Summary of Results: Solar and Storage Cost Survey

MEISTER CONSULTANTS GROUP
NREL NATIONAL RENEWABLE ENERGY LABORATORY

Rev: 12/21/15

TABLE OF CONTENTS

INTRODUCTION

The NYSolar Smart Distributed Generation (DG) Hub is a comprehensive effort to develop a strategic pathway to a more resilient distributed energy system in New York that is supported by the U.S. Department of Energy and the State of New York. This DG Hub survey was undertaken to obtain a snapshot of the resilient solar market (i.e. solar+storage market) in New York City. For information on other aspects of the resilient PV market, please see additional DG Hub resources, including factsheets on hardware components, economics and finance, permitting, and a glossary of solar+storage terms at: www.cuny.edu/DGHub.

About the Survey

The need to reduce grid constraints, anticipated opportunity from the Reforming the Energy Vision initiative, and the widespread power outages that followed Hurricane Sandy has brought increased attention to solar+storage in New York. To gain a better understanding of this market, solar and storage market participants were surveyed on solar+storage project information including: location, size, use, hardware and soft costs, financing, opportunities for cost reductions, and more. Below is an aggregated analysis of the solar+storage cost survey results, which will be used to support DG Hub projects including the development of a resilient solar calculator and roadmap.

Survey Respondents

Over a two-month period, 25 respondents completed a survey on the costs of resilient solar. Participants included energy storage and solar developers, energy advisers, engineering consultants, environmental advocates, governmental agencies, and non-profit organizations. Participants responded to the survey online and through phone interviews. Data from phone interviews were entered directly into the online survey platform for analysis.

Solar and Storage Market Development

Of the 25 respondents, 14 (56%) reported being active in the solar+storage space. Seventy-six percent (76%) reported completing work on solar and battery projects at some point in their company's past (Figure 1).

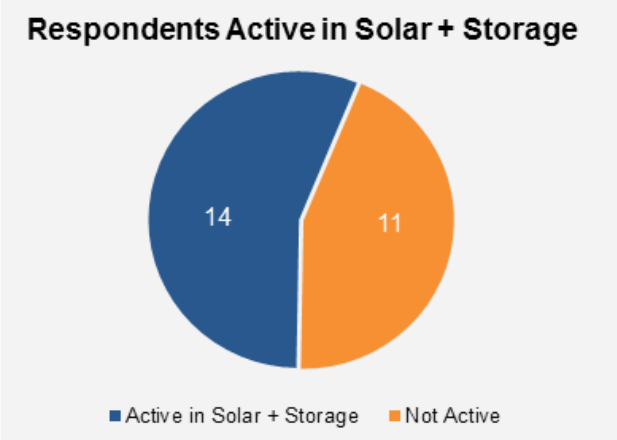

Figure 1. Respondent Breakdown

Solar and storage projects remain a small fraction or minor business line for most respondents. Seventy-two percent (72%) listed solar and storage as being less than 25% of their total development volume. Only four respondents indicated that solar and storage or hybrid projects (solar, storage and an additional generator) comprised more than 50% of their total projects with two indicating solar and storage was 100% of their project volume.

Eleven respondents (44%) confirmed they had completed projects in the U.S. within the past year. The majority were residential (<20 kW) and large commercial (101 kW – 1 MW) systems – at 250 projects and 150 projects, respectively. Roughly 35 small commercial (21 kW-100 kW) projects were completed, 5 industrial (>1 MW onsite) and a utility (>1MW offsite) project had been completed by the full set of respondents. Approximately 90% of systems were grid-tied with battery back-up, with 10% designed as off-grid-only systems. Fifty percent (7/14) of survey respondents indicated that resilience was either the primary or a highly motivating factor behind solar+storage installations.

Battery Technology Costs

Respondents reported using a wide variety of storage chemistries:

- Lithium-ion was the most common with 11/15 (73%) respondents stating they use this technology.
- Lead acid was the second most common with 8/15 (53%).
- Zinc Air batteries were reported by three respondents (20%).

Other technologies mentioned included, but were not limited to, flywheels, gel batteries, flow batteries, and lead carbon batteries.

The prices paid for lithium ion batteries in the past 6 months ranged from less than $400/kWh to greater than $600/kWh with an average of approximately $528/kWh. Lead acid batteries ranged from $100/kWh to more than $200/kWh with an average of approximately $190/kWh (Figure 2). Other batter chemistry costs ranged from $160/kWh to $5,000/kWh.

