3) gather information about potential projects that could be eligible for SCR funding; and 4) gain insight into information dissemination within the industry, and in particular, potential marketing and promotion channels for SCR. The survey addressed Evaluation Questions 4, 5, and 6.

IEc and APPRISE conduced in-house testing of the on-line survey prior to the launch, and opened the survey for approximately two weeks in November 2014. While the survey invitation allowed respondents to remain anonymous, roughly half of the respondents indicated that they would be willing to discuss their responses further with NYSERDA and provided contact information. The survey instrument is included as Appendix F; survey results are in **Appendix J** (for closed questions) and **Appendix K** (for open-ended questions).

Survey responses are summarized in **Table A-1**. The survey response rate for non-participants in SCR was five percent (59 individuals); another 61 individuals responded and indicated that they did not do any solar-related professional work or were SCR funding recipients themselves. Given that the survey targeted non-participants who may or may not have had extensive experience with NYSERDA, this response rate is not necessarily indicative of a low-quality survey.[21] Based on program staff's intended uses of the survey results, we did not establish a formal target for the number of complete survey responses, but we strove for approximately 70 complete responses. To increase the response rate, we sent multiple follow-up emails to survey recipients reminding them to complete the survey, and these reminders had an appreciable impact on the number of survey responses. We did not conduct follow-up phone calls or extend the survey deadline due to the time limitations of this evaluation.

Table B-1. Summary of Survey Responses

Response Type	Number of Survey Respondents
Screened out – no solar work	56
Screened out – SCR funding recipient	5
Complete Response	59
Incomplete Response	44

Given the particular evaluation objectives and need for quick turnaround, the sample was not designed to meet a 90/10 precision level. Thus, the IEc team is only reporting values for the survey sample and not making inferences about the opinions of the entire non-participant population based on the sample.

[21] The American Association of Public Opinion Research (AAPOR)-defined response rate for this survey was 0.048 (RR1 and RR3).

Appendix C: Cost Per Watt of PV System Components (2012)[22]

Soft cost category	Residential		Small Commercial (under 250 kW)		Large Commercial (over 250 kW)	
	Cost per Watt	Percentage	Cost per Watt	Percentage	Cost per Watt	Percentage
Supply chain costs (from Feldman et al 2013)	$0.61	11.7%	$0.42	8.4%	$0.42	10.3%
Installation labor (calculated)	$0.55	10.5%	$0.39	7.8%	$0.17	4.7%
Customer acquisition (surveyed)	$0.48	9.2%	$0.13	2.6%	$0.03	0.7%
Indirect corporate costs (modeled)	$0.47	8.9%	$0.47	9.4%	$0.47	11.5%
Installer/developer profit (modeled)	$0.46	8.8%	$0.94	18.9%	$0.45	11.1%
Transaction costs (modeled)	$0.30	5.8%	$0.36	7.1%	$0.33	8.1%
Sales tax, 5% (from Feldman et al 2013)	$0.26	5.0%	$0.25	5.0%	$0.20	5.0%
Permitting, interconnection, and inspection (surveyed)	$0.10	1.9%	$0.01	0.2%	$0.00	0.0%
Permitting fees (assumed)	$0.09	1.7%	$0.07	1.4%	$0.04	0.7%
All characterized soft costs	**$3.32**	**64%**	**$3.01**	**61%**	**$2.10**	**52%**
Total hardware costs	**$1.90**	**36%**	**$1.95**	**39%**	**$1.95**	**48%**
Total costs	**$5.22**	**100%**	**$4.97**	**100%**	**$4.05**	**100%**

[22] NREL, *Benchmarking Non-Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems, Using a Bottom-Up Approach and Installer Survey – Second Edition*, by Barry Friedman et al, October 2013.

Appendix D: Current BOS Projects Funded by DOE's SunShot Initiative

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	**Firm Location**	**Funding Announced**	**$ Awarded by SunShot**	**Project Description from SunShot Website**	**Soft Cost**	**Demonstration**	**Non-Module Hardware**	**Non-Module Hardware Costs**	**Business Costs**	**Development Costs**	**PV System Design, Installation, and Operation Costs**	**Permitting, Zoning, Interconnection, and Inspection Costs**
Aurora Solar, Inc.	Palo Alto, CA	2014	$400,000	Aurora Solar is building a cloud-based optimization platform that automates the design, engineering and permit generation functions of a solar photovoltaic installation. The optimization function will consider usage data, utility rates, solar component characteristics, irradiance and shading data to generate optimal site-specific plans.	X						X	X
Clean Energy Collective	Carbondale, CO	2014	$699,999	Clean Energy Collective is developing a national online portal to provide access to proven community solar solutions. NCSP (National Community Solar Platform) will make the resources needed to navigate the complex legal, financial, and transactional issues associated with community solar available to EPCs (engineering, procurement, and construction), utilities, and community advocates. This will dramatically lower the costs required to enter the market and allow for the rapid expansion of community solar nationwide.	X				X	X		X
Faraday	Middlebury, VT	2014	$1,000,000	Faraday is developing a data management platform that uncovers superior customer acquisition strategies to order to improve lead conversion rates. The map-driven tool includes nearly a terabyte of data on 100 million U.S. households and leverages advanced machine-learning algorithms to pinpoint households most likely to invest in solar. Solar installers, financers, and original equipment manufacturers will use Faraday to explore markets, construct audiences, launch outreach campaigns, and track and compare results for measurable improvements in return on investment.	X				X			

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
kWh Analytics	Oakland, CA	2014	$500,000	kWh Analytics will create a risk management software platform centered on a predictive score ("kWh Score") that enables investors to statistically quantify production risk for any solar investment in the United States. The kWh Score will be the output of a cutting-edge statistical model that is built atop the kWh Database, which is the solar industry's largest independent database of historical operating performance data (40,000+ systems).	X					X		
Mosaic	Oakland, CA	2014	$650,000	Mosaic is introducing a simple, low-cost home solar loan product and installer platform integrated into residential solar developers' sales processes, which will lower capital costs and dramatically increase project leads and close rates for partners, driving down overhead and customer acquisition costs.	X				X	X		
Norwich Technologies	White River Junction, VT	2014	$677,504	Norwich Technologies is working to commercialize its highly-efficient receiver design that enables the concentrating solar power (CSP) industry to realize higher outputs from parabolic trough plants, especially as the industry adopts higher temperature (higher-T) solar fields. Combined with a low-cost, high-accuracy collector, this solar field design will offer an unprecedented combination of high output and low price for trough CSP. In addition to working on the receiver, Norwich is working with project partners to build a collector (trough mirror) that will use a suspension structure instead of the traditional truss structure—dramatically reducing the amount of steel used in a CSP system which is a primary cost driver.			X	X			X	

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Qado Energy	Summit, NJ	2014	$1,749,892	Qado Energy's advanced distribution analytics platform GridUnityTM will be used by utilities and distributed energy resource (DER) developers to accelerate the engineering and economic decision making required for the reliable interconnection of DER from months to minutes. The capability to radically reduce the time it takes to analyze complex situations and make fact-based decisions reduces stakeholder risk and enables a sea change in business operations and customer engagement.	X				X			X
SafeConnect Solar	Honolulu, HI	2014	$498,918	SafeConnect Solar is building a prototype of its patent-pending device that pre-engineers hardware and software-based safety mechanisms into residential PV systems so that the system can be safely installed by non-specialized labor. SafeConnect's product reduces installation labor costs, will reduce customer acquisition, design, and permitting costs, and makes PV systems safer to install, own, and maintain.	X		X	X			X	X
Sighten	San Francisco, CA	2014	$1,000,000	Sighten is building a comprehensive software platform to streamline and consolidate the disparate tools currently used to deploy and manage capital in distributed generation solar assets. The platform spans the entire lifecycle of a solar asset from tools to improve origination and pricing to features that automate ongoing reporting and analytics.	X					X		
SineWatts	Palo Alto, CA	2014	$1,000,000	SineWatts is transforming the PV power plant for mainstream generation with its patent pending Inverter Molecule that completely eliminates any inverter footprint by miniaturizing and siliconizing the hardware into the PV panel junction box. A SineWatts power plant will have 70% lower landed inverter cost while providing advanced grid assist for next generation grid integration requirements.		X	X	X				

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Smash Solar, Inc.	Richmond, CA	2014	$1,000,000	Smash Solar is developing a simple, snap-together, module-integrated PV mounting system which will dramatically reduce the time, effort and skill needed to install rooftop solar. Smash Solar will focus on refining their design, engaging in customer trials and beginning certification and code compliance testing.			X	X			X	
Solar Grid Storage	Silver Spring, MD	2014	$968,120	Solar Grid Storage will develop a Solar Storage Operations Center (SSOC) to manage grid-connected PV + storage assets. The SSOC will make it possible to bring together multiple storage sites and enhance grid stability with every new PV + storage resource installed, all while reducing deployment costs. A scalable solution, the SSOC will help mitigate concerns about high-penetration PV deployment by enabling cost-effective control of residential, commercial, and utility-scale PV + storage systems.	X						X	
Stem	Millbrae, CA	2014	$875,000	Stem is developing a software platform for energy storage evaluation and automated storage system control. The project will improve the application of distributed storage in areas with high photovoltaic penetration while lowering grid integration costs and improving grid stability.	X						X	
Sundog Solar Technology	Arvarda, CO	2014	$420,962	Sundog Solar Technology is developing the world's first high-performance front-surface solar reflector using low-cost high-volume manufacturing methods. Nanoparticles are incorporated into the reflector to enhance abrasion resistance and reduce cleaning requirements. System costs are reduced, and overall system efficiency is enhanced because more heat is provided to the working fluids.			X	X				

