Lyndon B. Johnson School of Public Affairs

Policy Research Project Report

How Can Federal Programs Encourage New Business Models? Midterm Evaluation of the Solar in Your Community Challenge

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Abstract

The U.S. Department of Energy's Solar in Your Community Challenge (SIYCC) program (May 2017 to October 2018) aims to expand solar electricity access to low- and moderate-income households and community organizations. One specific option is community solar, which is a complement to the residential rooftop PV market and provides a means by which households that cannot or opt not to put solar on their roof can still participate as a virtual behind-the-meter PV adopter. The SIYCC was intended to catalyze the design and testing of various PV deployment models across more than 150 projects in the U.S., varying in approaches to customer engagement, subscription, utility engagement, and other factors. The program also seeks to develop expertise across the range of communities selected to participate.

In this project, the team explored SIYCC's progress toward its goals to date. The research process began by developing a logic model detailing the processes and outcomes for each of the program's activity streams. Because the analysis was conducted at the midpoint of the program's lifecycle, a key outcome of interest – installed PV capacity – was left out of the assessment. Instead, key outcomes of interest included scores by coaches given to the teams in periodic program reviews, resource utilization (services requested, funds spent, etc.) on a marketplace available to program participants, and several other progress-related outcomes such as capacity building (external knowledge acquisition), status of site selection, permitting, and so on. For the analysis, program administration data were matched with data from a survey of program participants (171 communities). The response rate for the survey was about 30% (51 of 171 SIYCC teams).

The research found that a high proportion (65%) of teams were using knowledge from external resources (largely from within their region), 89% of teams had identified installation sites, and roughly 35-50% of the teams had at least partial agreements in place for permitting and financing. Overall, the mean progress of teams in the survey sample toward final project goals (PV installation) was 39%. Most insightfully, program funds (blitz and seed funds) and vouchers were found to correlate with higher average rates of marketplace resource utilization, frequency of team meetings, and project progress as reported by coaches. A key limitation of the findings is that the data were collected at a midpoint of the program lifecycle. In addition, teams that responded to the survey tended to be more active (i.e. received green or yellow progress from coach); thus, the survey results are biased toward communities that received more funding and were assessed to be generally more successful at the midterm evaluation point. An assessment after the program has concluded will provide an opportunity to revisit the initial findings, and expand the scope of inquiry to include impacts on PV deployment and variation across program models.

Introduction

Our client, the U.S. Department of Energy's Solar Energy Technologies Office (SETO), created the Solar in Your Community Challenge (SIYCC) prize competition in an effort to expand access to solar technology to all Americans, particularly lower and middle-income Americans. The program, started in May 2017 and concluding in January 2019, awards a final prize of $1 million to the winning team. In the meantime, teams receive educational resources, seed funding, and/or technical assistance or blitz vouchers to help them through the prize competition.

There have been few systematic evaluations of prize competitions, like the SIYCC, to understand how and why they work and whether the prize structure is effective in inspiring innovative new business models. This project seeks to further clarify the effects of funding type, diversity of expertise on individual teams, business model type, and region on the desired outcomes of the program.

This project looks at both broad potential outcomes, including knowledge flows and business model innovation, as well as more individual level outcomes such as team performance and progress. The project began with three major research questions:

1. How do the communities participating in the Challenge differ from other communities installing rooftop, community, and utility-scale solar? Which communities are still left out?[1]

2. How do the resources provided to teams (specifically seed funds and technical assistance vouchers) affect performance? What aspect of the Challenge had the most perceived impact?

3. How can federal programs help financial and business model ideas spread?

Building from these research questions, we used process interviews, a thorough literature review, and our logic model to develop five rigorous hypotheses, explained in detail in our Methods section, to look for correlations between different aspects of the program.