There was not enough data to determine a blended $/kWh installed cost across size classes for a full solar+storage system.

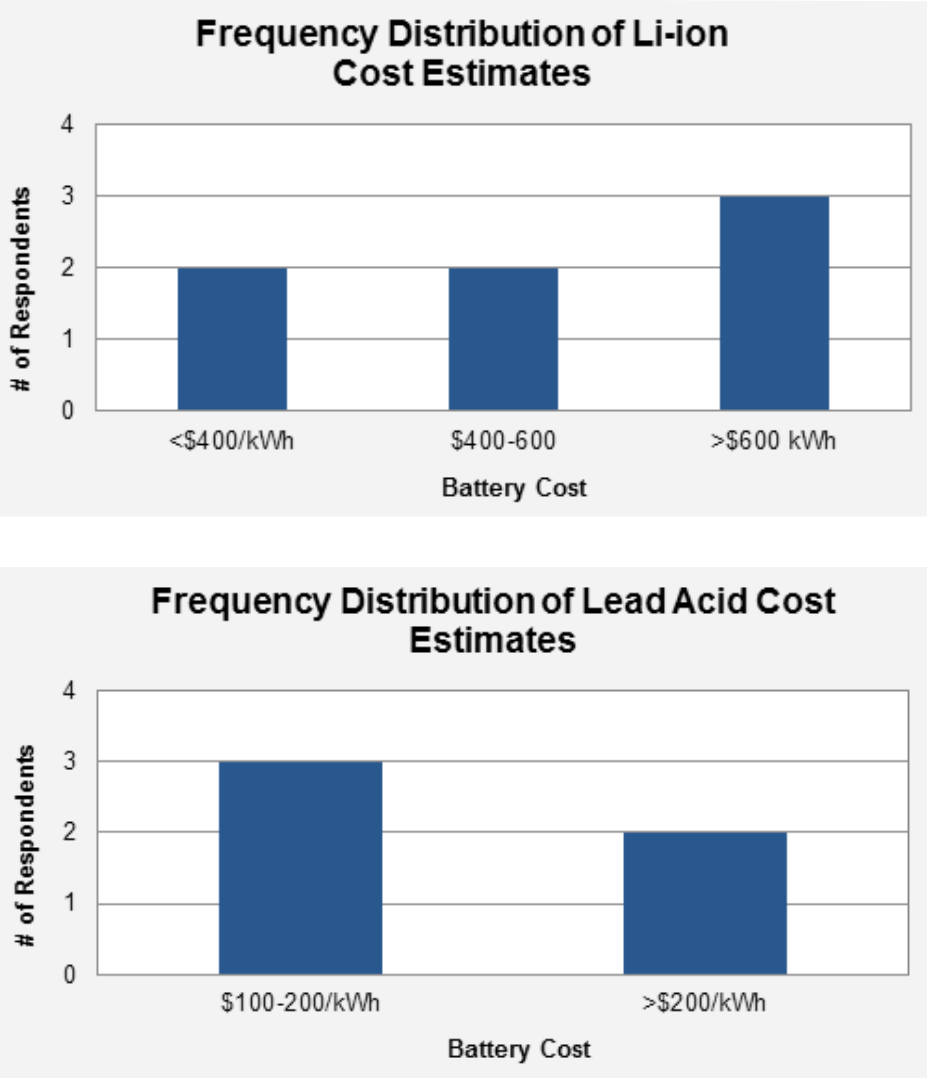

Figure 2. Frequency Distributions of Battery Chemistry Costs Based on Survey Responses

Payback Periods

The majority of responses regarding payback periods were heavily geared toward the commercial and industrial sectors. Commercial payback periods ranged from 4.17 years to 25 years with an average 9.17 years. Some respondents' projects were completed several years ago, before hardware cost declines and the emergence of business models which have led to lower observed payback periods for projects. Project economics can also vary substantially based on building type and host-site load profiles. The industrial sector had fewer data points, but a similar payback range of 5 to 20 years, with an average payback of 7.1 years. The residential sector had limited responses, one of which indicated there was not yet a payback (Figure 3).

