

# LIFT SOLAR EVERYWHERE

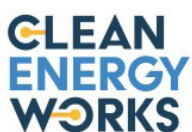
PROJECT FINANCE FOR ACCELERATING LMI SOLAR ACCESS



Illustration: Ngadi Smart

## Research Report: Analysis of Solar Project Finance Research

JUNE 2022



# ACKNOWLEDGEMENTS

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Hence, he was drawn to Groundswell's research series on Energy Burdens for each individual state in the US. In this research, he explored how a multitude of factors create various energy burdens for LMI families. Before joining Groundswell, Clarke served as the Head of Data Analytics at involveMINT, a community currency platform, and Manager of Data Migrations at Boosttr Inc, a CRM/OMS and business intelligence application purpose-built for the digital marketing industry. He has also worked to develop startups and organizations in advanced manufacturing and robotics.

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# ABOUT THE LIFT SOLAR EVERYWHERE SOLAR FINANCE RESEARCH INITIATIVE

Accelerating Low-Income Financing and Transactions for Solar Access Everywhere (LIFT Solar) is a research effort funded by the U.S. Department of Energy, Solar Energy Technologies Office (SETO) and led by Groundswell in collaboration with Elevate, Clean Energy Works and Southface Institute. LIFT Solar seeks to understand the financial performance and customer experience of community solar (CS) projects that serve low- and moderate-income (LMI) customers, with the goal of providing insights, tools, and best practices that accelerate the development of these projects nationwide.

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The LIFT Solar Everywhere Research initiative is led by Dr. Elvis Moleka, VP of Labs and Data Science at Groundswell.



# TABLE OF CONTENTS

I.	Executive Summary .....	7
II.	Introduction.....	9
III.	LIFT Finance Data Methodologies.....	9
A.	Purpose of Each Step:.....	10
i.	Purposes of the Data Request.....	10
ii	Purposes of the Data Intake Form .....	10
iii	Purposes of the Insight Survey .....	10
B.	Selection Criteria and Data Collection Process .....	10
C.	Data Cleaning and Aggregation .....	11
D.	Data Reconciliation, Limitations and Exclusion.....	11
IV.	Results .....	11
A.	Step 2 Finance Data Intake Findings.....	11
1.	What Drives the Greatest LMI Inclusion?.....	11
2.	What Drives the Greatest LMI Savings? .....	13
3.	How Can Financing Models Be Scaled? .....	13
4.	What Market Structures Drive Investment through IRR? .....	14
5.	Reducing Risk and Enabling LMI Participation through Financing Practices and Structures.....	14
6.	Additional Insights from Step 2 Data .....	15
B.	Step 3 Insight Survey Findings.....	15
1.	Solar Developers Offer Divergent Responses .....	15
2.	Barriers to LMI Community Solar Development .....	16
i.	Aggregate Analysis of Barrier Rankings .....	16
ii.	Analysis of Barrier Ranks by Role .....	18
3.	Ways the Solar Industry Can Make Community Solar More Accessible for LMI households.....	19
4.	Ways the Finance Industry Can Make LMI Community Solar More Accessible .....	21
	<b>Appendix A:</b> LIFT Survey Finance Forms used in Data Collection .....	23
	<b>Appendix B:</b> Printed Survey Questionnaire for LIFT’s Solar Project Finance Intake Step 2 .....	24

# I. EXECUTIVE SUMMARY

Accelerating Low-Income Financing and Transactions for Solar Access Everywhere (LIFT Solar) is a research effort funded by the U.S. Department of Energy, Solar Energy Technologies Office (SETO) and led by Groundswell in collaboration with Elevate, Clean Energy Works, and Southface Institute. The LIFT program seeks to understand the financial performance and customer experience of community solar projects that serve LMI customers, with the goal of providing insights, tools, and best practices that accelerate the development of these projects nationwide. We analyzed finance and customer experience data independently. Within this report, we strive to share trends and observations of community solar financing from several states, organizational business models, and regulatory environments.

***The LIFT finance research shows that most community solar projects serving LMI households are financed in the same ways mainstream community solar projects are financed. The value stacks and financial returns are no different. Therefore, for most LMI community solar projects, there are no barriers.***

This research aims to look at this minority of projects that still have barriers to understand why they have barriers and best practices for overcoming those barriers.

LMI CS is a new field with many unique and challenging problems regarding financing. In LMI census tracts, almost 30% of all adults do not have credit scores, which is about eight times higher than in upper-income census tracts. Our experience and research in LMI CS have shown us that various factors involved in financing projects act as major barriers to LMI CS projects. This research aimed to gather insights into the intricacies of these barriers and solutions to them. With a relatively small amount of LMI

CS projects and most states in the United States still not possessing a single project, we investigated what financial models, and sometimes program designs, are the most scalable and transferable to other projects.

The data collected for this report were provided by developers and financiers of CS projects who agreed to submit project- and portfolio-specific information. The finance data collected through the “Step 2 Finance Data Intake Form.” represent several different solar program designs that deliver solar savings to LMI households. [The LIFT Solar Finance Research found that LMI inclusion<sup>1</sup> and participation rate varies across programs, ranging from 10% to 100%.](#) The total number of LMI households served by a project ranged from 4 to 750 with an average of 148 LMI households served by a project. LMI kWdc allocations ranged from 0.9 to 5.72 kWdc, with an average of 3.29 kWdc. The report further discusses ways to reduce risk and enable LMI participation through financing practices and structures such as the use of grant funds, availability of state and federal incentives, no-cost subscription to LMI customers, etc.

Additionally, through the “Insights Survey,” barriers to LMI CS development were ranked by respondents and compared across by role of the respondents. The barrier rankings were very similar across roles in the industry.

***The LIFT Solar Finance Research found that the four most significant barriers were “Project/Portfolio Size,” “Risk Mitigation,” “Host Site negotiations including navigating affordable housing regulations,” and “Time needed to structure and execute the deal.”***

In aggregate, the barriers of moderate importance were: “Access to tax equity,” “Transaction costs (legal and accounting),” and “Interconnection costs.” The

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<sup>1</sup> LMI inclusion can be measured by the percentage of system capacity assigned to LMI households or the percentage of LMI subscribers participating in a given community solar project.

barriers of low importance were: “Lack of pre-existing relationships with capital sources” and “Property taxes.”

The report summarizes the dataset collected as well as detailed analysis of the data collection processes, including data cleaning, limitations, and reconciliation. While the collected datasets were small, the trends and patterns discovered regarding financing may inform solar developers in pathways that include a greater proportion of LMI households in CS programs while retaining sustainable project revenues.