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Sungage Financial	Boston, MA	2014	$700,000	Sungage Financial is a marketplace that provides homeowners with easy, online access to low-cost financing for solar equipment. Through its pilot activities in MA and CT, Sungage has gained expertise in how to meet the needs of consumers, installers, and capital providers in order to successfully and efficiently deliver financing solutions. Sungage will expand through partnerships with solar installation companies in active solar markets nationwide.	X					X		
Sunlayer, Inc.	Walnut Creek, CA	2014	$384,000	Sunlayar is developing a cloud-based software platform that utilizes augmented reality to decrease permitting, design and installation costs through the use of ground breaking visual computing technology. Sunlayar Augmented Reality Edition - as experienced through tablets and wearable tech - further simplifies the human-computer interactions necessary to drive Sunlayar's disruptive solar project lifecycle automation platform. This application will be able to pare down labor roles, and reduce the skill level and time required in the residential solar process through algorithmic business process automation.	X						X	X
Sunvestment Group	Tully, NY and Cortland, NY	2014	$398,379	Sunvestment Group is developing a web-based service platform and partner program that will allow prospective site hosts, solar developers, and investors to connect and access the documentation templates necessary to structure and complete Community-based Power Purchase Agreements (CPPA). Sunvestment Group's approach provides the potential to significantly expand PPA usage in the underserved mid-market segment (20 kW–1 MW), obtain cost of capital reductions of 20-50% through CPPAs, while keeping investment opportunities and returns in the community and leading to a local economic development multiplier effect.	X					X		

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Village Power Finance	Palo Alto, CA	2014	$500,000	Village Power Finance is implementing an innovative web platform and app to streamline the project development, fundraising and asset management processes for the dramatically under-served commercial and non-profit markets. This highly scalable model will leverage the investment power of community members, institutional investors, and corporate investors, while generating environmental improvements and investment opportunities at the community scale.	X					X		
Applied Novel Devices, Inc.	Austin, TX	10/22/13	$500,000	Applied Novel Devices is developing a new device architecture and manufacturing technology to reduce fabrication cost of high efficiency silicon (Si) solar cells and thereby lower the levelized cost of energy.			X	X				
Brittmore Group, LLC	San Jose, CA	10/22/13	$684,708	The Brittmore Group is developing and demonstrating an automated system for pre-assembling frameless photovoltaic (PV) modules into larger panels using construction adhesives. The panels are then deployed across large-scale PV arrays by industrial robots that travel back and forth on the mounting rack. This technique promises a significant reduction in construction duration and cost. In addition, it is expected to accelerate market acceptance of frameless PV modules, which further reduces structural materials and electrical installation costs.			X	X			X	

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Clean Power Research	Kirkland, WA	10/22/13	$945,529	Clean Power Research is developing a software platform that will significantly reduce the soft costs associated with interconnecting distributed generation and encourage adoption with visualization tools and economic metrics. This software platform builds on the PowerClerk family of software that has successfully streamlined processing for nearly 75% of distributed solar incentives nationwide. The platform has the potential to cut interconnection costs by up to 65% and reduce overall soft costs by up to $800 per installed system.	X							X
Demeter Power	West Palm Beach, FL	10/22/13	$500,000	Demeter is offering solar lease or services agreement financing collected as an assessment on the property tax bill: PACE3P. By securing payments to the property, not the offtaker, PACE3P lowers LCOE by 20%, makes more deals "bankable" without a corporate guarantee, and enables the first uniform, scalable financing for commercial solar.	X					X		
EnergySage	Cambridge, MA	10/22/13	$1,250,000	The EnergySage Marketplace transforms the complex solar PV shopping process into a simple, online comparison-shopping experience. The unique, innovative platform provides unprecedented levels of choice, transparency, and information at no cost to consumers, who can compare quotes from multiple pre-screened installers in an apples-to-apples matrix format across all financing options. EnergySage slashes time and effort for both consumers and installers, significantly reducing customer acquisition costs, boosting consumer confidence, and accelerating mass market solar adoption.	X				X			

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Folsom Labs	San Francisco, CA	10/22/13	$350,000	Folsom Labs makes software that helps PV system engineers quickly and efficiently design high-performance solar arrays by combining advanced performance modeling with cloud-based design tools. Under the SunShot award, Folsom Labs will extend its core HelioScope product to provide automatic evaluation of various system designs and component choices to quickly find the lowest LCOE approach for a given site.	X						X	
Genability	San Francisco, CA	10/22/13	$1,000,000	Genability is developing solar savings reports that installers and developers can deliver to their customers. These savings reports are used by solar companies at the time of the sale to communicate to potential solar savings, as well as after install to deliver what actual savings have been achieved. Genability is also developing a "Verified by Genability" certification that will go with these proposals and actual reports. This verification will serve as a 3rd party assessment of potential and actual solar savings. "Verified by Genability" will be the trusted 3rd party in communicating solar savings.	X						X	
Geostellar	Martinsburg, WV	10/22/13	$750,000	Geostellar is streamlining the procurement, financing, installation, and maintenance of solar arrays with the creation of a Solar Project Record. This will be available to homeowners, installers, government agencies, and financing companies through Web and mobile applications. The Solar Record provides application developers with important data, including the estimated cost of solar energy production on a particular rooftop, utility rates, load profiles, incentives, property ownership, equipment configuration, installation, and permitting requirements, for individual properties across the United States. Elements of the Solar Record will be updated through the application programming interface over the lifecycle of the solar array, providing valuable analytics on the	X				X	X	X	

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
				performance and pricing of solar goods and services for future product development and the development of a robust securitization market.								
Infinite Invention	Philadelphia, PA	10/22/13	$499,999	The Solar Socket is a device that adds a socket for plugging in a solar PV system between the electric meter and meter case. It streamlines the installation process by reducing wiring costs, scheduling requirements, and site inspection time and allows for swapping in new technologies as they emerge. In addition, a version with onboard metering and communications lets the power flow directly into the utility grid.	X		X	X			X	
kWh Analytics	Oakland, CA	10/22/13	$450,000	kWh Analytics is building big data information tools to help investors understand risk in the new solar asset class. Backed by the largest independent database of solar asset performance in the United States, kWh Analytics enables investors to deploy more capital with confidence.	X					X		
Renewable Power Conversion	San Luis Obispo, CA	10/22/13	$1,003,605	RPC is developing an environmentally sealed inverter featuring plug-and-play installation and a maintenance-free lifetime equal to that of PV modules. The Macro-Micro is a modular 17-kW inverter that provides high system MPPT granularity and high system up time. Power is converted with a CEC efficiency of 98.5% and low-loss system intrafield power collection is accomplished at 600 Vac. This distributed multi-string inverter provides multi-megawatt PV projects with a low LCOE alternative to large central inverters.			X	X				

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Picasolar (formerly Silicion Solar Solutions)	Fayetteville, AR	10/22/13	$500,000	Silicon Solar Solutions, in partnership with Georgia Tech and Roth & Rau, is developing a post-manufacturing hydrogen treatment to optimize the emitter of n-type solar cells resulting in improved conversion efficiency and reduced silver gridlines. The technology, commercialized as Picasolar, has shown 15% relative efficiency improvements while using one-third less silver grid lines in the lab. The goal of this project is to demonstrate the technology on commercial solar cells.		X	X	X				
Simply Civic	Parker, CO	10/22/13	$400,000	Simply Civic is streamlining the management of solar soft cost requests through an online application available to jurisdictions nationwide. The tool will seamlessly enable jurisdictions and installers to track solar projects while making it faster and simpler to complete required paperwork.	X						X	X
SineWatts	Palo Alto, CA	10/22/13	$499,735	SineWatts Inverter Molecules form the smallest building blocks of a grid-supportive and highly reliable PV power plant. This industry-transforming architecture achieves dramatic miniaturization, complete semiconductor integration, and plant-level component elimination while meeting the DOE cost reduction targets.			X	X				

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Solarnexus, Inc.	Oakland, CA	10/22/13	$496,987	SolarNexus and its partners are working to integrate a range of software used for customer acquisition, system design, permitting, and monitoring -- resulting in the industry's first ecosystem of interoperable software applications. The integration of key functionality from separate software vendors will significantly eliminate data re-entry and enhance the productivity of solar professionals with a simplified software experience. The ecosystem will leverage the Integrated Energy Project model, an existing, publicly-available data standard for the transfer of solar project information.	X				X		X	X
SMASHsolar	El Cerrito, CA	10/22/13	$500,000	SMASHsolar is working to break down barriers to solar by developing a proprietary, scalable PV mounting system that installs in half the time with half the parts and allows an array to easily expand over time. This project is developing and testing an integrated mounting system that shifts field work to the factory, resulting in a simplified installation process that drives down balance of systems costs. The product design will ultimately provide a refined and easy-to-use solar power product for homeowners.			X	X			X	
Solar Census	Walnut Creek, CA	10/22/13	$735,072	Solar Census is leveraging its patented algorithms to produce the first commercial-grade online shade tool that enables salespeople and system designers to customize PV systems in 3D and create highly accurate quotes in minutes. The software will streamline the sales and design process, reduce change orders and soft costs, and increase close rates and homeowner satisfaction.	X				X		X	

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Sun Number	Deephaven, MN	10/22/13	$1,000,000	Sun Number is analyzing rooftops to determine the best roofs and the best locations on roofs for solar. This data is used to create Sun Number Scores—a tool to educate consumers about the solar potential of their home. This data is combined with other data about the roof (i.e. age, material) and information about the owner of the building (i.e. behavioral modeling) to qualify properties and lower the cost of customer acquisition.	X						X	
Sunrun, Inc.	San Francisco, CA	10/22/13	$1,600,000	Sunrun is creating an integrated system that will streamline solar project development through automatic design, costing, simulation, proposal generation, pricing, permitting, and field change management. This end-to-end platform will optimize system performance and greatly reduce project cost and lead-to-cash process time.	X				X	X	X	X
Enki Technology	San Jose, CA	11/19/12	$1,500,000	Enki Technology is working to improve PV module efficiencies and reduce the levelized cost of energy (LCOE) through development of low-cost anti-reflective and anti-soiling coatings.			X	X				
REhnu, Inc.	Tucson, AZ	11/19/12	$1,000,000	REhnu is transitioning a new concentrating photovoltaics (CPV) technology, already proven in a University of Arizona prototype, to a low-cost form ready for commercial production. The technology uses large glass dish reflectors, each with a compact array of CPV cells at its focus. This makes it economical to build systems with an extended 40-year lifetime and maintain high power output by swapping in new cells as multijunction technology improves.			X	X			X	