- Hypothesis 1: Internal Team Diversity Impact on Program Outcomes
- Hypothesis 2: Technical Voucher Effects on Marketplace Usage
- Hypothesis 3: DoE Funding Effects on Team Performance Outcomes
- Hypothesis 4: Business Model and Funding Impacts on Program Outcomes
- Hypothesis 5: Direct Impact Factors on Knowledge Flows

We also gathered descriptive statistics on team attributes for the teams participating in our survey and compared them to descriptive information on the Challenge population at large, where possible. This analysis shows how metrics varied across teams outside of the specific hypotheses addressing performance and knowledge flows. It also gives a broader picture of where all teams stood at the midpoint of the SIYCC program. Together, these analyses help to illuminate the impacts of the

[1] This research question was not addressed in our final analysis due to difficulties with geographic data anonymization and privacy. It may be possible to address this question at a later date.

SIYCC program on business model development, team capacity building, and development of knowledge flows.

Given the timeline of the SIYCC, there were some critical limitations to our team's ability to provide a full evaluation. The midterm of this project recently passed and midterm data is not yet available. Necessarily, our work focused on process evaluation and design and implementation of an impact evaluation strategy to assess the early stages of the project. This survey was designed to be utilized again at the end of the SIYCC program by the client.

Methods

Working with our internal technical lead and client, we decided on three main evaluation steps for the academic year, listed below. This section describes our efforts on each, including preliminary findings.

- **Process Interviews**. We spoke with three people at the Department of Energy (DoE) who have been involved with the program from conception through the current stage of implementation. This helped us to understand the full concept, activities, and objectives of the Department as we designed our evaluation.
- **Logic Model and Survey**. The client provided a draft logic model which we revised and refined using the data collected from process interviews and publicly available data about the Challenge. Developing the logic model helped establish causal pathways and gave us the framework to design our evaluation model and survey.
- **Data Analysis**. The team undertook both regression models and descriptive statistics analysis of data obtained directly from the DoE as well as team survey responses collected in Step 2. Results from this analysis process constitute the bulk of our findings.

This section begins with a subsection for each of our five current hypotheses and follows with subsections on their accompanying variables. The appendix includes:

- Table 1—Y-variable descriptions for each hypothesis;
- Table 2—data source key; and
- Table 3—X-value and independent variables descriptions.

Several tables are also included in the main text, as appropriate.

Hypothesis Testing

Hypothesis 1: Internal Team Diversity Impact on Team Performance

The balance of team expertise makes up its knowledge capacity. Our review indicates that teams in the SIYCC have widely varying degrees of knowledge capacity (see internal diversity score in Table 3 for an operational definition). This family of hypotheses explores how this factor has influenced a range of program outcomes, including:

- External acquisition of knowledge;
- Coach scores;
- Shovel readiness;
- Progress on project milestones; and
- Progress on installation of PV solar units.

We created a composite expertise score or internal diversity score (IDS) by evaluating how much experience teams had in six key areas at the outset of the project: solar development, legal, finance, engineering, community outreach, and marketing. A detailed explanation of this composite and each independent variable can be found in Table 3 of the appendix.

The hypothesis endeavors to understand how initial expertise affects performance and knowledge acquisition using the six y-variables listed above and in Table 1. Our null hypothesis is that the dependent variables are not affected by team-level knowledge capacity as expressed by the internal diversity score. Our alternative hypothesis is that team-level knowledge capacity does influence performance and knowledge acquisition outcomes.

$$\text{Null Hypothesis: } H_0 : Y_{1.1\text{-}1.6} \neq IDS + X + e$$

$$\text{Alternative Hypothesis: } H_1 : Y_{1.1\text{-}1.6} = IDS + X + e$$

This analysis, described in the results section, demonstrates the effects of diverse expertise, present at the team's inception, on program performance across the board, including how much expertise a team seeks out and how quickly and effectively it accomplishes project milestones. This helps illuminate potential criteria that DoE may use to award funding in a similar project in the future.

Hypothesis 2: Funding Effects on Marketplace Usage

Teams selected for the Program were provided one of three award levels, a combination of those awards, or no award. We reason that the variation in funding types play an important role in the teams' internal acquisition of knowledge, as shown through utilization of the SIYCC marketplace consultants and services. During the SIYCC program, the DoE distributed three types of funding in varying amounts, often in combination:

- Technical vouchers ($10,000);
- Seed funding ($20,000); and
- 8-blitz technical vouchers ($20,000).