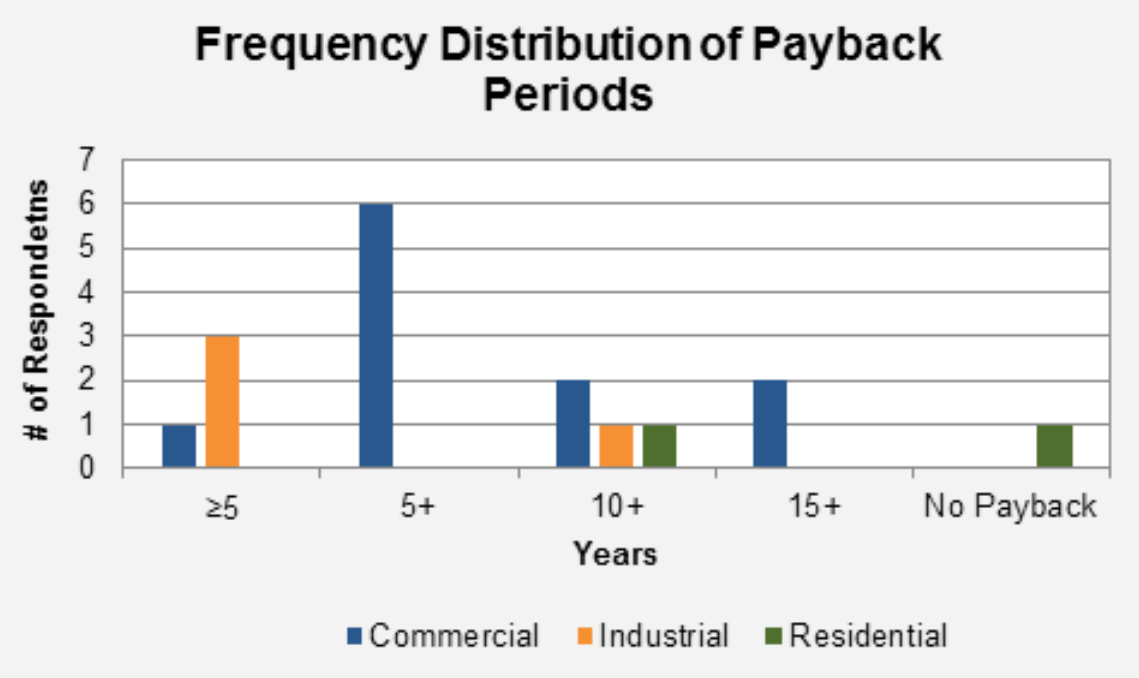

Figure 3. Distrubution of Payback Ranges

Finance and Cost Recovery

Respondents were asked to specify which incentive programs they had leveraged in New York in the past. Some respondents indicated they used the California Self Generation Incentive Program (SGIP) for their out-of-state installations under the "Other" category (Figure 4).

Projects which indicated they used multiple cost reduction strategies (e.g incentives and revenue streams) were further examined. The most common combinations were tax credits with the Demand Management program (5), or tax credits, MACRS and the Demand Management program (4) (Figure 5).

Respondents were also asked about the importance of different revenue in terms of recouping costs, including:

- time-of-use shifting
- peak shaving and demand charge reduction
- demand response programs
- incentives
- tax credits

Twelve respondents provided feedback. Peak shaving and demand charge reduction were listed as the most important factors when recouping the costs of solar and storage. Several respondents also stressed the importance of incentives as either their first or second choice.