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Solaflect Energy	Norwich, VT	11/19/12	$1,000,000	Solaflect Energy has developed a low-cost Suspension HeliostatTMthat dramatically reduces steel usage by utilizing steel cables to stabilize mirror panels rather than steel truss structures. The SunShot project will focus on continued development of the heliostat design, design for robotic manufacture, reduction of manufacturing and installation labor requirements, and the transition to high volume commercialization.			X	X			X	
Stion	San Jose, CA	11/19/12	$2,000,000	Stion has developed a disruptive technology based on a tandem copper indium gallium diselenide (CIGS) module that uses a revolutionary thin-film design to enable broader and more effective harvesting of available light. The tandem module, which utilizes mechanically stacked top and bottom modules to avoid the design and manufacturing challenges associated with multijunction monolithic integration, enables 18% efficiency on full-size CIGS modules.								
Mosaic	Oakland, CA	6/13/12	$2,000,000	Solar Mosaic brings much-needed capital to the solar industry with a web platform for everyday Americans to create and fund solar projects. Mosaic's unique online crowdfunding platform helps to reduce the soft costs of solar financing and customer acquisition while enabling thousands of Americans to own a piece of the growing clean energy economy.	X				X	X		
Boise State University	Boise, ID	11/1/11	$2,820,154	Develop an open-source, project planning tool based on geographic information systems that optimizes siting for utility-scale solar developments. The tool will enable users to assess sites based on quantifiable physical characteristics and constraints of the natural resource as well as military, land use, solar resource, water resource, and public acceptance factors.	X						X	

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	Firm Location	Funding Announced	$ Awarded by SunShot	Project Description from SunShot Website	Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	PV System Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, and Inspection Costs
Clean Power Finance	San Francisco, CA	11/1/11	$3,000,000	Develop an open-source, online information technology (IT) platform that will consist of a database of PV permitting requirements by the authorities that have jurisdiction, in addition to complementary turnkey IT solutions for installers and electric utility companies.	X							X
Hawaii Department of Business, Economic Development, and Tourism	Honolulu, HI	11/1/11	$750,000	Provide technical assistance to the state Public Utilities Commission as it sets statewide technical reliability standards through the form of a technical and policy-solution roadmap. The roadmap aims to resolve grid-reliability issues and reduce commercial business concerns around the integration of renewables, specifically solar, onto the transmission and distribution systems.	X							X
Illinois State University	Normal, IL	11/1/11	$850,000	Design, populate, and maintain a comprehensive national database of utility rates and rate design.	X							
Interstate Renewable Energy Council	Albany, NY	11/1/11	$3,000,000	Focus on removing technical and administrative barriers to cost-effective interconnection and transmission, expanding market opportunities for solar PV by enabling the availability of net metering, community solar, and solar in wholesale power markets, and incorporating high-penetration PV scenarios into utility planning and operations management.	X							X
Rocky Mountain Institute	Boulder, CO	11/1/11	$683,692	Accelerate large-scale adoption of solar PV through the creation and adoption of innovative approaches to utility regulation, rate design, and business models that enable high penetration of solar PV onto the utility grid.	X							X

Project Information					Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
Project / Firm	**Firm Location**	**Funding Announced**	**$ Awarded by SunShot**	**Project Description from SunShot Website**	**Soft Cost**	**Demonstration**	**Non-Module Hardware**	**Non-Module Hardware Costs**	**Business Costs**	**Development Costs**	**PV System Design, Installation, and Operation Costs**	**Permitting, Zoning, Interconnection, and Inspection Costs**
SolarTech	San Jose, CA	11/1/11	$2,500,000	Develop a scalable national platform to develop model codes, standards, rules, and processes that will enable reduced time frames for PV installations and deployment at lower cost.	X							X

Appendix E: Evaluation of Potential Overlap Between NYSERDA SCR and DOE SunShot Projects

See Appendices A and D for more detail on projects funded by SCR and SunShot respectively.

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Stimulate and Streamline NY Solar Sales by Promoting Novel Online Comparison-Shopping Marketplace	Energy Sage	Energy Sage will tailor its online education and shopping platform for solar PV systems to the New York State market and promote the platform through several consumer channels. Similar to Amazon or Expedia, Energy Sage's online Marketplace provides comparison-shopping functionality and impartial customer advisory services for solar PV systems.	Business costs	• Clean Energy Collective, National Community Solar Platform • Energy Sage (same funding recipient) • Faraday, customer acquisition data management platform • Geostellar, streamlined Solar Project Record • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Solar Census, shade tool • Solarnexus, interoperable software applications • Sunrun, integrated end-to-end project management software	Energy Sage (same funding recipient)	SunShot funded the development of Energy Sage's platform, while SCR funded the customization of content for New York State and the development of a network of New York partners.	No.

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Solar One Community Initiative	Solar One, Sustainable CUNY	Solar One will evaluate and identify best practices for customer aggregation pilot projects and implement this model in 2-3 new residential purchasing projects and 2-3 non-profit purchasing projects.	Business costs (customer acquisition)	• Clean Energy Collective, National Community Solar Platform • Energy Sage, online comparison shopping marketplace • Faraday, customer acquisition data management platform • Geostellar, streamlined Solar Project Record • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Solar Census, shade tool • Solarnexus, interoperable software applications • Sunrun, integrated end-to-end project management software	Clean Energy Collective, National Community Solar Platform	Installation of actual PV projects; NY-specific implementation; nonprofit focus. Note that SCR funded this project prior to SunShot funding Clean Energy Collective, so to the extent there are similarities, SCR did not duplicate a pre-established SunShot project.	No
NYSolar Smart: SunShares	Vote Solar Initiative (VSI), Sustainable CUNY	The project team will offer a customer aggregation program using targeted outreach to existing affinity groups such as employers, local governments, universities, and non-profit organizations.	Business costs (customer acquisition)	• Clean Energy Collective, National Community Solar Platform • Energy Sage, online comparison shopping marketplace • Faraday, customer acquisition data management platform • Geostellar, streamlined Solar Project Record • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Solar Census, shade tool • Solarnexus, interoperable software applications • Sunrun, integrated end-to-end project management software	None	N/A (no SunShot projects using similar approach)	No

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Westchester Solar Initiative	Energy Improvement Group (EIG) et al.	The project team will work directly with the building departments of 40 local governments to address permitting and zoning barriers, and will establish two waves of group-purchasing ("solarizing") programs in four municipalities.	Business costs (customer acquisition); permitting, zoning, interconnection, and inspection	• Aurora Solar, cloud-based optimization platform for design, engineering, and permit generation • Clean Energy Collective, National Community Solar Platform • Clean Power Finance, permitting requirement database • Energy Sage, online comparison shopping marketplace • Faraday, customer acquisition data management platform • Geostellar, streamlined Solar Project Record • Hawaii DBEDT, tech assistance to state PUC • IREC, promoting policy changes • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • RMI, innovative approaches to utility regulation, rate design, and business models • Simply Civic, project tracking software • Solar Census, shade tool; SolarTech, platform for model codes, standards, etc. • Solarnexus, interoperable software applications • Sunlayer, visual computing software for permitting, design and installation • Sunrun, integrated end-to-end project management software	• Hawaii DBEDT • IREC • RMI • SolarTech	NY-specific focus; provision of direct technical assistance; solarizing component	No

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Central New York Solar Initiative	Central New York Planning Board, Optony	The project team will establish a collaborative procurement program for local government, institutional, and non-profit customers in central New York, providing a wide range of technical assistance.	Business costs (customer acquisition); Permitting, zoning, interconnection, and inspection	• Aurora Solar, cloud-based optimization platform for design, engineering, and permit generation • Clean Energy Collective, National Community Solar Platform • Clean Power Finance, permitting requirement database • Energy Sage, online comparison shopping marketplace • Faraday, customer acquisition data management platform • Geostellar, streamlined Solar Project Record • Hawaii DBEDT, tech assistance to state PUC • IREC, promoting policy changes • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • RMI, innovative approaches to utility regulation, rate design, and business models • Simply Civic, project tracking software • Solarnexus, interoperable software applications • Solar Census, shade tool SolarTech, platform for model codes, standards, etc. • Sunlayer, visual computing software for permitting, design and installation • Sunrun, integrated end-to-end project management software	None	N/A (no SunShot projects using similar approach)	No

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Community Solar for New York	Clean Energy Collective	Clean Energy Collective will build a large-scale, grid-connected PV array in New York City and allow utility customers to receive on-bill credits by purchasing individual panels.	Business costs; development costs	• Clean Energy Collective, National Community Solar Platform – same funding recipient as SCR, but different project focus • Demeter Power, solar lease linked to property, not offtaker • Energy Sage, online comparison shopping marketplace • Faraday, customer acquisition data management platform • Geostellar, streamlined Solar Project Record • kWh Analytics, investment risk management software • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Sighten, streamlined solar asset management software • Solar Census, shade tool • Solarnexus, interoperable software applications • Sungage Financial, solar loans for homeowners • Sunrun, integrated end-to-end project management software • Sunvestment Group , web-based platform for community PPAs • Village Power Finance, streamlined project development, fundraising and asset management platform	None. The SunShot Clean Energy Collective project develops national online portal for community solar solutions, while SCR project is a demonstration project for community solar.	N/A (no SunShot projects using similar approach). Note that SCR funded Clean Energy Collective prior to SunShot, so to the extent there are similarities, SCR did not duplicate a pre-established SunShot project.	No

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Sunvestment Group Community Power Purchase Agreement (PPA)	Sunvestment Group, Keegan Associates, Phillips Lytle	The project team will design a web-based platform to post projects soliciting investment, refine the legal documentation necessary to complete several demonstration projects for community PPAs, and prepare to scale the service to a wider audience.	Development costs (financing)	• Clean Energy Collective, National Community Solar Platform • Demeter Power, solar lease linked to property, not offtaker • Geostellar, streamlined Solar Project Record • kWh Analytics, investment risk management software • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Sighten, streamlined solar asset management software • Sungage Financial, solar loans for homeowners • Sunvestment Group (same funding recipient) • Village Power Finance, streamlined project development, fundraising and asset management platform	Sunvestment Group (same funding recipient)	None; however, SCR funded this project prior to SunShot.	Yes, but SCR funded this project prior to SunShot. Thus, SCR did not duplicate a SunShot project at the time it made its funding decision. SCR funded about one-third of the total project cost.