Additionally, both the “Step 2 Finance Data Intake Form” and the “Insights Survey” asked narrative response options to allow for respondents to discuss problems and solutions more qualitatively. These responses were manually read, categorized, and tagged. These data offer trends and novel solutions for the financing of LMI CS projects.

## *Key Findings and Recommendations*

### **LMI Inclusion**

- LMI inclusion and participation rate varies across programs, ranging from between 10% and 100%
- Across the sample, the average number of LMI households served by a project is 148.

### **Savings and Value**

- The greater the value stack, the more likely subscriber savings will be higher. LIFT Finance Research found that capital stacks are varied, highly place-based and time sensitive.

### **Barriers to LMI CS Development**

- The four most significant barriers to LMI CS Development were “Project/Portfolio Size,” “Risk Mitigation,” “Host Site negotiations including navigating affordable housing regulations,” and “Time needed to structure and execute the deal.”
- Pre-development expenses, scale, and transaction costs are barriers to LMI-inclusive developments.

### **The Impact of Policy**

- Industry leaders and advocates must keep driving the policy changes (including relationships and innovative financing approaches) to ensure projects serving LMI households are realized, but relationships with financiers have not caught up with this expectation and persistence is needed for LMI-inclusion in CS project design.



## II. INTRODUCTION

The LIFT Solar Everywhere project gathered primary data on both financial structures and customer experiences from CS projects that serve LMI households. The two data streams offer distinct lessons for policymakers, financiers, utilities, municipal authorities, and solar developers who may wish to develop inclusive, sustainable CS programs that include households at every income level.

LIFT's finance research utilized qualitative analysis of project and portfolio finance data received from 22 submissions, with an emphasis on comparisons of Internal Rate of Return (IRR).

This research builds upon [LIFT's preliminary finance research](#), which was conducted in 2020. The three primary findings of the preliminary research were:

1. Capital stacks are varied, highly place-based, and time sensitive.
2. Pre-development expenses, scale, and transaction costs are barriers to LMI-inclusive developments.
3. Relationships, innovative financing, and developers have found ways to ensure projects serving LMI households are realized, but relationships with financiers have not caught up with this realization and persistence is needed for LMI-inclusion in CS project design.

Following this introduction, Section 3 discusses the LIFT finance data methodologies. Section 3 identifies what the data represents, where there were data gaps, and what it does not represent. The rationale and validity of each finance data intake form, including selection criteria of the data collection process are reported in this section, alongside data cleaning, aggregation, and data limitations. The collected data is further augmented with other finance research datasets such as the LIFT survey insight dataset for trend analysis and reporting framework. The results of the financial performance analysis are summarized in Section 4. Although the collected datasets were small, trends and patterns in solar financing have emerged that may inform solar developers on ways to include a greater

proportion of LMI households in CS programs while retaining sustainable project revenues.

This LIFT Finance Report discusses **actual project financial data provided by CS administrators - utilities and solar developers - and addresses policy within the context of how some elements of legislative or regulatory frameworks are financial drivers for LMI CS**. We encourage readers to explore the many excellent available solar finance background resources, including those published by the U.S. Department of Energy, Solar Technologies Office (SETO) and the National Renewable Energy Laboratory (NREL), among others.

## III. LIFT FINANCE DATA METHODOLOGIES

The finance data collected represent several different solar program designs that deliver solar savings to LMI households – that is projects that had a specific mandate to serve LMI households. These designs include:

1. Standard CS “garden” installations, with a larger solar project installed offsite and accessed via virtual net metering by participating subscribers
  - a. In at least one instance, we see participation in the CS garden linked to participation in other programs, including energy efficiency
2. Net metered installations (co-located, installed on or virtually net metered) and CS installations supporting affordable housing residents and tribes with solar savings shared via on-bill mechanisms

Finance data were collected via two surveys following an intake form. The data collection steps were as follows:

1. LMI Solar Project Data Request (Intake form and legal consent)
2. Solar Project Finance Data Intake, and
3. Solar Project Finance Insights Survey

## A. Purpose of each step

### i. Purposes of the Data Request

1. To formally outline the LIFT financial research goals to potential participants.
2. To define LIFT's qualifying criteria for LMI CS projects.
3. To screen out respondents whose projects do not meet LIFT's qualifying criteria for LMI CS projects (in section B. below).
4. To determine the viability of respondents to share customer feedback from their LMI CS projects.
5. To gain legal consent to further survey the respondents. Respondents were ensured their data would be anonymized to protect their identities and the identity of their customers to encourage honest responses.

### ii. Purposes of the Data Intake Form

1. To collect more detailed data on current financial models used for projects including forecasted and some actual metrics/drivers such as: costs, IRR, tax treatments, RECs, and revenues.
2. To collect data on current financial models, including how long it took to secure financing, the scalability of the financing model, and model performance.
3. Identify LMI participation (both in number of LMI participants and percentage of power allocated to this demographic) in these projects.
4. To gather information on LMI financial outcomes from participation in these programs.

### iii. Purposes of the Insight Survey

1. To collect information regarding the barriers to LMI participation in CS projects.
2. To collect information regarding potential solutions to the barriers of developing LMI CS programs.

## B. Selection Criteria and

## Data Collection Process

To be considered an LMI CS project for LIFT's financial research, a project had to meet two criteria:

1. The project must have specific mandates for LMI participation, including income requirements for all participants or a carve-out of system capacity dedicated to LMI households.
2. AND, that the LMI requirement must ensure a minimum of 10% or more of the project's power output capacity goes to LMI households.

Surveys titled "LMI Solar Project Data Request, Data Collection Step 1 of 3" were sent out to CS project developers or utilities to determine if any of their projects would qualify as LMI CS projects under LIFT Solar's criteria and if they would willingly consent to participate in LIFT's research.

If the organization qualified and agreed to participate in the research, LIFT researchers sent the project administrator or an identified data manager the Solar Project Finance Data Intake - Step 2 Survey. The "Step 2" survey was distributed individually to developers and financiers who consented to provide project- and portfolio-specific financial data by email, phone, or by completion of the Step 1 response form. Responses to the "Step 2" survey were recorded in SurveyMonkey. Some respondents entered their responses directly into the online survey; others preferred a telephone interview with Groundswell, after which Groundswell entered responses into the survey based on recorded responses during the interview.

The "Solar Project Finance Insights – Step 3" survey was distributed broadly to industry connections via email. The distribution plan included individual outreach to contacts (including both individuals who responded to the "Step 2" survey as well as individuals who did not) as well as requests from major industry networks (trade associations, etc.) to distribute the survey among their members and contacts. Responses to the "Insights Survey" were recorded directly in SurveyMonkey by respondents; no interviews were conducted.