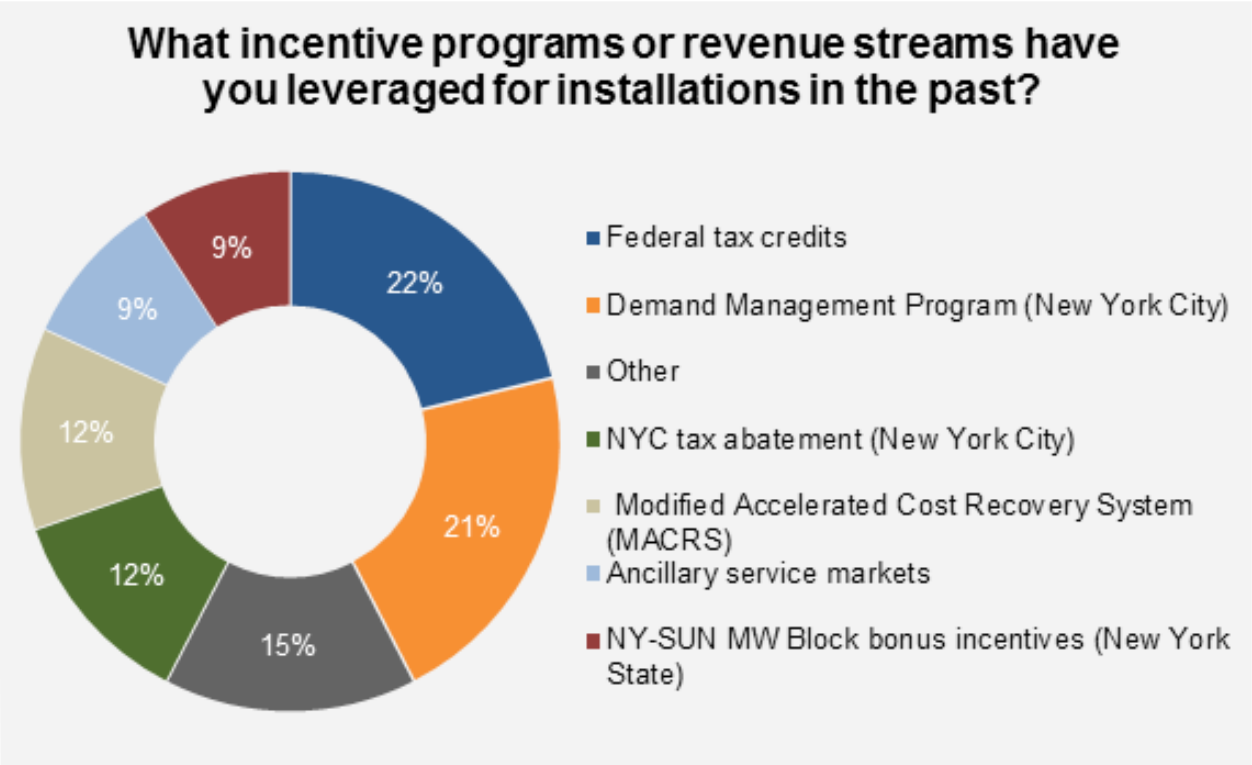

Figure 4. Summary of Incentives Leveraged

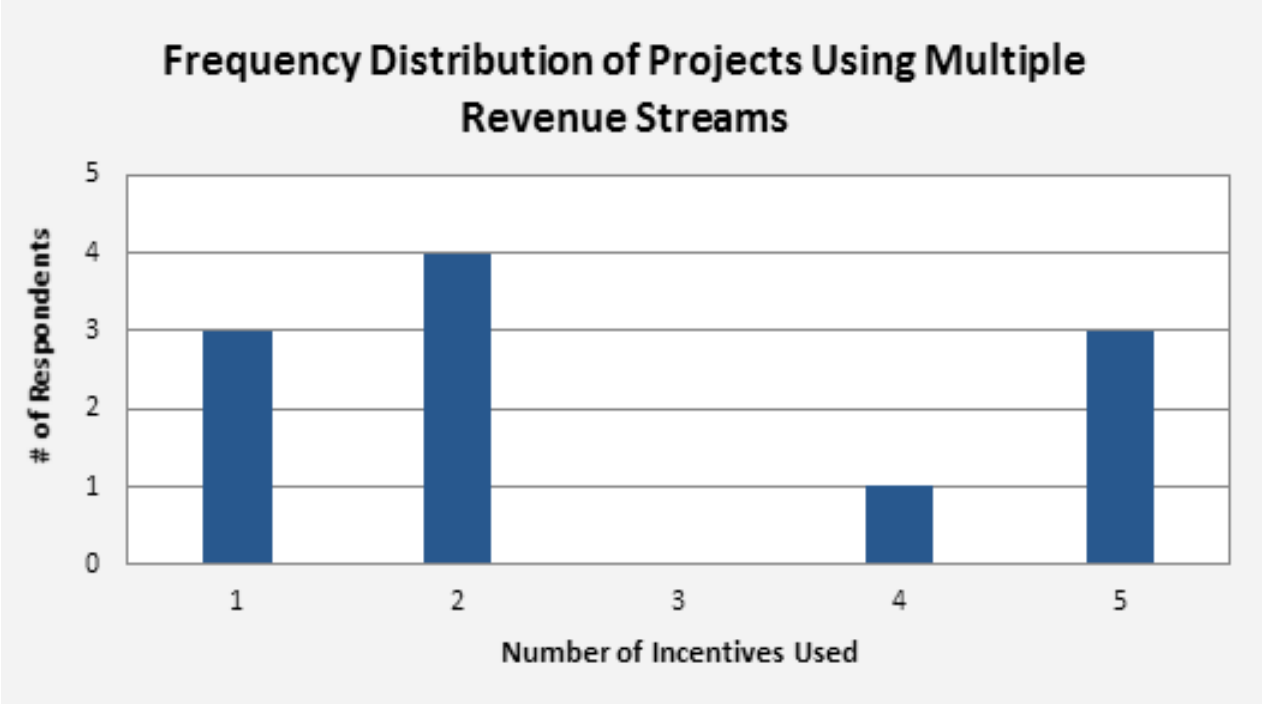

Figure 5. Frequency Distribution of Projects Using Multiple Revenue Streams

Finally, respondents were asked to describe how the majority of their solar and storage projects were financed. Third-party ownership is presently the predominate model for projects, totaling 48% of financing projects between PPA and lease options (Figure 6).