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
2 – Sunvestment Group Community Power Purchase Agreement (PPA)	Sunvestment Group	As a continuation of Sunvestment Group's activities funded in round one, this project will create the back-end capability required to transform their website into a transaction-based investment platform and tracking service.	Development costs (financing)	• Clean Energy Collective, National Community Solar Platform • Demeter Power, solar lease linked to property, not offtaker • Geostellar, streamlined Solar Project Record • kWh Analytics, investment risk management software • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Sighten, streamlined solar asset management software • Sungage Financial, solar loans for homeowners • Sunvestment Group (same funding recipient) • Village Power Finance, streamlined project development, fundraising and asset management platform	Sunvestment Group (same funding recipient)	None; however, SCR funded this project prior to SunShot.	Yes, but SCR funded this project prior to SunShot. Thus, SCR did not duplicate a SunShot project at the time it made its funding decision. SCR funded about one-third of the total project cost.

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
New York Affordable Housing Program	GRID Alternatives	Combining philanthropy, industry partnerships and innovative tax strategies, GRID Alternatives will develop and implement a sustainable financing model to reduce the cost of solar for low-income homeowners in New York State by eliminating all up-front customer expenses and most ongoing customer expenses.	Development costs (financing)	• Clean Energy Collective, National Community Solar Platform • Demeter Power, solar lease linked to property, not offtaker • Geostellar, streamlined Solar Project Record • kWh Analytics, investment risk management software • Mosaic, solar loan and installer platform • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • Sighten, streamlined solar asset management software • Sungage Financial, solar loans for homeowners • Sunvestment Group, web-based platform for community PPAs • Village Power Finance, streamlined project development, fundraising and asset management platform	None	N/A (no SunShot projects using similar approach)	No

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Remote Rooftop Shade Tool for Installers and Financiers	Solar Census	Solar Census has developed the first commercial-grade automated rooftop shade analysis tool and will deploy this software across most of urban New York State.	Design, installation, and operation	• Aurora Solar, cloud-based optimization platform for design, engineering, and permit generation • Boise State University, GIS-based project planning software • Brittmore Group, automated pre-assembly for large-scale PV • Folsom Labs, design engineering software • Genability, solar savings reports • Geostellar, streamlined Solar Project Record • Infinite Invention, solar socket • Norwich Technologies, CSP receiver, collector and field design • REhnu, CSP reflectors • SafeConnect Solar, pre-engineered safety mechanisms • Simply Civic, project tracking software • Smash Solar, snap-together mounting system • Solaflect Energy, Suspension Heliostat • Solar Grid Storage, storage operations center • Solar Census (same funding recipient) • Solarnexus, interoperable software applications • Stem, energy storage evaluation and control software • Stion, thin-film copper indium gallium diselenide module • Sunlayer, visual computing software for permitting, design and installation Sun Number, Sun Number Scores • Sunrun, integrated end-to-end project management software	Solar Census (same funding recipient)	Support for commercial-ization vs. prototype development; NY-specific implementation. Note that SunShot funded this project before SCR.	No. Note that SCR was aware of SunShot's prior support for this funding recipient at the time it made its funding decision, so SCR presumably considered the issue of potential duplication directly at that time.

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
NYC Grid Ready Solar	City University of New York (CUNY), Con Edison, NREL	For buildings with large-scale PV potential, CUNY, Con Edison, and NREL will analyze the technical risk factors for grid interconnection and create public resources to allow developers to make informed decisions about project location and cost, including a layer on the NYC Solar Map showing where buildings may face interconnection issues.	Permitting, zoning, interconnection, and inspection	• Aurora Solar, cloud-based optimization platform for design, engineering, and permit generation • Clean Energy Collective, National Community Solar Platform • Clean Power Finance, permitting requirement database • Hawaii DBEDT, tech assistance to state PUC • IREC, promoting policy changes • Qado Energy, GridUnity analytic platform for distributed energy resource interconnection • RMI, innovative approaches to utility regulation, rate design, and business models • Simply Civic, project tracking software • SolarTech, platform for model codes, standards, etc. • Sunlayer, visual computing software for permitting, design and installation • Sunrun, integrated end-to-end project management software	None	N/A (no SunShot projects using similar approach)	No

NYSERDA SCR Projects				DOE SunShot Projects		Comparison	
Project	**Team Members**	**Description**	**Primary BOS Cost Category Addressed**	**Projects Addressing Same Primary BOS Cost Category**	**Projects Using Similar Approach to SCR**	**Key Differentiating Characteristics of SCR Project**	**Substantial Duplication?**
Roof-Integrated Lightweight PV Systems	The Research Foundation for SUNY, Johns Mansville, Solar Frontier, Tecta Solar, College of Nanoscale Science and Engineering at SUNY	The project team will install a prototype system to demonstrate the commercial viability of thin-film PV modules combined with rack-less roof integration methods and hardware, to create a reliable, lower-cost fully integrated PV product.	Non-module hardware	• Brittmore Group, automated pre-assembly for large-scale PV • Enki Technology, anti-reflective coatings • Infinite Invention, solar socket • Norwich Technologies, CSP receiver, collector and field design • Picasolar, solar cell hydrogen treatment • REhnu, CSP reflectors • Renewable Power Conversion, plug-and-play inverter • SafeConnect Solar, pre-engineered safety mechanisms • SineWatts, inverter molecule • Smash Solar, snap-together mounting system • Solaflect Energy, Suspension Heliostat • Stion, thin-film copper indium gallium diselenide module • Sundog, solar reflector	Smash Solar	Combination of rack-less integration and thin-film module; demonstration of established technology vs. development of new technology	No
New York Solar Soft Cost Survey	Meister Consultants Group	Meister Consultants Group will administer an online soft cost survey to major players in the New York PV market, hold a series of regional workshops, and report on findings.	Other	None	None	N/A (no SunShot projects using similar approach)	No

Appendix F: SunShot-Funded Projects Identified as Innovative

Project / Firm	Project Description from SunShot Website	Notes	Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
			Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, Inspection Costs
Clean Power Research	Clean Power Research is developing a software platform that will significantly reduce the soft costs associated with interconnecting distributed generation and encourage adoption with visualization tools and economic metrics. This software platform builds on the PowerClerk family of software that has successfully streamlined processing for nearly 75% of distributed solar incentives nationwide. The platform has the potential to cut interconnection costs by up to 65% and reduce overall soft costs by up to $800 per installed system.	SCR has not focused on interconnected distributed generation, an issue that may become more prominent in NYSERDA's vision for future energy systems. This type of software has limited availability in the market.	X							X
kWh Analytics	kWh Analytics will create a risk management software platform centered on a predictive score ("kWh Score") that enables investors to statistically quantify production risk for any solar investment in the United States. The kWh Score will be the output of a cutting-edge statistical model that is built atop the kWh Database, which is the solar industry's largest independent database of historical operating performance data (40,000+ systems).	Statistical quantification of production risk has not been broadly applied in the solar market. SCR has only addressed financing costs to a limited extent.	X					X		
Qado Energy	Qado Energy's advanced distribution analytics platform GridUnityTM will be used by utilities and distributed energy resource (DER) developers to accelerate the engineering and economic decision making required for the reliable interconnection of DER from months to minutes. The capability to radically reduce the time it takes to analyze complex situations and make face-based decisions reduces	SCR has not focused on ways to facilitate rapid scale-up of DER, an issue that may become more prominent in NYSERDA's vision for future energy systems.	X				X			X

Project / Firm	Project Description from SunShot Website	Notes	Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
			Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, Inspection Costs
	stakeholder risk and enables a sea change in business operations and customer engagement.	This type of software has limited availability in the market.								
Renewable Power Conversion	RPC is developing an environmentally sealed inverter featuring plug-and-play installation and a maintenance-free lifetime equal to that of PV modules. The Macro-Micro is a modular 17-kW inverter that provides high system MPPT granularity and high system up time. Power is converted with a CEC efficiency of 98.5% and low-loss system intrafield power collection is accomplished at 600 Vac. This distributed multi-string inverter provides multi-megawatt PV projects with a low LCOE alternative to large central inverters.	Plug-and-play design represents an under-developed area with potential for substantial cost reductions.			X	X				
SafeConnect Solar	SafeConnect Solar is building a prototype of its patent-pending device that pre-engineers hardware and software-based safety mechanisms into residential photovoltaic (PV) systems so that the system can be safely installed by non-specialized labor. SafeConnect's product reduces installation labor costs, will reduce customer acquisition, design, and permitting costs, and makes PV systems safer to install, own, and maintain.	The literature identifies reducing the need for specialized labor as a key area where further work is needed, with potential for substantial cost reductions.	X		X	X			X	X

Project / Firm	Project Description from SunShot Website	Notes	Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
			Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, Inspection Costs
SineWatts	SineWatts is transforming the PV power plant for mainstream generation with its patent pending Inverter Molecule that completely eliminates any inverter footprint by miniaturizing and siliconizing the hardware into the PV panel junction box. A SineWatts power plant will have 70% lower landed inverter cost while providing advanced grid assist for next generation grid integration requirements.	The “inverter molecule” appears to be a radically different technology from current practice. See the text box below on Google’s Little Box Challenge regarding inverter size.		X	X	X				
Smash Solar, Inc.	Smash Solar is developing a simple, snap-together, module-integrated PV mounting system which will dramatically reduce the time, effort and skill needed to install rooftop solar. This project is developing and testing an integrated mounting system that shifts field work to the factory, resulting in a simplified installation process that drives down BOS costs. The product design will ultimately provide a refined and easy-to-use solar power product for homeowners.	Standardizing hardware can drive efficiencies in installation labor, an area identified in the literature as a key area where further work is needed.			X	X			X	
Solar Grid Storage	Solar Grid Storage will develop a Solar Storage Operations Center (SSOC) to address the unique needs of managing grid-connected PV + storage assets. The SSOC will make it possible to bring together multiple storage sites and enhance grid stability with every new PV + storage resource installed, all the while reducing deployment costs. A scalable solution, the SSOC will help mitigate concerns about high-penetration PV deployment by enabling cost-effective control of residential, commercial, and utility-scale PV + storage systems.	SCR has not addressed energy storage, and this type of technology is not yet commercially available. NYSERDA’s REV process makes suggests this could be particularly relevant.	X						X	