To signify the variety of funding combinations, we use the composite variable Funding Type (FT). For more information, please refer to Table 3 in the appendix.

This hypothesis evaluates funding models' influence on teams' utilization of the DoE marketplace. Our null hypothesis is that team usage of the marketplace is not affected by the type or amount of DoE funding given to teams. Our alternative hypothesis is that DoE funding does impact usage of those resources.

$$\text{Null Hypothesis: } H_0 : Y_{2.1} \neq FT + X + e$$

$$\text{Alternative Hypothesis: } H_2 : Y_{2.1} = FT + X + e$$

This hypothesis testing shows how the three types of DoE funding affect teams' likelihood to use program-provided resources. This helps illuminate teams' propensity to engage with program resources and to what extent funding is tied to those motivations.

Table 1, Y Variable Descriptions (see Table 2 in the appendix for Data Source key)

H#	Var ID	Var Name	Description	Data Source
H1	1.1	External knowledge acquisition	Describes whether teams contacted external help outside of the Challenge framework. This was set up by using two binary variables (for inside and outside of region).	S 32, 34
H1	1.2	Coach scores	Quarterly scores based on progress towards program milestones, expressed as an ordinal variable with four categories (i.e. missing, red, yellow and green status).	C 545
H1	1.3	Shovel readiness	Progress toward the development of plans for agreements with city and government officials, permitting, siting, and financing. Each of these four areas was measured by a binary variable.	S 43-45
H1	1.4	Project progress	Progress toward implementation of siting, permitting, customer acquisition, rate of participation by LMI and nonprofits, project development, interconnection, long-term management, and financing plans, expressed as an average percentage of completion across categories.	C 679-686
H1	1.5	Installed capacity	Number of teams' started and/or completed PV units, as a continuous variable.	S 42
H2	2.1	Marketplace usage	Describes how often teams submitted service requests and how much money was spent in the marketplace per team, both as continuous variables.	M
H3	3.1	Team vigor	Describes how active teams are by looking at how frequently teams meet and meet with coaches, as a six-level ordinal variable.	S 12
H3	3.2	Project progress	Progress toward implementation of siting, permitting, customer acquisition, rate of participation by LMI and nonprofits, project development, interconnection, long-term management, and financing plans, expressed as an average percentage of completion across categories.	C 679-686
H3	3.3	Installed capacity	Number of teams' started and/or completed PV units, as a continuous variable.	S 42
H4	4.1	External knowledge acquisition	Describes whether teams contacted external help outside of the Challenge framework. This was set up by using two binary variables (for inside and outside of region).	S 32, 34
H4	4.2	Coach scores	Quarterly scores based on progress towards program milestones, expressed as an ordinal variable with four categories (i.e. missing, red, yellow and green status).	C 545
H4	4.3	Shovel readiness	Progress toward the development of plans for agreements with city and government officials, permitting, siting, and financing. Each of these four areas was measured by a binary variable.	S 43-45
H4	4.4	Project progress	Progress toward implementation of siting, permitting, customer acquisition, rate of participation by LMI and nonprofits, project development, interconnection, long-term management, and financing	C 679-686

			plans, expressed as an average percentage of completion across categories.	
H4	4.5	Installed capacity	Number of teams' started and/or completed PV units, as a continuous variable.	S 42
H5	5.1	External knowledge acquisition	Describes whether teams contacted external help outside of the Challenge framework. This was set up by using two binary variables (for inside and outside of region).	S 32, 34
H5	5.2	Cross-team learning	Describes whether teams reached out to other teams enrolled in the Challenge for assistance in at least one of six expertise areas, expressed as a binary variable.	S 24

Hypothesis 3: DoE Funding Effects on Team Performance Outcomes

The underlying theory of change behind the DoE SIYCC program is that additional funding will help to improve team performance. This analysis seeks to determine how different types of funding can impact team performance. Initial research indicated that DoE funding levels do play a role in a team's overall outcomes. This hypothesis family includes several dependent variables to better understand the impacts of funding across several categories. These include:

- Team vigor, as defined by team meeting frequency;
- Progress on project milestones; and
- Progress on installation of PV solar units

These values are expressed by Y variables 3.1-3.3 (see Table 1). To signify the variety of funding combinations, we use the composite variable Funding Type (FT). For a detailed explanation, please refer to Table 3 in the appendix.