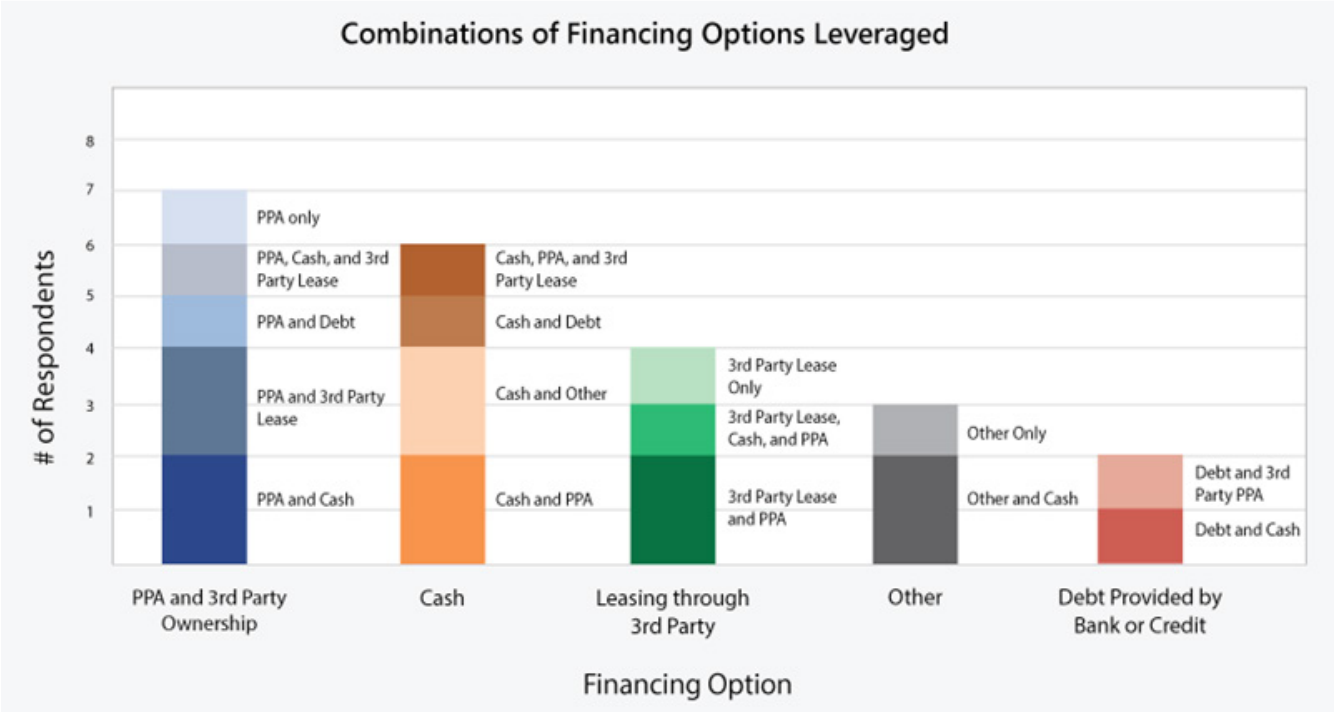

Figure 6. Financing Options for Solar and Storage

Installed Costs and Cost Breakdowns

Participants were asked to rank soft cost components on their total contribution to installed costs. Eleven participants responded to this question. Five respondents indicated that permitting was the largest contributor to non-hardware installed costs, primarily due to delays. A copy of the survey question and summary of the full results follows.