## C. *Data cleaning and Aggregation*

LMI CS, like many new fields, lacks standardized terminology and metrics. A goal of LIFT is to standardize some of these metrics to facilitate more LMI CS development. For many of the questions asked in the surveys, the questions specified units and formats. However, for other questions, units and formats were not specified. Additionally, we asked many open-ended questions regarding the respondents' opinions on CS finance. Our approach with these open-ended questions was to obtain candid and unbiased answers, which were not leading nor directed by any of our preconceived answers.

For numerical metrics, respondents used a variety of different formats. Therefore, standard data cleaning practices were used to convert responses into more easily analyzed figures. For instance, one response included a response of "\$4million" as a dollar amount. This response was then converted to "\$4,000,000" for easy tabulation of the findings. The responses for numerical metrics were also often provided in different units. For instance, when organizations were asked about modeled savings for LMI households, some provided an estimated annual savings in USD, while others provided the percentage discounts on bill credit value. In these cases, we did not convert the units because no conversion would be able to maintain accuracy of the data – implying that relative percentages were reported as they were.

Additionally, numerical responses were also often followed by textual remarks in the same input box. The remarks were individually analyzed and used to determine the significance of the figures provided. The numerical responses were separated into new columns to allow for quantitative analysis. Oftentimes two figures would be provided by a respondent in one input box with remarks indicating that one figure was for all their customers, and another was for only their LMI customers. Given the focus of the project, the figures relating to the LMI customers were used for analysis, to align with the goals of the LIFT research.

For questions with open-ended responses, each response was manually read, analyzed, and tagged. The tags served three purposes: 1. To break the responses into individual ideas, if there was more than one, 2. To shorten and summarize the responses, and, 3. To aggregate and analyze responses based on main ideas of each response more easily. This method retains novel ideas and allows for better analysis of the aggregated data.

## D. *Data Reconciliation, Limitations and Exclusion*

22 records were recorded for the "Step 2 Finance data intake form". After reviewing the information, we determined that four of the projects or portfolios would not qualify as LMI CS under LIFT's criteria. The data from these four responses were kept for potential comparison in the future but were not included in the analysis of the data provided in this report. Of the remaining 18 responses, 15 were for individual projects, while three were for entire solar portfolios. These data were all from CS developers and financiers.

When survey questions were not answered by a participant, the response for that question was not included in the analysis, but the respondent's survey submission was still used in analysis where the respondent included responses. Since the finance data is mostly qualitative and limited in sample size, descriptive statistics including correlations, and trend analysis have been used in this report to derive insights from the data.

# IV. RESULTS

## A. *Step 2 Finance Data Intake Findings*

### 1. **What drives the greatest LMI inclusion?**

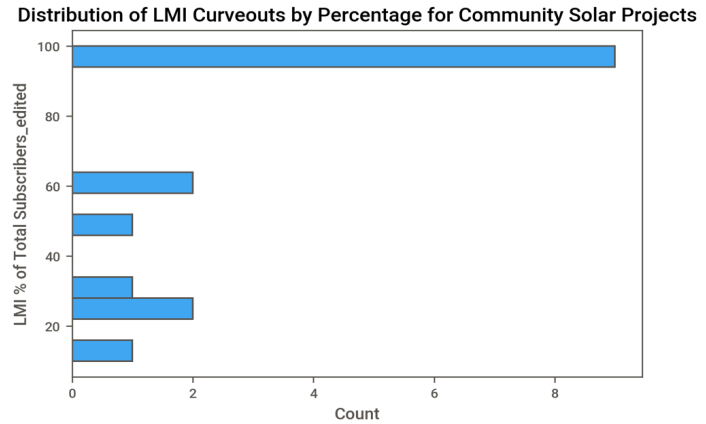
In alignment with the stated purpose of the LIFT Solar Everywhere research – accelerating LMI access to solar – a primary goal of the solar project finance

research is to understand what drives the highest levels of LMI inclusion. LMI inclusion can be measured by the percentage of system capacity assigned to LMI households or the percentage of LMI subscribers participating in each CS project.

Nine of the 18 responses analyzed indicated that 100% of the energy is allocated to LMI households. A tenth project allocates 100% of its energy to tribal households. Every example can be attributed to one of three approaches for reaching LMI households:

1. A partnership with affordable housing authorities and facilities (both net metered and CS approaches are used to deliver solar savings), or
2. State-wide programs requiring 100% of project system capacity be allocated to LMI households to receive incentives (both CS and residential rooftop approaches are used to deliver solar savings), or
3. The project was entirely grant-funded with no return on investment required.

LMI participation rates on other (non-100% LMI requirement) projects ranged from 10% to 60% as shown in Figure 1 to the right.

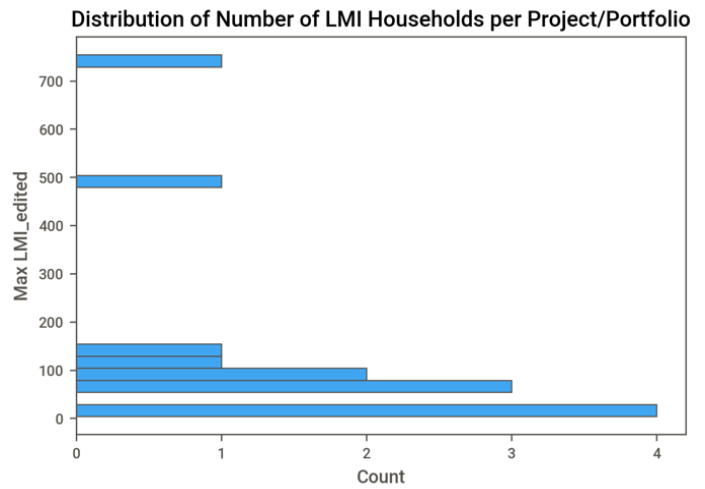


**Figure 1: Distribution of LMI Carveouts by Percentage for Community Solar Projects**

der LIFT’s Criteria, four were not in Investor-Owned Utility (IOU) service territories. Two smaller projects and a third large project were in a municipal utility area. Meanwhile, only one Electric Member Cooperative Solar Installation provided data for this survey.

Finance data also collected on solar programs offered by three municipally-owned utilities and one rural cooperative utility offered little to no incentives to LMI households to participate (for example, through increased discounts or no-cost subscriptions) nor were they designed to adhere to LMI-specific carve-outs, nor did the programs measure participation of LMI households in the programs. As such, LMI inclusion in these programs could not be quantified even though these programs offered innovative program designs intended to be accessible by LMI households (such as participation without contracts or one-month minimum participation requirements).<sup>2</sup>

The total number of LMI households served by a project ranged from four to 750 with an average of 148 LMI households served by a project. LMI kWdc allocations ranged from 0.9 to 5.72 kWdc, with an average of 3.29 kWdc.