Project / Firm	Project Description from SunShot Website	Notes	Solar Cost Reduction PON Category Addressed			BOS Cost Category Addressed				
			Soft Cost	Demonstration	Non-Module Hardware	Non-Module Hardware Costs	Business Costs	Development Costs	Design, Installation, and Operation Costs	Permitting, Zoning, Interconnection, Inspection Costs
Stem	Stem is developing a software platform for energy storage evaluation and automated storage system control. The project will improve the application of distributed storage in areas with high PV penetration while lowering grid integration costs and improving grid stability.	SCR has not addressed energy storage, and this type of technology does not appear to be currently available. NYSERDA's REV process makes suggests this could be particularly relevant.	X						X	
Sungage Financial	Sungage Financial is a marketplace that provides homeowners with easy, online access to low-cost financing for solar equipment. Through its pilot activities in MA and CT, Sungage has gained expertise in how to meet the needs of consumers, installers, and capital providers. Sungage will expand through partnerships with solar installation companies in active solar markets nationwide.	Solar loans for homeowners are not yet prevalent in the New York State market, and represent an emerging trend in solar financing. SCR has only addressed financing costs to a limited extent.	X					X		

Appendix G: Literature Review Bibliography

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Appendix H: Interview Guide for Key Informant Interviews

This general interview guide served as guidance for developing more specific interview questions for individual interview subjects.

Introductory Questions

1. Can you briefly summarize your experience in the solar PV industry?
    a. In New York State specifically?

Questions about Key Barriers and BOS Cost Reduction Strategies

2. NYSERDA'S Solar Cost Reduction program aims to reduce balance-of-system costs for solar PV systems in New York State by addressing several broad categories of barriers to cost reduction. Please describe your familiarity with each of the following types of barriers.
    a. Barriers and solutions related to non-module hardware;
    b. Barriers and solutions related to business costs, including customer acquisition costs;
    c. Barriers and solutions related to development costs, including contracting and financing;
    d. Barriers and solutions related to system design, installation, and operation; and
    e. Barriers and solutions related to permitting, zoning, interconnection, and inspection.

3. Which barriers to BOS cost reduction do you consider to be the most significant in New York State? Why?
    a. Which barriers to BOS cost reduction do you think can be addressed effectively at the state level? Which are most appropriately addressed through national programs such as DOE's SunShot Initiative?

4. Are you aware of any particularly innovative and/or promising efforts to reduce BOS costs, either in New York State or elsewhere?
    a. *[If yes]* Please describe these efforts.
    b. *[If yes]* Would these efforts be effective in New York State, or if already occurring in NYS, would it be effective to expand these efforts within NYS?

5. *[For industry stakeholders knowledgeable about BOS hardware components]* Please describe the opportunities to reduce BOS costs by altering the design, manufacture, or another aspect of non-module hardware components.
    a. From your perspective, are there opportunities to lower non-module hardware costs through statewide action by NYSERDA or another state energy agency? Why or why not?

6. *[For industry stakeholders knowledgeable about BOS hardware components]* Are you aware of any efforts underway to design or manufacture innovative hardware solutions to reduce BOS costs:
    a. That are occurring outside of New York State? If yes, which of these would be useful to demonstrate in New York State, in order to stimulate market adoption?
    b. That are occurring within New York State?
    c. That have struggled to secure funding?

Questions about the Solar Cost Reduction Program

7. How would you recommend that NYSERDA program staff reach out to individuals, companies, and/or organizations that are developing innovative strategies for reducing BOS costs? For example, are there particular industry groups that NYSERDA should be targeting? Are there particular publications in which NYSERDA should be advertising its programs?

8. We are interested in your thoughts on the potential of NYSERDA-funded projects to achieve replication effects in New York State. Replication effects refer to other market actors adopting a technology or approach pioneered by a NYSERDA-funded project.
    a. From your perspective, what particular characteristics would cause project developers or other industry stakeholders to take notice of a project aimed at reducing BOS costs? *[Tailor question to specific barriers with which interview subject is familiar]*
    b. From your perspective, how large would a project need to be in order to achieve replication effects?

9. We are interested in assessing the effectiveness of NYSERDA's Program Opportunity Notice (PON) 2672, which solicited funding applicants for the Solar Cost Reduction (SCR) program. The PON funded projects in three categories. Category A funded projects targeting BOS soft costs; the maximum funding award was $500,000 for the total project, with a $250,000 maximum per project phase. Category B funded hardware or other product development projects, with a maximum funding award of $500,000 per project. Category C funded demonstration projects to validate products or practices that reduced soft costs; the maximum funding award was $1,000,000 per project.
    a. Do you think that the size of funding awards was appropriate for attracting high quality applicants? *[Tailor question as needed to the specific types of projects with which the interview subject is familiar.]*
    b. Do you think that the size of funding awards was appropriate for addressing barriers to BOS cost reductions in New York State? *[Tailor question as needed to the specific barriers with which the interview subject is familiar.]*
    c. Do you have any recommendations for improving the scale of funding awards in each category? *[Tailor question as needed to the specific types of projects with which the interview subject is familiar.]*

10. The PON requested that applicants share the costs of their proposed projects. NYSERDA preferred at least 25% cost sharing for projects in Category A (soft cost reduction projects), and required at least 50% cost sharing for projects in Categories B and C, (product development and demonstration projects).
    a. Do you think that the cost sharing requirement was appropriate for attracting high quality applicants? *[Tailor question as needed to the specific types of projects with which the interview subject is familiar.]*
    b. Do you have any recommendations for improving the cost sharing requirement in each category? *[Tailor question as needed to the specific types of projects with which the interview subject is familiar.]*

11. How can the SCR program best leverage efforts being undertaken by other programs, such as DOE's SunShot Initiative, to achieve further BOS cost reductions?
    a. Where is there room for further BOS cost reduction efforts and where is the market already saturated?
    b. How can the SCR program avoid duplicating other programs' efforts?

Appendix I: Survey Instrument

Introduction: This survey is in regard to the New York State Energy Research and Development Authority's (NYSERDA's) Solar Cost Reduction program. This program aims to reduce balance-of-system (BOS) costs of solar photovoltaic (PV) installations. BOS costs include everything involved in a PV system except the module, such as the costs of non-module hardware, design, installation, permitting, interconnection, inspection, financing, and customer acquisition.

The Solar Cost Reduction program awards funding to third parties through Program Opportunity Notice (PON) 2672, which solicits proposals for projects that will result in cost savings associated with purchasing, installing, owning, and operating a PV system in New York. Several questions in this survey concern this PON. The project categories eligible for funding under the PON include:

- **BOS Soft Cost Reduction:** Non-hardware projects that address and reduce specific BOS 'soft' cost elements. Maximum funding for this Category is $500,000 for the total project, with a maximum of $250,000 per project phase. Proposer cost share of at least 25% is preferred.

- **BOS Product Development:** Projects that develop a BOS product or component (hardware) that will lead to lower overall installed costs of PV systems. Maximum funding for this category is $500,000 per project. Proposer cost share of at least 50% is required.

- **Demonstration Projects:** Projects that demonstrate and validate BOS cost reduction strategies for either soft costs or hardware, such as business models, other innovative soft cost reduction strategies, or BOS components or products. These projects must also involve installation of PV systems. Maximum funding for this category is $1,000,000 per project. Cost share of at least 50% is required.

The survey should take approximately 10-15 minutes to complete.

If you have questions or want more information on the survey, please contact Jennifer Phelps, Associate Project Manager in NYSERDA's Evaluation group, at 518-862-1090 x 3569 or Jennifer.phelps@nyserda.ny.gov.

Go on to question 1.

1. Do you or your organization conduct work related in any way to solar photovoltaic (PV) systems?

   a. ☐ Yes
   b. ☐ No

   If yes, go on to question 2. If no, skip to question 23.

2. In 2013, NYSERDA issued Program Opportunity Notice (PON) 2672, "Photovoltaic Balance-of-System Cost Reduction." Applications for the first round of funding were due in July 2013, and applications for the second round of funding were due in January 2014.

   Has your organization already been selected to receive funding for a project submitted under this PON?

   a. ☐ Yes
   b. ☐ No
   c. ☐ Not sure

   If yes, skip to question 23. If no or not sure, go on to question 3.