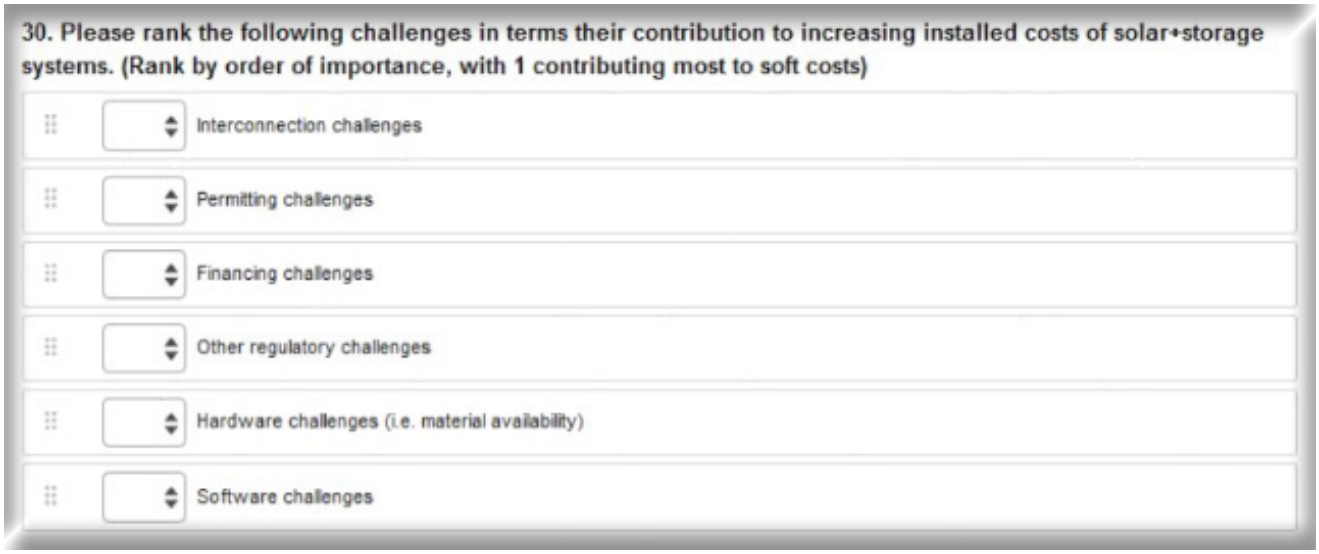

Figure 7. Soft Cost Survey Question

Respondents were asked to rank these cost components based on their contribution to installed costs on a scale from one to six, one being the most important contributor to installed costs and six being the least important contributor to installed costs. The figures below present the respondents rankings for each installed cost challenge (Figure 8).