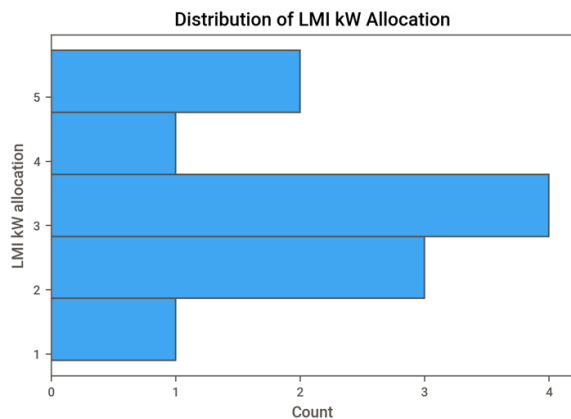


**Figure 2: Distribution of Number of LMI Households per Project/Portfolio**

Of the 18 projects that qualified as LMI CS Projects un-

<sup>2</sup> Unique and valuable program design elements from these innovative LMI community solar programs are included as Case Studies within the LIFT Toolkit, Resources and Map.





**Figure 3: Distribution of LMI kW Allocation**

## 2. What drives the greatest LMI savings?

Sixteen projects modeled annual savings amounts for LMI and/or tribal households, which are mostly delivered through on-bill monetary credit or reduction of kWh consumption. These savings ranged from \$134 to \$700 per household per year in Year 1 of the Projects, with an average of \$403 in annual savings. Two projects modeled relative annual savings amounts for participant households based on their current electricity bills. These savings ranged from 8-9% of the bill credit value. One project reported Power Purchase Agreement (PPA) savings of 16.87%.

The highest savings amounts are associated with the following financing elements:

1. “Good” value of state level RECs and subsidies available – the greater the value stack, the more likely subscriber savings will be higher, or
2. The cost of capital via low-cost federal loan financing.

**LIFT Solar Finance Research found that a decrease in savings delivered to LMI households correlates with:**

1. “Poor” value of state level RECs and subsidies available, or
2. Less than full retail rate crediting of solar production.

It is worth noting that most projects within the data-

set offer no-cost subscriptions to LMI participants. This minimizes barriers for LMI households and increases the savings that can be delivered, even if the subscription size (kW or kWh) does not offset the household’s entire electricity consumption.

## 3. How can financing models be scaled?

Not all datasets included answers to this question, and not all financing approaches lend themselves to scaling up, especially while serving LMI residential ratepayers. However, of the responses, the following points were made:

1. Project finance approaches are often only scalable within a specific geographic area with similar incentives such as economic value and government legislation.

- a. Partial upfront payment of Renewable Energy Credits (RECs) can be beneficial.
- b. PPA payments from customers to developers include a 2.8% escalator per year for 20 years.

### *Regulatory Considerations:*

*“Removing requirements for long term contracts, upfront deposits and eliminating requirements to prove income eligibility such as FICO score will allow for greater scalability of LMI CS project development.”*

2. A large amount of federal loan financing is available, particularly through the Rural Utilities Service agency at USDA, to utilities serving rural populations throughout the US.
3. Programs bringing solar into the fuel mix can scale by lowering the cost to participate as the average price per kWh typically decreases. [Note: Programs that adopted this model of project finance did not specifically include LMI household service as part of their program design or objectives.]
4. Approaches which partner with affordable hous-

ing providers can be replicated with other providers.

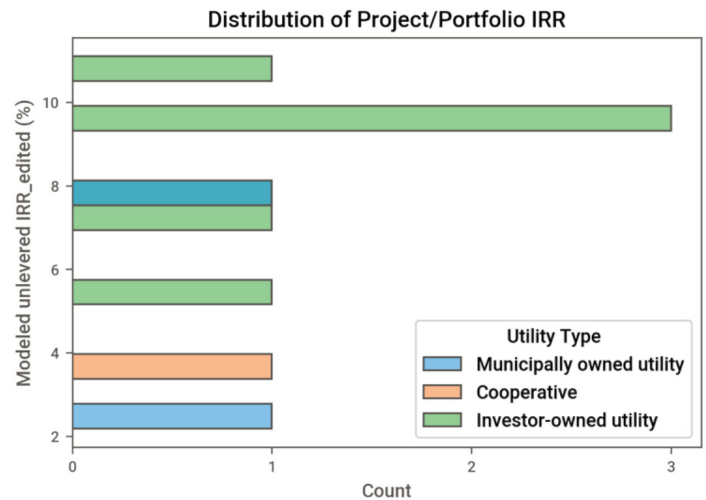
Many LIFT respondents report not seeing a path for scaling the financing approach. This can be due to:

1. Complexity of the project finance structure driving up the transaction cost.
2. The need for a credit backstop within the project finance structure, which requires finding and negotiating with an interested party.
3. Prevalence of one-time or limited grant funding as a source of capital for project construction.
4. Limited availability of state incentives like RECs.
5. Necessity of finding an investment partner with a tax appetite for non-profit developers (including cooperatives and municipally owned utilities) to monetize the Investment Tax Credit (ITC).
6. Capacity incentives on RECs may reduce risk to investors who may not want to consider fluctuations in production when considering investments.

#### 4. What market structures drive investment through IRR?

Reported internal rates of return (IRR) ranged from 2.18% to 11.1% for projects with LMI-specific incentives or participation carve outs. All these projects are in service territories with average energy rates, as defined by LIFT research.<sup>3</sup> Projects in investor-owned utility service territories generally had higher IRR values than projects in municipally owned or cooperative utility territories. One project in the LIFT dataset was entirely grant funded and thus an IRR cannot be calculated.

*LIFT Solar Finance Research found that: "Not all financing approaches lend themselves to scaling up, especially while serving LMI residential ratepayers."*



**Figure 4: Distribution of Project/Portfolio IRR by Utility Type**

LIFT Solar Finance research found that the value of state level RECs and subsidies as well as the CS 'bill credit value' directly correlate with IRR. Projects with either or both of "poor" REC and subsidy levels or with supply-only/avoided cost bill credit values have lower IRR values than projects with "good" REC and subsidy levels or full retail rate bill credits. This is to say that projects that had higher value stacks performed better financially.

#### 5. Reducing risk and enabling LMI participation through financing practices and structures

Developers and financiers demonstrated creativity in de-risking projects that include LMI households, and they identified many financial elements that enabled LMI participation in their projects. Examples provided include:

1. Availability of state and federal incentives, specifically RECs and tax credits, to make projects pencil with LMI households included.
2. Payout of RECs at prior to energization rather than during project operation.
3. Negotiating PPAs on a production basis rather

<sup>3</sup> LIFT designed its research to use six 'drivers' of community solar programs: For energy rates, High= 12 cents/kWh and above; Average = 8 cents-11.9 cents/kWh; Low = less than 8 cents/kWh.

than capacity, thereby eliminating construction risks (like interconnection) and production risk (like curtailment).