Our null hypothesis is that the team performance as defined by the variables above are not influenced by the type or amount of DoE funding given to teams. Our alternative hypothesis is that DoE funding does influence team performance.

$$\text{Null Hypothesis: } H_0 : Y_{3.1\text{-}3.3} \neq FT + X + e$$

$$\text{Alternative Hypothesis: } H_3 : Y_{3.1\text{-}3.4} = FT + X + e$$

Examining funding's effects on performance is one of the most important parts of this analysis. The influence of different combinations of DoE funding on the teams demonstrates the effectiveness of funding and which type of funding benefits teams the most. Using a variety of variables for performance, not just progress towards milestones, gives a broader picture of the effects of program funding. In particular, as the program was not completed at the time of our analysis, this method gives early visibility into team performance because the Y-variables include progress indicators..

Hypothesis 4: Business Model Impacts on Program Outcomes

Another key goal of the SIYCC program is to encourage innovative business models to flourish. The fourth hypothesis seeks to show how business models perform across knowledge acquisition and performance metrics. This hypothesis uses the same Y-variables as Hypothesis 1, including external acquisition of knowledge, coach scores, marketplace usage, shovel readiness, project progress, and PV installation rates. Program funding type is a key mediating variable, as we anticipated this may

significantly impact team success. Business model type was determined by survey and categorized into one of 10 business models grouped under three ownership models:

- Subscription model;
- Customer-owned; and
- Third-party owned.

Descriptive statistics on the number of business models in each category are provided in the results section.

This hypothesis seeks to describe the effects of interaction between business model and funding type as they influence key outcomes. Our null hypothesis is that business model type, controlled for DoE funding type received, does not influence the range of performance outcomes defined above. Our alternative hypothesis is that business model, varying by funding type, does have an impact on team performance.

$$\text{Null Hypothesis: } H_0 : Y_{4.1\text{-}4.5} \neq FT + BM + X + e$$

$$\text{Alternative Hypothesis: } H_4 : Y_{4.1\text{-}4.5} = FT + BM + X + e$$

By comparing and analyzing the business models across a variety of performance metrics, we can determine both which business models are most suited to succeed in SIYCC-type programs and which business models thrived in combination with which funding strategies. This helps build industry knowledge on innovative business model efficacy.

Hypothesis 5: Direct Impact Factors on Knowledge Flows

The fifth hypothesis measures how business model type, region, and internal diversity scores impact knowledge flows. For this hypothesis, we examine two types of knowledge flow:

- External acquisition of knowledge; and
- Flows of knowledge between SIYCC teams.

Understanding knowledge flows is critical to creating effective practices and effective strategies in the solar industry. Survey questions designed to understand teams' knowledge acquisition resource utilization help illuminate knowledge flows.

Our null hypothesis is that knowledge flows are not affected by a range of factors including business model, knowledge capacity, and region. Our alternative hypothesis is knowledge flows are affected by at least some of these factors.

$$\text{Null Hypothesis: } H_0 : Y_{5.1\text{-}5.3} \neq BM + IDS + R + MC + e$$

$$\text{Alternative Hypothesis: H5: } Y_{5.1\text{-}5.3} = BM + IDS + R + MC + e$$

This analysis builds understanding of what influences knowledge flows. It also helps the DoE to create more effective learning pathways in the future.

Independent Variables

The tables below, also in the appendix, provide a detailed description of the independent variables used in our hypotheses.