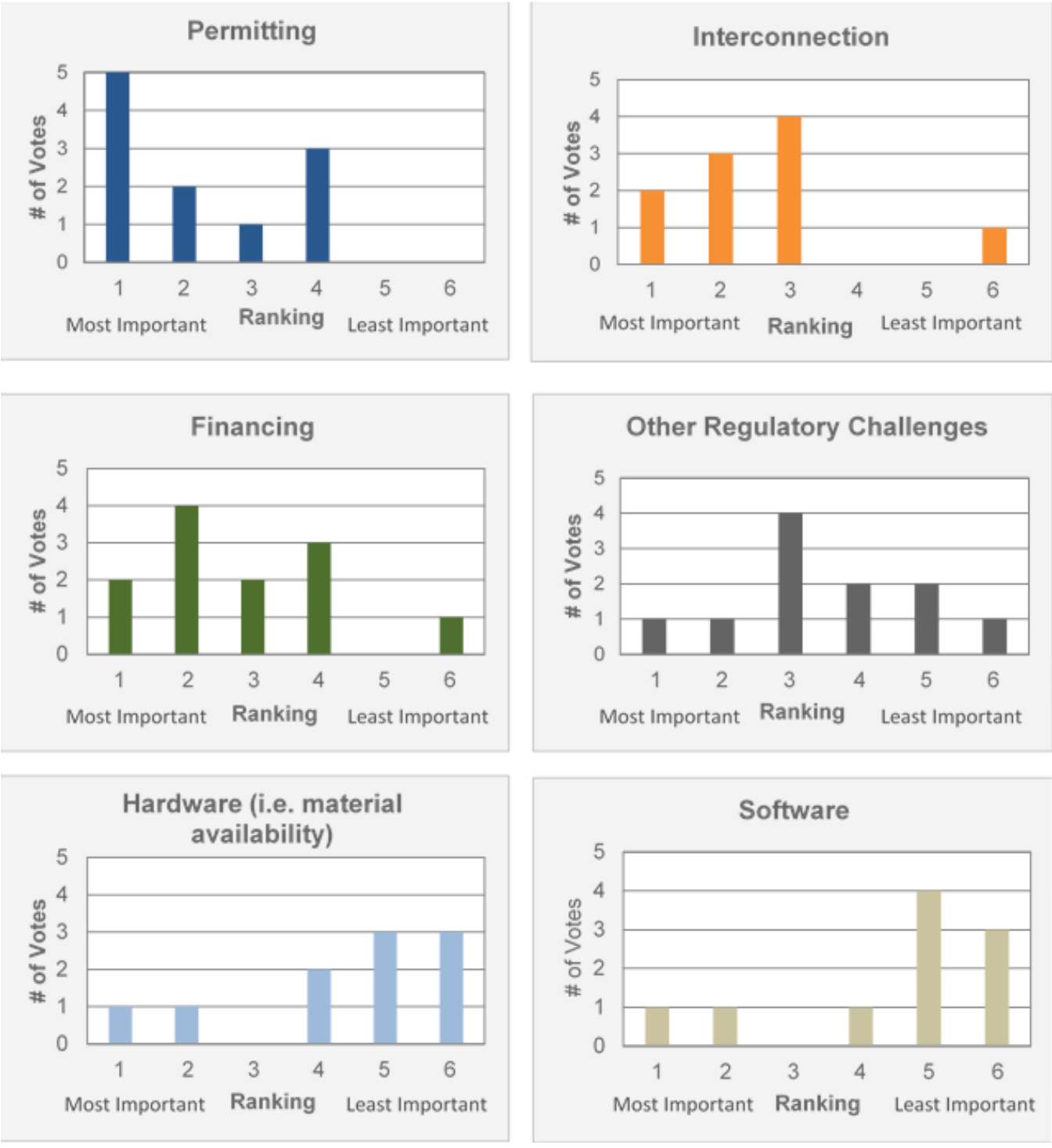

Figure 8. Respondents Ranking of Installed Cost Challenges

The findings displayed in Figure 8 were aggregated and Figure 9 summarizes the results. A lower score and darker color indicates a higher perceived contribution to installed costs and a higher score and a lighter color indicates a lower contribution to installed costs. Permitting was a top-ranked contributor for the most respondents followed by interconnection and financing.