4. Changes in incentive structures (a move to watt-based incentives caused too much risk).
5. Purchasing solar production insurance. [NOTE: ‘Negotiating PPAs...’ and ‘Purchasing solar production insurance’ practices were found in CS projects that did not specifically include LMI residential subscribers but are applicable to LMI serving projects in many locations.]
6. Offering no-cost subscriptions to LMI households eliminates the non-payment risk.
7. Project bundling to create greater economies of scale, driving down transaction cost and allowing greater risk and less or no revenue from LMI electricity sales.

Interestingly, of the 11 responses received to the question of whether credit scores were collected for LMI customers, nine indicated that credit scores were not collected, and the remaining two indicated that credit scores were required but with the same or lower score minimum than for market rate customers participating in the same project.

## 6. Additional Insights from Step 2 Data

Projects in operation accounted for the maximum number of LMI household participation as against those that were still in development and/or financing is still in place. The LIFT Solar Finance Research found a correlation between average energy rates and project size (in kWdc) – implying that higher rates incentivize bigger projects. Therefore, the resale price from solar power at market rate energy rates plays a strong role in the size of the investments.

In addition, **the LIFT research shows that the regulatory structure plays a key role in LMI inclusion – projects in deregulated markets accounted for the majority of LMI kW allocations.**

## B. Step 3 Insight Survey Findings

Groundswell also administered a survey focused on gathering insights that are not project- or portfolio-specific, separate from the dataset referenced above. The goal of the Step 3 Insight Survey was to gain more qualitative information on the opportunities and challenges of LMI CS. The number of observational units in this dataset was 40.

The survey targeted developers and financiers and was broadly distributed. Findings from this survey include:

### *Policy Implications:*

*Projects that are energized and operating in deregulated markets accounted for the maximum number of LMI household participation and the majority of LMI kW allocations.*

1. Developers identified “risk mitigation” and “time needed to structure and execute the deal” as the top two barriers impacting the financing of CS projects that serve LMI households. **By risk mitigation, they mean if all LMI programs could be net crediting which essentially means the discount goes directly to the LMI customers (say, for example, 10%), and the rest of the credit (90%) goes directly to the provider from the utility, then that would remove the LMI concern about credit worthiness since there is no collection necessary.**
2. Financiers clearly identified “project/portfolio size (too small)” as the greatest barrier impacting the financing of CS projects that serve LMI households, followed by “risk mitigation.”

Addressing these observations – will be the challenge for policymakers. The LIFT Toolkit provides choice points in its ‘Project Optimizer’ feature to allow users to explore options for project finance size and ownership models.

### 1. Solar Developers Offer Divergent Responses

When comparing the answers from respondents who

identified as Developers as their primary role with the CS industry to the other answers received, the Developers tended to be much more inclined toward CS than residential projects. Investors and those who identified as both Developers and Investors showed that they had significantly higher rates of work in residential than CS-based projects.

Since residential (individual rooftop or ground mount) projects don't offer the large payoffs for the developers, who must spend more time managing projects than investors, the logic holds that developers will be more interested in CS than residential solar. And, for investors, the time requirements aren't as demanding on a per-project basis. Therefore, many smaller projects like those offered by residential solar will still offer acceptable returns.

## 2. Barriers to LMI Community Solar Development

In the Insights Survey, Step 3, respondents were asked to rank common barriers to financing for projects that serve low-income households. They were asked to sort 11 different barriers in ascending order, from most important to least. Two of the barriers asked for the user to provide more specific details on the barrier in a free-form text box. These two barriers were: "Risk mitigation" and "Other". Our knowledge and prior research led us to believe that risk mitigation was a major barrier, and we sought to gather more details about this with the textbox. For the "Other" choice, we added a textbox to gather information about barriers that we did not foresee to financing.

### i. Aggregate Analysis of Barrier Rankings

1. Without grouping rankings by role or other characteristics of the respondent, the most important barriers were: "Project/portfolio size," "Risk Mitigation," "Host Site negotiations including navigating affordable housing regulations," and "Time needed to structure and execute the deal."
2. In aggregate, the barriers of moderate importance were: "Access to tax equity," "Transaction costs"

(which include customer acquisition and subscriber management costs), and "Interconnection costs."

3. In aggregate, the barriers of low importance were: "Lack of pre-existing relationships with capital sources" and "Property taxes."
4. The average of the standard deviations of the ranks was 2.68, which indicates general agreement upon the ranks of the barriers. The ranking with lowest standard deviation and consistently ranked of the least important was "Property taxes" with standard deviation of 1.62. "Other" had the highest standard deviation of 4.37 as shown in Table 1 on the next page.



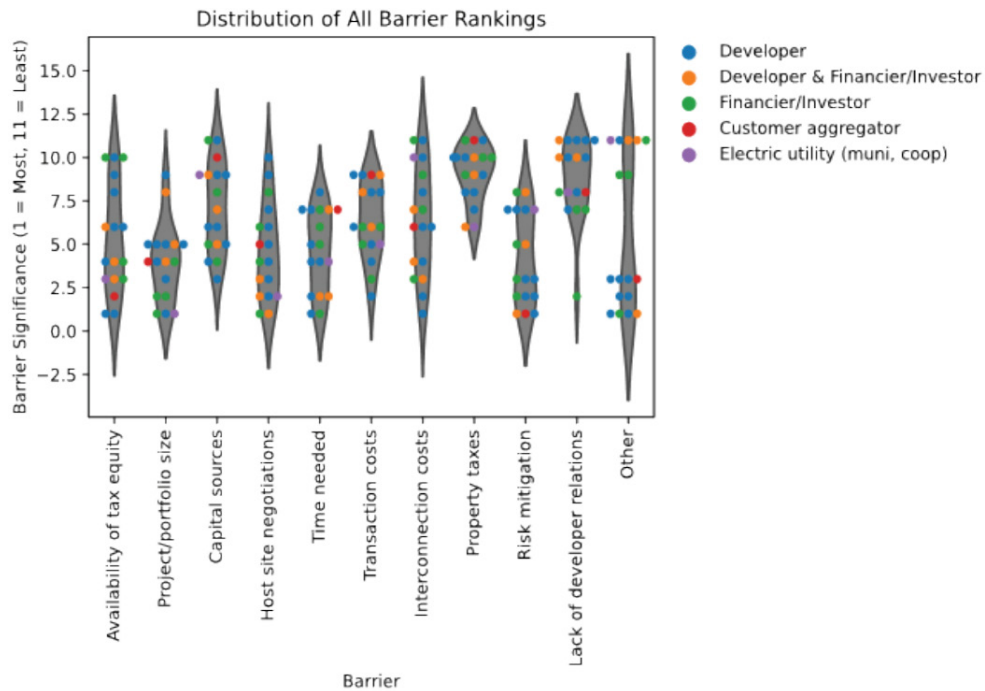


Figure 5: Aggregate Barrier Rankings (1 = Most Significant, 11 = Least Significant)