Table 2: Data Source Key

Code	Data Source Name
S	UT Survey and question number
C	Quarterly Coach Scores
M	Marketplace Data
D	Data provided by the DoE when returning the survey

Table 3: Independent Variables

Variable ID	Variable Name	Description	Data Source
IDS	Internal diversity score	Composite score based on teams' initial expertise in six areas: solar development, legal, financing, engineering, community outreach and marketing	S 10-11
FT	Funding type	Combination of program funding teams received, including technical vouchers, seed funding, and 8-blitz technical vouchers	D
BM	Business models	Team business model they utilize, in ten total categories under three main areas: subscription model, customer-owned, and TPO.	S 5-8
TS	Team size	Number of full-time team members.	S 9
R	Region	Region where team is located.	D

Background and Related Literature

The energy sector is rapidly changing. With the advent of the widespread use of renewable resources, the solar sector has become one of the most dynamic segments of the energy sector. These rapid changes are in part due to the implementation of new strategies, models and plans which reflect a multitude of factors. These factors include policy, the adoption of new business models, knowledge created within organizations, shared knowledge and prize competitions. Business leaders, politicians, and energy professionals can use and evaluate these crucial factors to maximize all available resources and create effective strategies for the implementation of solar energy and community solar.

Policy Implications

Solar energy is still in its infancy and needs the support of many outside institutions and actors to expand. One of the most significant factors supporting solar is policy driven by local and national governments. According to Richter (2013), the spread of solar energy is highly dependent on regulatory frameworks. Policy plays a significant role because solar faces many challenges such as high costs, regulatory practices, the traditional role of utilities, entranced mindsets of energy production, and how to create value in new business models. This has a substantial impact on the innovation and creation of new business models by utilities. Capello and Faggian (2004) state that to encourage knowledge growth and cooperation, local and national governments need to put policies

into place to maximize the capability of firms. These policies should be aimed at the local level to encourage collective learning. Tappeiner, Hauser, and Walde (2008) contend that supporting knowledge spillover policies requires a means of stimulating investment in both the public and the private sector. Investment can facilitate the growth of knowledge and create incentives for the promotion of research and enterprise. The role of policy in solar is a critical factor for its future success and proliferation.

Business Models

As part of the SIYCC, teams must design individual business models as part of their initiative. To create economically viable programs or projects, teams must create successful business models. Huijben and Verbong (2013) state that there has been an increase in the innovation of new business models, such as Customer-Owned, Community-Shared, and Third-Party models. This increase is happening because of support by both local and national governments, advocacy groups and the private sector. This support allows for teams to have the space and resources to learn new techniques and models. Additionally, volunteering organizations are often more willing to share knowledge or insight then commercial enterprises. Zhang (2016) states that one of the most significant factors in the growth of photovoltaics in the United States is the innovation in business models and the mechanization of financing. These kinds of innovation can allow firms to overcome changing external factors. Hamwia and Lizarralde (2017) assert that business models allow for the creation of new technology and are a locus of innovation. The authors conclude that effective business models are created through innovation which also allows for adjustment and is learning process. Otherwise, business models may often fail to meet their targets and objectives because of a lack of knowledge or inability to secure financial benefits. The creation of new business models does help firms overcome many of the existing challenges that exist with solar.

Knowledge through Cohorts and Firms

The acquisition of insights and knowledge comes from many different sources. Among these sources is the interaction between individuals who work and interact with each other on a regular and personal basis. According to Asheim and Coenen (2005), the creation of clusters, or a reinforced close niche of individuals and organizations, allows for the flow of information. This information can include insights that lead to increases in production and problem-solving. The result of this interaction in a closed space leads to new ideas, interactive learning and the transfer knowledge between individuals at these organizations. Moodysson (2008) states that the exchange of knowledge and know-how comes through a highly selective process. Unless professionals and firms know how to interpret new information from other actors, it is hard to use new knowledge in their work. However, this lack of understanding can often be overcome by social relations both in professional and informal realms. Forming these relationships allow actors to use and understand new knowledge in their projects and initiative. Howells (2002) asserts that inter-organizational relationships are essential for knowledge spillover. This transfer of knowledge is only possible when individuals in organizations share schedules, work hours, practices and socialize with each other. These activities are vital because they help to create an environmental context where workers can learn from each other and understand insights from others. Individuals from different organizations working together allows for knowledge spillover and increases an organization's capacity to make and produce new knowledge or materials.