3. Which of the following best describes your organization? Check only one.

   a. ☐ PV system/component manufacturer or hardware developer
   b. ☐ PV project developer
   c. ☐ PV system installer/contractor
   d. ☐ Utility
   e. ☐ For-profit business that offers a PV-related service
   f. ☐ Financing organization
   g. ☐ Other for-profit business
   h. ☐ Local government organization
   i. ☐ Other (non-local) government organization
   j. ☐ Academic institution
   k. ☐ Non-profit organization, research focus
   l. ☐ Non-profit organization, advocacy focus
   m. ☐ Other (please explain)

   (Optional) Comments:_____

4. Which of the following best describes your organization? Check only one.

   a. ☐ 1-10 employees
   b. ☐ 11-25 employees
   c. ☐ 26-100 employees
   d. ☐ 101-500 employees
   e. ☐ > 500 employees

5. To the best of your recollection, how did you hear about Program Opportunity Notice (PON) 2672, "Photovoltaic Balance-of-System Cost Reduction?" Check all that apply.

   a. ☐ Received email notification directly from NYSERDA

b. ☐ Saw PON on NYSERDA website
c. ☐ Notified by a third party
d. ☐ Press release
e. ☐ Don't remember/not sure
f. ☐ Other (please explain)
g. ☐ I was not aware of this PON before now

(Optional) Comments:_____

6. On a scale of 1-5, with 1 being not at all important and 5 being very important, how important were each of the following factors in your decision not to submit a funding proposal under PON 2672?

a. Was not aware of PON at time of proposal deadline
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

b. Did not have a relevant project to submit
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

c. Had a relevant project, but it was excluded by scope of PON
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

d. Had a relevant project, but could not wait for funding award to begin
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

e. Insufficient funding available (maximum of $500,000 for soft cost reduction and product development projects; maximum of $1,000,000 for demonstration projects)
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

f. Cost-sharing requirement too onerous (25% cost share preferred for soft cost reduction projects; 50% cost share required for product development and demonstration projects)
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

g. NYSERDA cost recoupment requirement (i.e., royalty payments) for products reaching commercialization too onerous (product development projects only)
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

h. Insufficient time between funding announcement and proposal deadline
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

i. Application process too difficult
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

j. Insufficient likelihood of proposal being accepted for funding
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

k. Preferred to submit proposal to a different funder (please explain)
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

l. Unacceptable project requirements or contract terms (please explain)
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

m. Negative past experience with NYSERDA

☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

n. Other (please explain)
☐ 1 (not important) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (very important) ☐ N/A or not sure

(Optional) Comments:_____

7. Do you have a potential project for which you might consider submitting a funding proposal to the NYSERDA Solar Cost Reduction program in the future?

   a. ☐ Yes
   b. ☐ No
   c. ☐ Not Sure

   If yes, go on to question 8. If no or not sure, skip to question 12.

8. How likely are you to submit a funding proposal to NYSERDA for this project?
   a. ☐ Very unlikely
   b. ☐ Somewhat unlikely
   c. ☐ Somewhat likely
   d. ☐ Very likely
   e. ☐ Not sure

9. Which of these categories best describes this project? Check only one.

   a. ☐ Soft costs (non-hardware)
   b. ☐ Product or hardware components
   c. ☐ Demonstration of hardware or a soft cost concept, where such demonstration includes installation of PV system(s)
   d. ☐ Not sure

10. Which of the following issues does this project address? Check all that apply.

    a. ☐ Non-module hardware
    b. ☐ Customer acquisition or other business costs
    c. ☐ Contracting, financing, or other development costs
    d. ☐ PV system design, installation, and operation
    e. ☐ Permitting, zoning, interconnection, and inspection
    f. ☐ Other
    g. ☐ Not Sure

11. Please provide a brief (one or two sentence) description of the project.

    Comments: _____

12. In your opinion, what is the best opportunity for reducing solar balance-of-system (BOS) costs in New York State, <u>other than</u> project ideas that you might submit to NYSERDA for funding? That

is, what is the most important cost issue to be addressed, and/or the most effective strategy for addressing that issue? In particular, what could other market actors do that would benefit your organization the most? If you don't have any suggestions, leave your response blank.

Comments: _____

13. In your opinion, what level of funding award (per project) would be likely to encourage you to submit a project proposal for funding under PON 2672 in the future? Bear in mind that NYSERDA currently prefers cost sharing of at least 25% for soft cost reduction projects, and requires cost sharing of at least 50% for product development and demonstration projects.

    a. ☐ No change needed (Maximum funding level for soft cost reduction and product development = $500,000; for demonstration = $1,000,000)
    b. ☐ $750,000
    c. ☐ $1,000,000 (current level for demonstration projects)
    d. ☐ $1,500,000
    e. ☐ $2,000,000 or more
    f. ☐ Not sure

    (Optional) Comments:_____

14. Given the current funding levels (maximum funding for soft cost reduction and product development projects = $500,000; for demonstration projects = $1,000,000), what level of funding would you request, if you submitted a project proposal for funding under PON 2672 in the future? Please enter your best estimate. Bear in mind that NYSERDA currently prefers cost sharing of at least 25% for soft cost reduction projects, and requires cost sharing of at least 50% for product development and demonstration projects.
    a. Enter Dollar Amount $ _____
    b. I will definitely not submit a proposal for funding in the future
    c. Not sure/Cannot Estimate a Request Amount

    (Optional) Comments:_____

15. Which of the following do you use on a regular basis to get information regarding developments in the solar PV industry? Check all that apply. Please provide additional details on your answer in the comments.
    a. ☐ Trade journals and other publications
    b. ☐ Conferences/meetings
    c. ☐ Email listservs/newsletters
    d. ☐ NYSERDA website
    e. ☐ Other third-party website
    f. ☐ Social media (LinkedIn, Facebook, etc.)
    g. ☐ Press releases
    h. ☐ Other (please explain)

    (Optional) Comments:_____

16. What specific information sources do you typically consult for information on funding opportunities (e.g., specific publications, websites, or organizations)? Be as specific as you can, identifying sources by name if at all possible.

    (Optional) Comments:_____

17. Do you have any suggestions for ways in which PON 2672 should be promoted or publicized in the future (e.g., specific publications, websites, or organizations)? If yes, please explain. Be as specific as you can.

    a. ☐ Yes
    b. ☐ No

    (Optional) Comments:_____

18. Do you have any other comments or suggestions you wish to communicate to NYSERDA regarding Program Opportunity Notice 2672 or the Solar Cost Reduction program? If yes, enter them below.

    (Optional) Comments:_____

19. Are you willing to be contacted by NYSERDA and/or its contractor to provide additional information on your responses to this survey? If yes, NYSERDA and/or its contractor may contact you by phone or email for a one-time follow-up. Your contact information will not be shared with other parties or used for any other purpose.

    a. ☐ Yes
    b. ☐ No

    If yes, go on to question 20. If no, skip to question 21.

20. Please provide your contact information, including name, position, organization, email address, and phone number.

    Name: _____
    Position: _____
    Organization:_____
    Email address: _____
    Phone number:_____

21. Please provide your email address. This is for survey validation purposes only. You will not be contacted unless you indicated that you are willing to have NYSERDA contact you. Even if you already provided your email address, please do so again now.

    Email address: _____

22. The survey is complete. Thank you for your participation.

    End survey.

23. Based on your response, you are not eligible to take this survey. Thank you for your time and willingness to participate.

    End survey.

Appendix J: Survey Results

SURVEY QUESTION	SURVEY QUESTION	# OF RESPONSES	SURVEY RESPONSES											
1	Do you or your organization conduct work related in any way to solar photovoltaic (PV) systems?	120	**Yes**		**No**									
			#	**%**	**#**	**%**								
			64	53.3%	56	46.7%								
2	In 2013, NYSERDA issued Program Opportunity Notice (PON) 2672, "Photovoltaic Balance-of-System Cost Reduction." Applications for the first round of funding were due in July 2013, and applications for the second round of funding were due in January 2014. Has your organization already been selected to receive funding for a project submitted under this PON?	64 (those who answered "yes" to question 1)	**Yes**		**No**		**Not Sure**							
			#	**%**	**#**	**%**	**#**	**%**						
			5	7.8%	48	75.0%	11	17.2%						
3	Which of the following best describes your organization? Check only one.	59	**Checked**											
			#	**%**										
	PV system/component manufacturer or hardware developer		3	5.1%										
	PV project developer		5	8.5%										
	PV system installer/contractor		15	25.4%										
	Utility		2	3.4%										
	For-profit business that offers a PV-related service		9	15.3%										
	Financing organization		0	0.0%										
	Other for-profit business		2	3.4%										
	Local government organization		4	6.8%										
	Other (non-local) government organization		0	0.0%										
	Academic institution		7	11.9%										
	Non-profit organization, research focus		0	0.0%										
	Non-profit organization, advocacy focus		4	6.8%										
	Other (please explain)		8	13.6%										

SURVEY QUESTION	SURVEY QUESTION	# OF RESPONSES	SURVEY RESPONSES											
4	Which of the following best describes your organization? Check only one.	59	**1-10 employees**		**11-25 employees**		**26-100 employees**		**101-500 employees**		**> 500 employees**			
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**		
			23	39.0%	10	16.9%	10	16.9%	5	8.5%	11	18.6%		
5	To the best of your recollection, how did you hear about Program Opportunity Notice (PON) 2672, "Photovoltaic Balance-of-System Cost Reduction?" Check all that apply.	59	**Checked**		**Not checked**									
			#	**%**	**#**	**%**								
	a. Received email notification directly from NYSERDA		36	61.0%	23	39.0%								
	b. Saw PON on NYSERDA website		10	16.9%	49	83.1%								
	c. Notified by a third party		2	3.4%	57	96.6%								
	d. Press release		1	1.7%	58	98.3%								
	e. Don't remember/not sure		4	6.8%	55	93.2%								
	f. Other (please explain)		1	1.7%	58	98.3%								
	g. I was not aware of this PON before now		11	18.6%	48	81.4%								
6	On a scale of 1-5, with 1 being not at all important and 5 being very important, how important were each of the following factors in your decision not to submit a funding proposal under PON 2672?	59												
	a. Was not aware of PON at time of proposal deadline	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			16	27.1%	4	6.8%	6	10.2%	3	5.1%	12	20.3%	18	30.5%
	b. Did not have a relevant project to submit	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			5	8.5%	5	8.5%	5	8.5%	7	11.9%	22	37.3%	15	25.4%
	c. Had a relevant project, but it was excluded by scope of PON	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			13	22.0%	2	3.4%	6	10.2%	5	8.5%	2	3.4%	31	52.5%
	d. Had a relevant project, but could not wait for funding award to begin	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**