Table 1 Aggregate Barrier Rankings (1 = Most Significant, 11 = Least Significant)

Barrier	Rank	Count	Mean	Std	Min	25%	50%	75%	Max
Project/portfolio size	1	17	4.00	2.26	1	2	4	5	9
Risk mitigation	2	17	4.24	2.63	1	2	3	7	8
Host site negotiations	3	17	4.59	2.76	1	2	4	6	10
Time needed	4	17	4.65	2.37	1	2	5	7	8
Availability of tax equity	5	17	5.29	3.14	1	3	4	8	10
Other	6	17	5.47	4.37	1	2	3	11	11
Transaction costs	8	17	6.35	2.21	2	5	6	8	9
Interconnection costs	8	17	6.35	3.18	1	4	6	9	11
Capital sources	9	17	7.12	2.57	3	5	7	9	11
Lack of developer relations	10	17	8.82	2.35	2	8	10	11	11
Property taxes	11	17	9.12	1.62	6	8	10	10	11

**Table 2: Means of Barrier Rankings by Role (1 = Most Significant, 11 = Least Significant)**

Roles	Counts	Availability of Tax Equity	Project / Portfolio Size	Capital Sources	Host Site Negotiations	Time Needed	Transaction Costs	Interconnection Costs	Property Taxes	Risk Mitigation	Lack of Developer Relations	Other
Developer	8	5.63	4.63	6.63	5.75	4.75	6.38	6.00	9.13	4.00	9.88	3.25
Developer & Financier / Investor	4	4.33	5.67	7.00	2.00	3.67	7.67	4.67	8.33	4.67	10.33	7.67
Financier / Investor	3	6.75	2.25	7.00	4.75	4.75	5.00	7.50	10.00	4.50	6.00	7.50
Customer Aggregator	1	2.00	4.00	10.00	5.00	7.00	9.00	6.00	11.00	1.00	8.00	3.00
Electric Utility (Muni, Coop)	1	3.00	1.00	9.00	2.00	4.00	5.00	10.00	6.00	7.00	8.00	11.00

## ii. Analysis of Barrier Ranks by Role

When the responses were grouped by the role of the respondents, most of the total aggregated trends remained the same. However, Developers identified “Other” as their highest ranked barrier in this case. Of the five Developers to enter answers in the textbox for “Other”, two cited difficulty finding customers, two cited a lack of policy incentives, and one cited poor government legislation and program designs.

**Table 3: Developer Ranking of Aggregate Barrier (1 = Most Significant, 11 = Least Significant)**

Role	Barrier	Rank	Count	Mean	Std	Min	25%	50%	75%	Max
Developer	Other	1	8	3.25	3.24	1	1.75	2.5	3	11
	Risk mitigation	2	8	4.00	2.56	1	2	3	7	7
	Project/portfolio size	3	8	4.63	2.26	1	3.75	5	5	9
	Time needed	4	8	4.75	2.49	1	3.5	4.5	7	8
	Availability of tax equity	5	8	5.63	3.42	1	3.25	6	8.25	10
	Host site negotiations	6	8	5.75	2.82	2	3.75	5.5	7.5	10
	Interconnection costs	7	8	6.00	3.59	1	3.5	6	8.5	11
	Transaction costs	8	8	6.38	2.56	2	4.75	7	8.25	9
	Capital sources	9	8	6.63	2.77	3	4.75	6	9	11
	Property taxes	10	8	9.13	1.36	7	8	9.5	10	11
	Lack of developer relations	11	8	9.88	1.55	7	9.5	10.5	11	11

Table 4: Financier/Investor Ranking of Aggregate Barrier (1 = Most Significant, 11 = Least Significant)

Role	Barrier	Rank	Count	Mean	Std	Min	25%	50%	75%	Max
Financier/ Investor	Project/portfolio size	1	4	2.25	1.26	1	1.75	2	2.5	4
	Risk mitigation	2	4	4.50	2.65	2	2.75	4	5.75	8
	Host site negotiations	3	4	4.75	2.99	1	3.25	5	6.5	8
	Time needed	4	4	4.75	2.63	1	4	5.5	6.25	7
	Transaction costs	5	4	5.00	1.41	3	4.5	5.5	6	6
	Lack of developer relations	6	4	6.00	2.71	2	5.75	7	7.25	8
	Availability of tax equity	7	4	6.75	3.77	3	3.75	7	10	10
	Capital sources	8	4	7.00	3.16	4	4.75	6.5	8.75	11
	Interconnection costs	9	4	7.50	3.42	3	6	8	9.5	11
	Other	10	4	7.50	4.43	1	7	9	9.5	11
	Property taxes	11	4	10.00	0.82	9	9.75	10	10.3	11

Table 5: Developer & Financier or Investor Ranking of Barrier (1 = Most Significant, 11 = Least Significant)

Role	Barrier	Rank	Count	Mean	Std	Min	25%	50%	75%	Max
Developer & Financier /Investor	Host site negotiations	1	3	2.00	1.00	1	1.5	2	2.5	3
	Time needed	2	3	3.67	2.89	2	2	2	4.5	7
	Availability of tax equity	3	3	4.33	1.53	3	3.5	4	5	6
	Interconnection costs	4	3	4.67	2.08	3	3.5	4	5.5	7
	Risk mitigation	5	3	4.67	3.51	1	3	5	6.5	8
	Project/portfolio size	6	3	5.67	2.08	4	4.5	5	6.5	8
	Capital sources	7	3	7.00	2.00	5	6	7	8	9
	Other	8	3	7.67	5.77	1	6	11	11	11
	Transaction costs	9	3	7.67	1.53	6	7	8	8.5	9
	Property taxes	10	3	8.33	2.08	6	7.5	9	9.5	10
	Lack of developer relations	11	3	10.33	0.58	10	10	10	10.5	11

### 3. Ways the Solar Industry can make Community Solar more accessible for LMI households

In the *Insights Survey*, Step 3, respondents were asked on question 7, “What do you think the solar industry can do to make developing LMI CS easier?” and to provide answers in a free-form text box.