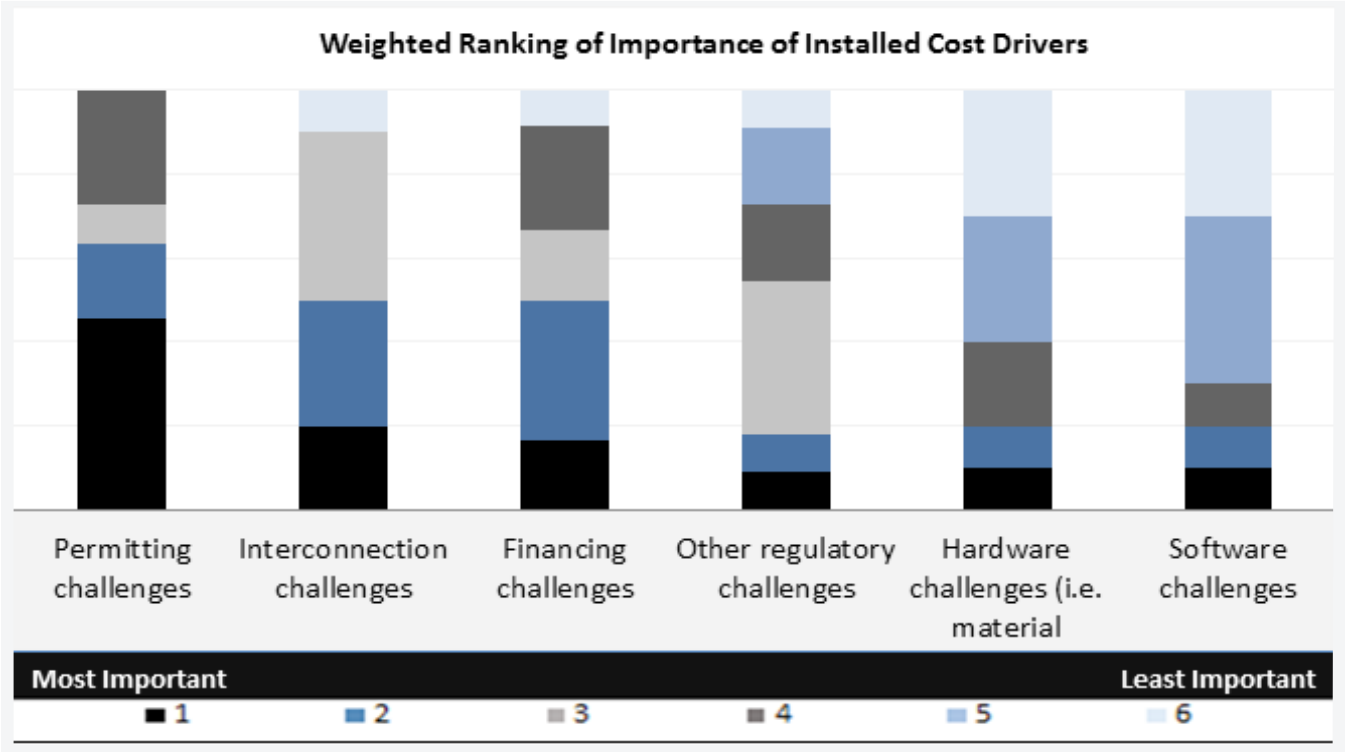

Figure 8. Weighted Ranking of Sof Cost Drivers

Participants were also asked to approximate installed cost contributions of hard[1], soft[2], and balance of system[3] cost components by percentage. Eight participants responded to this question.

In the residential and commercial sectors, batteries, modules, permitting, and labor were the primary cost drivers. In the utility sector, batteries and modules were the main drivers of installed costs. Across all industries, the capital costs of batteries and modules were the leading components of installed costs, while permitting was the largest soft cost driver.

When considering soft costs within the commercial sector, respondents indicated soft cost contributions ranged from 10% to 50%, with an average of 27%. This aligns with the approximately 25% soft cost contribution for solar-only systems as reported by Department of Energy-funded research.[4]

The balance of system costs for the commercial sector averaged 73%. Balance of system costs for solar-only projects accounts for 64% of overall project costs based on the same research study. Industry surveys have estimated that balance of system costs for li-ion storage projects are approximately 66% of costs.[5]

1 Hardware costs include the cost of hardware such as the panels, inverters, wiring, battery, charge controller and control software.
2 Soft costs include the costs for customer acquisition, installation labor, permitting, inspection, and interconnection.
3 Balance of system costs include all system costs, excluding panels and batteries.
4 Rocky Mountain Institute. (2014). SIMPLE: Solar Balance of System Costs. Produced for the U.S. Department of Energy Sunshot Initiative. Available at: http://rmi.org/simple.
5 Paulous, B. (November 2014). The Next Big Opportunity to Drop Balance of System Costs: Batteries. Green Tech Media. Available at: http://www.greentechmedia.com/articles/read/lowering-the-cost-of-batteries-through-lower-bos.

Conclusion

The survey results indicate the solar+storage market is beginning to grow in New York City, with many respondents indicating they intend to increase their installed capacity of solar+storage systems over the next year. However, the costs of these systems are still significant, with long paybacks in some markets. Survey respondents indicated in New York that there are significant burdens coming from permitting, specifically. Decreases in soft costs in this area could support reduction of overall project costs and completion times. The investment tax credit (ITC), which is being exteded through 2024 for utility and commercial scale projects and through 2021 for residential scale projects, remains an important driver of cost reduction.

There remain important opportunities to provide incentive support and regulatory clarity at the local level regarding permitting, interconnection, and future availability of incentives. The Smart DG Hub project will release guidance documents and work with key stakeholders to provide information on existing local processes for solar and storage and opportunities for improvement. To keep informed of project updates, please visit: www.cuny.edu/DGHub or join the DG Hub Roundtable listerv by contacting DGHub@cuny.edu.

About

Sustainable CUNY of the City University of New York (CUNY) is the lead implementer of the NYSolar Smart DG Hub, in partnership with Meister Consultants Group and the National Renewable Energy Laboratory. The DG Hub is supported by the U.S. Department of Energy's Solar Market Pathways program, the NY-Sun Initiative, and the New York Power Authority. The DG Hub thanks the Hardware Working Group for their support in the development of this resource.

The information, data, or work presented herein was funded in part by the Office of Energy Efficiency and Renewable Energy (EERE), U.S. Department of Energy, under Award Number DE-EE0006913. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Contact

DGHub@cuny.edu | www.cuny.edu/DGHub