SURVEY QUESTION	SURVEY QUESTION	# OF RESPONSES	SURVEY RESPONSES											
			19	32.2%	4	6.8%	3	5.1%	2	3.4%	4	6.8%	27	45.8%
	e. Insufficient funding available (maximum of $500,000 for soft cost reduction and product development projects; maximum of $1,000,000 for demonstration projects)	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			20	33.9%	4	6.8%	6	10.2%	2	3.4%	4	6.8%	23	39.0%
	f. Cost-sharing requirement too onerous (25% cost share preferred for soft cost reduction projects; 50% cost share required for product development and demonstration projects)	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			15	25.4%	3	5.1%	6	10.2%	4	6.8%	9	15.3%	22	37.3%
	g. NYSERDA cost recoupment requirement (i.e., royalty payments) for products reaching commercialization too onerous (product development projects only)	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			13	22.0%	0	0.0%	3	5.1%	6	10.2%	9	15.3%	28	47.5%
	h. Insufficient time between funding announcement and proposal deadline	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			13	22.0%	3	5.1%	8	13.6%	3	5.1%	7	11.9%	25	42.4%
	i. Application process too difficult	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			10	16.9%	5	8.5%	8	13.6%	3	5.1%	8	13.6%	25	42.4%
	j. Insufficient likelihood of proposal being accepted for funding	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			9	15.3%	3	5.1%	6	10.2%	6	10.2%	9	15.3%	26	44.1%
	k. Preferred to submit proposal to a different funder (please explain)	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			19	32.2%	6	10.2%	3	5.1%	0	0.0%	0	0.0%	31	52.5%
	l. Unacceptable project requirements or contract terms (please explain)	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			13	22.0%	9	15.3%	2	3.4%	0	0.0%	3	5.1%	32	54.2%
	m. Negative past experience with NYSERDA	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	

SURVEY QUESTION	SURVEY QUESTION	# OF RESPONSES	SURVEY RESPONSES											
			#	%	#	%	#	%	#	%	#	%	#	%
			20	33.9%	3	5.1%	4	6.8%	0	0.0%	1	1.7%	31	52.5%
	n. Other (please explain)	59	**1**		**2**		**3**		**4**		**5**		**N/A or not sure**	
			#	%	#	%	#	%	#	%	#	%	#	%
			14	23.7%	2	3.4%	2	3.4%	0	0.0%	5	8.5%	36	61.0%
7	Do you have a potential project for which you might consider submitting a funding proposal to the NYSERDA Solar Cost Reduction program in the future?	59	**Yes**		**No**		**Not Sure**							
			#	%	#	%	#	%						
			29	49.2%	12	20.3%	18	30.5%						
8	How likely are you to submit a funding proposal to NYSERDA for this project?	29 (those who answered "yes" to question 7)	**Very unlikely**		**Somewhat unlikely**		**Somewhat likely**		**Very likely**		**Not sure**			
			#	%	#	%	#	%	#	%	#	%		
			3	10.3%	2	6.9%	14	48.3%	7	24.1%	3	10.3%		
9	Which of these categories best describes this project? Check only one.	29 (those who answered "yes" to question 7)	**Soft costs (non-hardware)**		**Product or hardware components**		**Demonstration…**		**Not sure**					
			#	%	#	%	#	%	#	%				
			7	24.1%	8	27.6%	12	41.4%	2	6.9%				
10	Which of the following issues does this project address? Check all that apply.	29 (those who answered "yes" to question 7)	**Checked**											
			#	%										
	a. Non-module hardware		5	17.2%										
	b. Customer acquisition or other business costs		7	24.1%										
	c. Contracting, financing, or other development costs		9	31.0%										
	d. PV system design, installation, and operation		16	55.2%										
	e. Permitting, zoning, interconnection, and inspection		10	34.5%										
	f. Other		3	10.3%										
	g. Not Sure		3	10.3%										
11	Please provide a brief (one or two sentence) description of the project.	29 (those who												

SURVEY QUESTION	SURVEY QUESTION	# OF RESPONSES	SURVEY RESPONSES											
		answered "yes" to question 7)												
12	In your opinion, what is the best opportunity for reducing solar balance-of-system (BOS) costs in New York State, other than project ideas that you might submit to NYSERDA for funding? That is, what is the most important cost issue to be addressed, and/or the most effective strategy for addressing that issue? In particular, what could other market actors do that would benefit your organization the most? If you don't have any suggestions, leave your response blank.	59												
13	In your opinion, what level of funding award (per project) would be likely to encourage you to submit a project proposal for funding under PON 2672 in the future? Bear in mind that NYSERDA currently prefers cost sharing of at least 25% for soft cost reduction projects, and requires cost sharing of at least 50% for product development and demonstration projects.	59	**No change needed**		**$750,000**		**$1,000,000**		**$1,500,000**		**$2,000,000 or more**		**Not sure**	
			#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
			19	32.2%	0	0.0%	7	11.9%	2	3.4%	1	1.7%	30	50.8%
14	Given the current funding levels (maximum funding for soft cost reduction and product development projects = $500,000; for demonstration projects = $1,000,000), what level of funding would you request, if you submitted a project proposal for funding under PON 2672 in the future? Please enter your best estimate. If you are not sure, leave your response blank. Bear in mind that NYSERDA currently prefers cost sharing of at least 25% for soft cost reduction projects, and requires cost sharing of at least 50% for product development and demonstration projects.	59	**Entered dollar amount**		**Will not submit a proposal**		**Not sure/cannot estimate**							
			#	**%**	**#**	**%**	**#**	**%**						
			14	23.7%	7	11.9%	38	64.4%						
		14 (those who submitted a dollar amount)	**$0-$250,000**		**$250,001-$500,000**		**>$500,000**							
			#	**%**	**#**	**%**	**#**	**%**						
			5	35.7%	3	21.4%	6	42.9%						
15	Which of the following do you use on a regular basis to get information regarding developments in the solar PV industry? Check all that apply. Please provide additional details on your answer in the comments.	59	**Checked**											
			#	**%**										
	a. Trade journals and other publications		45	76.3%										
	b. Conferences/meetings		39	66.1%										
	c. Email listservs/newsletters		41	69.5%										
	d. NYSERDA website		40	67.8%										
	e. Other third-party website		23	39.0%										

SURVEY QUESTION	SURVEY QUESTION	# OF RESPONSES	SURVEY RESPONSES											
	f. Social media (LinkedIn, Facebook, etc.)		13	22.0%										
	g. Press releases		21	35.6%										
	h. Other (please explain)		9	15.3%										
16	What specific information sources do you typically consult for information on funding opportunities (e.g., specific publications, websites, or organizations)? Be as specific as you can, identifying sources by name if at all possible.	27 (those who provided a written answer)												
17	Do you have any suggestions for ways in which PON 2672 should be promoted or publicized in the future (e.g., specific publications, websites, or organizations)? If yes, please explain. Be as specific as you can.	11 (those who provided a written answer)												
18	Do you have any other comments or suggestions you wish to communicate to NYSERDA regarding Program Opportunity Notice 2672 or the Solar Cost Reduction program? If yes, enter them below.	11 (those who provided a written answer)												
19	Are you willing to be contacted by NYSERDA and/or its contractor to provide additional information on your responses to this survey? If yes, NYSERDA and/or its contractor may contact you by phone or email for a one-time follow-up. Your contact information will not be shared with other parties or used for any other purpose.	59	**Yes**		**No**									
			#	**%**	**#**	**%**								
			29	49.2%	30	50.8%								

Appendix K: Survey Responses to Open-Ended Questions

Optional Additional Comments Provided on Close-Ended Questions
3. Which of the following best describes your organization? Check only one.
• [omitted to preserve confidentiality] • Our PV installation/contracting business is part of our overall engineering company, doing a range of design and energy related project work. • [omitted to preserve confidentiality] • Developing solar structures to speed deployment in areas that can have accessory structures, to provide added value and reduced solar costs • Provider of thin film coated components that enhnace *[sic]* PV technical and finanical *[sic]* gains. • The system only allows one selection. We also manufacture mounting equipment. • We are renewable energy and sustainability consultants and help public "not-for-profit" Clients to become energy independent via solar PV installation via competitive procurement of PPA from Developers. We believe that our role saves on soft costs and eliminates duplicate engineering by all developers. • Not directly in the PV business but are researching systems and how to lower operating cost annually • Engineering consulting firm • My firm prepares grant applications for solar installations. We also conduct information seminars regarding solar andother *[sic]* renewable energy applications. • Consulting engineers
5. To the best of your recollection, how did you hear about Program Opportunity Notice (PON) 2672, "Photovoltaic Balance-of-System Cost Reduction?" Check all that apply.
• No comments received
6. On a scale of 1-5, with 1 being not at all important and 5 being very important, how important were each of the following factors in your decision not to submit a funding proposal under PON 2672?
• My work is education, not research or development. But very often NYSERDA PONs allow too little time between notice and deadline; and the application process is onerous. • Our proposal areas of focus were likely to yield small returns on system lifetime levelized cost of energy. Quickly changing industry economics (including changing NYSERDA incentives) much more powerful cost drivers. • We did not have the internal resources available to write the proposal at the time. We budget 50-100 hours for a proposal like this, and just did not have our proposal-writer available, as well as time available for our technical staff to develop the concepts and support the proposal. • We are a small organization with excellent ideas but limited time and money. For us to pay out a royalty on our own designs is difficult. In the same token I believe job creation within New York State would be just as beneficial to NYSERDA as receiving a royalty. • [omitted to preserve confidentiality] • Balance of cost can be reduced by better financial terms of payment and higher incentives paid at early stage. If installers and grant applicants can secure low interest construction phase funding (like EFC zero % construction loans) then the net capital cost can be financed over a 10 years period and this loan paid back from the avoided cost of power. Simplified funding means lower markup for the developer and lower cost per watt for installation. • It seems that the PON's are so narrowly drawn as to stifle ideas and process' that may not be fully tested. It appears that the requirements are only drawn to specific systems as may be pre-determined • Was not previously aware on PON. • Did not have applicable project. • As a regulated utility, we are currently not able to own generation. • BOS cost reduction not within our business areas. We develop, finance and build PV projects. We