1. Most of the responses and therefore suggested very specific, direct, and unique solutions. There were three suggestions that were repeated twice: “net-crediting,” “elimination of added cost for subscriber management and acquisition,” and “standardization of LMI qualification, outreach, and contracting.”
2. These broad categories were kept preserving the details of each response but further tagging of the categories was performed to assess which broad aspects of the LMI solar industry might present the best opportunities to improve upon.

- a. The broad suggestions were grouped into five categorical bins: 11 for “Easier registrations or processes,” six for “Financial solutions,” one for “Innovative ownership models,” and one for “Required LMI carve-outs for every project.”
- b. The abundance of recommendations shows that accessibility to LMI Solar projects can be improved with process refinements and not simply money. Currently the added friction and complexity of LMI CS seems to be deterring development of LMI CS.
- c. Among the bin for “Easier registrations or processes” that the Solar Industry can implement to improve CS for LMI Households, most of the suggestions centered around the extra work and processes required for LMI CS, including:
  - i. Standardization of LMI of qualification, outreach, and contracting
  - ii. Easier access to LMI customers
  - iii. Income verification be removed or have lowered standards
  - iv. The solar industry will focus more on LMI customers but will need
  - v. Removing the need for two separate monthly payments.
- d. The financial policy suggestions included:
  - i. Use of net-metering
  - ii. Use master metering
  - iii. Reducing loan risk
  - iv. Use of more green banks



**Table 6: What Can the Solar Industry Do to Make Developing LMI Community Solar Easier?**

Category	Category	Tag Counts
Eliminate added cost for subscriber management and acquisition	Easier registration <sup>4</sup> or processes	11
Standardized LMI offtaker qualification, outreach, and contracting mechanisms	Easier registration or processes	11
Easier aggregation of projects	Easier registration or processes	11
Lower/remove income verification	Easier registration or processes	11
Easier access to LMI customers	Easier registration or processes	11
Eliminate need for 2 monthly payments	Easier registration or processes	11
Work with finance companies to help them with LMI off take	Easier registration or processes	11
Incentivize solar industry to focus on LMI customers	Easier registration or processes	11
Difficult to qualify moderate income participants	Easier registration or processes	11
Net Crediting	Financial solutions	6
Reduce loan risk	Financial solutions	6
Advocate for Master Metering	Financial solutions	6
Use more Green Banks	Financial solutions	6
Programs designs to facilitate partnerships with utilities	Program design	2
Allocate % to LMI for every project	Program design	2
Focus on identifying and removing barriers to ownership/management entities	Innovative ownership models	1

#### 4. Ways the Finance Industry Can Make LMI Community Solar More Accessible

In the *Insights Survey*, Step 3, respondents were also asked in Question 8, “What do you think the finance industry/investment community can do to make developing LMI CS easier?” and to provide answers in a free-form text box.

1. Overall, there weren’t as many answers regarding what the financial industry can do to make developing CS easier as there were for Question 7. Many suggested answers that were actions that can only be taken by the government like higher incentives.
2. Of the tagged responses related to the financial industry, there were a few main themes:

<sup>4</sup> Accessibility and inclusiveness

- a. Three responses suggested that the financial industry should reconsider if perceived LMI risk is material, two responses suggested solutions regarding standardization of underwriting, two responses suggested cost reductions, two suggested that the financial industry needs to reduce profit expectations, two suggested that investors focus more on overall subscriber pool stability, and two suggested alternative financial modeling techniques.
- b. An advisor to the LIFT project and Vice President at a large multinational bank focusing on Environmental Programs noted that for banks to lend money to LMI CS Projects, returns are required to be “risk-adjusted” due to traditional measures of repayment risk. Therefore, banks cannot unilaterally decide to reduce profit expectations. The advisor also noted that the current information used by banks to make lending decisions require higher interest rates to projects with LMI customers, but that new data may show that LMI customers do not carry increased risk, and banks can then lower rates for these types of projects.

**Table 7: What Can the Finance Industry Do to Make Developing LMI Community Solar Easier?**

Responses	Category	Category Count
Net Crediting	Financial modeling techniques	3
Structure long-term interest rates to match project life	Financial modeling techniques	3
More innovative models beyond formal community solar projects	Financial modeling techniques	3
Show that payments aren't dependent on FICO entirely	Reconsider if perceived LMI risk is material	3
Promote how LMI repayment is higher for some	Reconsider if perceived LMI risk is material	3
Finance industry needs to validate whether LMI risk is material.	Reconsider if perceived LMI risk is material	3
Blend LMI and non-LMI in program to mitigate the risk of LMI customers	Focus on overall subscriber pool stability	2
Focus on overall subscriber pool stability	Focus on overall subscriber pool stability	2
Accept lower tax equity	Reduce profit expectations	2
Reduce minimum returns required for LMI focused project	Reduce profit expectations	2
Standardized LMI off taker qualification, outreach, and contracting mechanisms	Standardization of underwriting	2
Standardized underwriting criteria	Standardization of underwriting	2
Low-cost capital and pooled tax equity earmarked for LMI solar.	Carve-outs	1
Not charge a premium for LMI component	Reduce Cost premiums for LMI Projects	2
Allow higher LMI ratio without penalizing developer fee.	Reduce Cost premiums for LMI Projects	2

# APPENDIX A: LIFT SURVEY FINANCE FORMS USED IN DATA COLLECTION

Almost all surveys were administered via the internet on SurveyMonkey.com. Survey preview links are provided as well as the pdf versions of the survey questionnaires, which are provided below. Even though the questions are the same in both versions, the more interactive nature of online surveys can create a different experience for the respondents and therefore yield different results.

Link to the Solar Project Data Intake Step 2 Survey Questionnaire:

[https://www.surveymonkey.com/r/Preview/?sm=rvhUFGekMIwomCEnkIfIXMgfB\\_2BdWPPTrsfHiho-Qt-d6wuBNs\\_2B4ApvZiQqNuzdrkVf](https://www.surveymonkey.com/r/Preview/?sm=rvhUFGekMIwomCEnkIfIXMgfB_2BdWPPTrsfHiho-Qt-d6wuBNs_2B4ApvZiQqNuzdrkVf)

Link the Insights Survey Questionnaire:

[https://www.surveymonkey.com/r/Preview/?sm=NwEtFTHX-31VW7xISXFGH\\_2FSdpZ11adSVDsolGyYyh-P\\_2BEn2vyPANA3fkOs0WBBcks8](https://www.surveymonkey.com/r/Preview/?sm=NwEtFTHX-31VW7xISXFGH_2FSdpZ11adSVDsolGyYyh-P_2BEn2vyPANA3fkOs0WBBcks8)