Optional Additional Comments Provided on Close-Ended Questions
are neither a manufacturer nor an IT or professional services biz.
13. In your opinion, what level of funding award (per project) would be likely to encourage you to submit a project proposal for funding under PON 2672 in the future? Bear in mind that NYSERDA currently prefers cost sharing of at least 25% for soft cost reduction projects, and requires cost sharing of at least 50% for product development and demonstration projects.
• I don't do research/development on solar PV, so would not submit a proposal. • The cost sharing requirements are large and are difficult to enlist in the balance of system areas of PV installation. • Not enough characters allowed to answer. 150 characters is nothing. • Using an example of 2MW project the total capital cost of the system is around $4 Million. A construction Line of Credit of 1.5 Million can help finance the project construction and it can be converted to a 10 Year term loan. The NYSERDA grant incentive of 30% paid upon completion. Total project cost can thus be reduced by making money available when it is needed. • A Feed in Tariff program would be more successful than direct grants and subsidies.
14. Given the current funding levels (maximum funding for soft cost reduction and product development projects = $500,000; for demonstration projects = $1,000,000), what level of funding would you request, if you submitted a project proposal for funding under PON 2672 in the future? Please enter your best estimate. If you are not sure, leave your response blank. Bear in mind that NYSERDA currently prefers cost sharing of at least 25% for soft cost reduction projects, and requires cost sharing of at least 50% for product development and demonstration projects.
• You will get a greater pool of ideas if cost sharing is 25% for product development because some designers have limited funding. • My organization is not a developer or installer • No real projects, can afford the time, cost, royalty imposed regardless of the benefit of the innovation to the project. Private sector is too ccompetitive *[sic]* to allow it . New York is trying to operate in a fishbowl by " deciding" which innovation is worthy. • No known projects at this time
Question 15: Which of the following do you use on a regular basis to get information regarding developments in the solar PV industry? Check all that apply. Please provide additional details on your answer in the comments.
• Short courses by colleges and professional associations that will adress *[sic]* the practical and financial aspects of the projects.

11. Please provide a brief (one or two sentence) description of the project.
[Responses omitted to preserve confidentiality of survey responses.]

12. In your opinion, what is the best opportunity for reducing solar balance-of-system (BOS) costs in New York State, other than project ideas that you might submit to NYSERDA for funding? That is, what is the most important cost issue to be addressed, and/or the most effective strategy for addressing that issue? In particular, what could other market actors do that would benefit your organization the most? If you don't have any suggestions, leave your response blank.
• Standardization of installations • Cost of municipal interconnection should be funded. Lots of closed landfills or other open space should be supported for solar by NYSERDA or NYPA funding. CCAs for energy planning and municipal microgrids should be funded by NYSERDA -- especially for first responders. • Reducing BOS costs on individual residential projects seems marginal. There is just a lot of detail work that can't be avoided on each project. Perhaps having a unified community solar policy in NYS to encourage larger projects aggregating a number of residential customers for efficiency? • Our local Solar Tompkins program was very successful, recently. This essentially reduces marketing costs by having an independent, not-for-profit, "trusted source", do marketing, outreach, and signups, as well as selecting contractors, negotiating prices, and setting quality

12. In your opinion, what is the best opportunity for reducing solar balance-of-system (BOS) costs in New York State, other than project ideas that you might submit to NYSERDA for funding? That is, what is the most important cost issue to be addressed, and/or the most effective strategy for addressing that issue? In particular, what could other market actors do that would benefit your organization the most? If you don't have any suggestions, leave your response blank.
standards. • Nyserda reducing paperwork and overhead costs • The auction based system for competitive pricing is extremely confusing and hard to apply for. • Reducing up front cost for nonprofits and government entities. perhaps development of power purchase agreements or similar tools. • Generate more energy per investment dollar of system costs to improve the ROI to the customer. Project cost analysis has moved away from Energy Credit model per Watt installed to a model of distributed generation with a 30 performance lifetime. • Not enough characters allowed to answer. • Unified permitting and interconnection process made more streamline *[sic]*,with less hassle from local utility. • A holistic subsidy approach and uncertainty surrounding the NY REV proceedings • Finance • Standardized designs • Standardizing permitting processes. Eliminate TSRF requirements. Allow funding based on projected shaded and conduct inspections. The need for accuracy adds enormous cost. • Standardizing and automating the entire PI&I process could have massive implications for reduced costs and project turnaround times. • Community Solar program to allow small commercial ground mount to benefit multiple homes. With diminishing incentives residential leasing will be only choice which benefits investment groups more than actual homeowner. Community Solar provides economy of scale to individual homeowners. Another concept is to employ incentive to NY State built components, eg..rack & mounts or higher tariff rate for limited time period. More generic products from NY State can be used for eg. tinnerman makes module clips for unistrut. Every electrician carries unistrut to mount electrical components but PV installers are for the most part not electricians. A company like Newburg metals could be encouraged to assist in product development to allow more generic building materials to be used thereby eliminating custom rail and rack extrusions. • Support FIT, allow for true remote net metering, allow net metering for other DER(CHP), remove utility discretion on interconnection, impose accountability for delays in interconnectio(::PSC) *[sic]* • Financing costs are high when private capital is required which expects the returns to be 20% and higher. Public pension money is sitting in accounts earning 2-3% and it can better be used to fund solar projects to reduce costs and help local economy. • Paperwork reduction with GRANT applications, utility interconnection process, and continue to streamline permitting process, • Electrical engineering for system, including batteries and connections for all electric vehicles. • Increasing demand for systems, qualifications of installers, awareness of customers & thus reduce manufacturing, sales & installation costs through increased output and experience • Provide additional information on the cost-effectiveness photovoltaic systems within the context of available NYSERDA nicer to funding. • It would be helpful to have more certainty around permitting processes. The uncertainty around how AHJs interpret codes can add a lot to project costs. • Mass production stimulated by policy that assigns a cost to pollution created by the use of fossil fuels. • Streamline permitting • Customer acquisition and utility interconnection costs.

16. What specific information sources do you typically consult for information on funding opportunities (e.g., specific publications, websites, or organizations)? Be as specific as you can, identifying sources by name if at all possible.

- Websites
- Cornell sources and I'm on NYSERDA lists.
- NYSERDA
- For PV we are principally focused on installation. For other funding opportunities, we are attentive to NYSERDA's programs.
- Energize NY seems to be increasingly active, and likely to work in solar. - There are many emerging not-for-profits in the sustainability field. Examples below.
- NYSERDA, NY Best
- NYSERDA website
- Google
- www.nyserda.ny.gov
- NYSERDA websites
- Not applicable
- National Grid NYSERDA Grant Writers
- Nothing outside of Dept of Ag. & Nyserda. I have very little time as my company employs only 4-men leaving me to be engineer, salesman, electrician, site assessor, purchasing, grant writer, financer...etc
- NYSERDA, NY Power Authority
- The NYSERDA press releases and website are my primary sources for NYSERDA PON information.
- DESIRE web site Renewable energy E-newsletters
- NYSERDA website
- Nyserda website
- Our electrical engineers BOMA IFMA AIA continuing education sessions at our office Local USGBC Chapter events.
- Nationwide List serves on topics of corporate interest
- NYSERDS Website
- The DESRE website is very helpful in summarizing funding opportunities.
- NYSERDA, Contract Reporter, email notifications, conferences, manufacturers
- Many
- GTM Media, SEIA, CleanTechnica, PVMagazine, Clean Energy States Alliance, DOE, DSIRE Database
- Solar Pro, Greentech media, enerG,Renewable Energy World, Blumberg, Navigent Research, PV America
- SolarPro Magazine, Home Power Magazine

17. Do you have any suggestions for ways in which PON 2672 should be promoted or publicized in the future (e.g., specific publications, websites, or organizations)? If yes, please explain. Be as specific as you can.

- Examples: Syracuse COE, Sustainable Tompkins, TCCPI, and many more. Many of these organizations share NYSERDA PONs and other opportunities, through e-mail, through their social media, etc. Seek to add all the emerging sustainability not-for-profits to your mailing lists.
- Make sure that it is more easy to find a new offering on the NYSERDA website
- call key PI that have worked on your solar projects.
- In my opinion emailing is best.
- Send information to all local governments on a regular basis .
- IAEI code meetings
- Focus on direct loan and grant financing during construction phase. 10 year term loans for paying

17. Do you have any suggestions for ways in which PON 2672 should be promoted or publicized in the future (e.g., specific publications, websites, or organizations)? If yes, please explain. Be as specific as you can.
off the net cost of project(30-40%) after reducing the tax incentives and grants. • BPI , Nextstar, usgbc, Nyserda websites • See above. [*sic*, not referring to above comment] • Cross-posting on Facebook and Twitter, as well as GTM Media, SEIA, CleanTechnica, PVMagazine, Clean Energy States Alliance, DOE, DSIRE Database and state SEIA newsletters

18. Do you have any other comments or suggestions you wish to communicate to NYSERDA regarding Program Opportunity Notice 2672 or the Solar Cost Reduction program? If yes, enter them below.
• None • 300 char limit is frustrating here & limits info you will get. BOS cost is sum of many small tasks, materials, factors beyond installer control, e.g., suppliers, weather. Reduction in LCOE for any one did not seem to add up for our specific demo projects. Cost sharing in this arena was challenging. • On surveys like this in the future, please don't limit responses to 150 or 300 characters! It made the survey take three times as long, as I had to continuously edit my responses. Or at least warn us about the limits! • No • I am definitely interested in being contacted for more information. The maximum amount of allowable characters makes it difficult to make any statement. • NO • No, but in general continue to be impressed with nyserda and its programs • The installations should carry install guide lines and should be allowed to individuals and small projects that can be studied over time to meet the funding needed to further the expansion and further develop systems, and be tied into not increasing property taxes at least for 10 years. • Greater subsidies to non-profits • Keep up the great work • Subsidies divert political attention from the fact that the cost of pollution from dirty energy sources is transferred to the public at large and is NOT paid by the polluter. The general public, however, does not understand this economic fact of life. Instead fiscal conservatives have convinced the public that cleaner energy sources are granted unfair subsidies by do-gooders that distorts "free" market competition. This is NUTS. NYSERDA needs to invest more soft money in public education about the real costs of pollution and the real benefits of clean energy.