# APPENDIX B: PRINTED SURVEY QUESTIONNAIRE FOR LIFT'S SOLAR PROJECT FINANCE INTAKE STEP 2

## *LIFT Solar Everywhere - Solar Project Finance Data Intake (Step 2 of 3)* *General project information*

**\* 1. Please enter the financing portfolio name, as provided by the LIFT Solar Everywhere research team.**

**2. Please enter the financing portfolio research ID for this project, as provided by the LIFT research team.**

**\* 3. Please enter your name, company, email address, and phone number.**

Name

Company

Email Address

Phone Number

**\* 4. Please provide a brief description of the project.**

**5. If the project utilizes any alternative finance mechanisms, such as credit enhancements, PRIs, green bank loans, etc., please describe that here.**



**6. If one is available, please share the URL of the project website.**

**\* 7. What is the installation type of the project?**

- ☐ Community Solar
- ☐ Rooftop Solar (Behind the meter, including both residential and C&I installations)
- ☐ If other, please specify:

**\* 8. In kWdc, what is the size of this project? Please provide size to one decimal place (example: 503.5kWdc). If a residential rooftop portfolio, provide the full portfolio size.**

**\* 9. Where is the project located? Please provide a site address.**

Address

Address 2

City/Town

State/Province

ZIP/Postal Code

**\* 10. Please enter the name of the utility service territory in which the project is operating. For example: Pepco DC, Ameren.**

**\* 11. What is the utility service territory type in which the project operating?**

- ☐ Investor-owned utility
- ☐ Cooperative
- ☐ Municipally owned utility

**12. What is the utility regulatory structure of the state in which the project is located?**

- ☐ Regulated
- ☐ Deregulated

**\* 13. Please indicate the project's current status.**

- ☐ Project is in development and all financing is not yet in place
- ☐ Project is in development and all financing is in place
- ☐ Project is operating
- ☐ Project has been decommissioned
- ☐ If other, please specify:

**14. If the project is currently operating, please indicate the month and year (MM/YYYY) it began operation.**

**15. If the project has been decommissioned, please indicate the month and year (MM/YYYY) it ceased operation.**

**\* 16. How many LMI customers can participate in this project at one time?**

**17. How many market rate customers, if any, can participate in this project at one time?**

**\* 18. What is the unlevered IRR of this project? Please provide IRR to one decimal place (example: 9.7%).**

**19. What is the modeled simple payback period, in years, for this project?**

**\* 20. What is the performance period, in years, used for project finance modeling?**

**21. What is the modeled WACC for this project?**

**\* 22. What was the total installation cost of this project? Please include only hard costs to construct only ; please exclude legal, accounting, etc.**

**23. How much did interconnection cost for this project?**

**24. What were the (estimated) legal costs required to close on financing? If the project was financed as part of a portfolio, provide the legal costs allocable to this project relative to its capacity contribution to the portfolio (\$/Wdc).**

**25. What were the (estimated) accounting costs required to close on financing? If the project was financed as part of a portfolio, provide the accounting costs allocable to this project relative to its capacity contribution to the portfolio (\$/Wdc).**

**\* 26. Which of the following tax treatments are included in the project model? Please select all that apply.**

- ☐ ITC
- ☐ Depreciation
- ☐ 100% bonus depreciation
- ☐ If other, please provide additional details on other tax treatments or tax credits monetized, like "NMTC" or "LIHTC."

**\* 27. What is the total modeled dollar value of contracted REC payments during the modeled project life span?**

**Please include all REC payments anticipated to be contracted during financing, even if not yet under contract during modeling.**

**If no contracted RECs are included in the model for this project, please enter \$0.**

**\* 28. What is the total modeled dollar value of uncontracted REC payments during the modeled project life span?**

**Please include only REC payments that are modeled but not anticipated to be contracted during financing (i.e., “out year” RECs for which revenue can reasonably be assumed but cannot yet be contracted).**

**If no uncontracted RECs are included in the model for this project, please enter \$0.**

**29. Please describe and provide total modeled values for other modeled sources of revenue, such as electricity sales, non-REC incentives, and other state subsidies.**

Electricity Sales: total modeled amount

Add'l Source 1: Name and total modeled amount

Add'l Source 2: Name and total modeled amount

Add'l Source 3: Name and total modeled amount

Add'l Source 4: Name and total modeled amount



**30. Do you see the project finance approach used for this project/portfolio as scalable? Within the same market and/or in other markets? Why or why not?**

**31. Could this approach to project finance be standardized? What elements could be more readily standardized across the industry?**

**32. How long in months did it take to secure financing for this project? Please calculate from initial modeling to transaction closure.**

**33. If the project is operating, how is this project performing financially as compared to the modeled performance?**

- ☐ Better than modeled
- ☐ Materially the same as modeled
- ☐ Worse than modeled
- ☐ N/A – project isn't operating

**34. Please share any additional comments or context on the project's actual financial performance as compared to modeled performance.**

**\* 35. How is low- and moderate-income defined for this project?**

**36. Does the project deliver savings to individual LMI participants?**

- ☐ Yes
- ☐ No

**37. How are savings from this project delivered to LMI customers?**

- ☐ On-bill monetary credit or reduction of kWh consumption

- ☐ Off-bill monetary benefit (i.e., transit cards, rent reduction)
- ☐ Direct delivery of programs or services
- ☐ If savings are not delivered to LMI customers but are provided to an LMI-serving entity, or if savings are delivered to LMI customers in another way, please describe:

**\* 38. What are the modeled savings delivered to an individual LMI customer in the first model year, after all costs and fees paid by the customer?**

**Please specify amount, units, and/or frequency. Examples: \$523 per year, \$0.02/kWh on supply costs and 15% discount on full retail rate.**

**\* 39. What are the modeled savings delivered to an individual LMI customer averaged across all modeled years, after all costs and fees paid by the customer?**

**Please specify amount, units, and/or frequency. Examples: \$517 per year, \$0.02/kWh on supply costs and 15% discount on full retail rate.**

**40. Can you identify an individual financial element that made it most possible for you to include LMI participants in this project? Examples may include high(er) SREC values, government incentives, tax credit twinning, project bundling, credit enhancements, etc.**

**41. What steps have you taken, if any, to mitigate real or perceived risks associated with including LMI households in this project? If any concerns were expressed by other financing partners (lenders, etc.), how were they addressed?**

**42. Are LMI customer credit scores are being evaluated for project participation, and if so, how does the minimum score required compare to that for market rate customers?**

- ☐ Yes, credit scores are required from LMI customers, and the minimum is higher than for market rate customers
- ☐ Yes, credit scores are required from LMI customers, but the minimum is the same or lower than for market rate customers
- ☐ No, credit scores are not required from LMI customers