Knowledge Through Networks and Region

Technology does not develop in a void with a single entity creating and innovating. Instead, technology and its progress are a combined effort of countless individuals, organizations, and

governments. Often these interactions happen outside of an office setting and are external to the goals and targets of the organization. Hauser, Gottfried, and Walde (2007) claim new knowledge and insight come through loose contacts and informal networks rather than through formal work relationships and close friendships. The authors also report that social networks have a significant impact on economic knowledge. Similarly, Yusuf (2008) asserts that cutting-edge technology requires a high level of networking, which allows for knowledge transfer. This reliance on networking allows for knowledge to be transmitted between workers. These networks can form over long distances, but they often happen in regions or at the local level. Makkonen, Inkinen (2014) argues that the gathering of people creates knowledge that easily spreads to people throughout a group and area. The authors state that this type of interaction often happens naturally when many people gather together. Howells (2002) states that the exchange of knowledge at the local level is vital because over time and distance knowledge decays. Having localized knowledge is vital for the acquisition and retaining of new knowledge. Social networks along localized knowledge are essential for many individuals and organizations, and without this interaction, many firms or ventures could fail.

Knowledge Through Prizes and Awards

A significant way that institutions such as companies or governments can create the exchange and development of knowledge is through prizes and awards. Kalil (2006) argues that inducement prizes encourage contestants to innovate and create through governmental programs. The author states that prizes should be used to stimulate innovation and scientific advancement. Kay (2011) states that prize incentives encourage innovation. The money value or prestige of these prizes are also motivation for both unconventional and conventional participants to enter these contests. Often the result is the formulation of new innovations and the sharing of ideas. Makkonen and Inkinen (2014) discern that rewards are the channel to encourage innovation because these events are a way to encourage institutions to innovate together and create knowledge. Gök (2013), however, states that policymakers should be careful about implementing prize programs because some studies have shown these programs have low impact. Despite this criticism, the author states that these programs can be useful in creating innovation, allowing individuals to engage with each other, and provides more flexible solutions to issues. Prize contests have the potential to distribute knowledge but if designed poorly they may not be effective.

Background Summary

The Solar in Your Community Challenge was created so that the people involved in the solar sector can have the knowledge and insight to put new practices and strategies in place to make solar viable. The Challenge is a government supported program, and it is only possible by having policies that support community solar. The research about policy suggests that the Challenge will help solar be implement at the large-scale level across the country. Solar faces many struggles to become a major part of the energy sector, however, the support of many parties is allowing for the creation of effective business models. These business models are critical because research implies that business models that receive more support are more effective at implementing solar. Knowledge is an essential part of any technology-based initiative, however, to be useful there must be a transfer of this information between people interacting with each other. This impact of social relations with the transfer of knowledge is a crucial part of the Challenge. Knowledge can also come from more informal systems such as social networks or natural forming groups of people. Research about knowledge infers that it can be transferred and it is essential for innovation in solar. Competitions can be a valuable tool for the creation of knowledge because it can encourage people and institutions to work together and innovate. Knowledge creation is a core characteristic of the

Challenge, and the success or failure of the Challenge is dependent on this concept. The Challenge is an ideal program to analyze because it allows us to see which programs or projects are the most successful and how they can be replicated in the field.

Summary of Preliminary Findings

Process Interviews

In an effort to gain a thorough understanding of the design and implementation of the SIYCC, the team conducted three process interviews with different members of the Department of Energy team. Interviews were semi-structured and included the same general questions for all three interviewees. Team members asked probe questions to get more in-depth answers when needed. A full interview guide is attached as Appendix A.

The interviews illuminated several key areas of the project. These areas included:

- Desired outcomes and milestones, including both those explicitly stated in program rules and those hoped for by Department of Energy staff;
- Outreach and recruitment activities for teams, consultants and coaches in the lead-up to the program; and,
- Program theory of change and potential hypotheses for different aspects of the program.

Input collected during the three process interviews was used to inform the creation of both the logic model and the metrics table (Appendix B and C).

Logic Model

The logic model, attached as Appendix B, illustrates the major outputs and outcomes of the SIYCC program design. Barriers, outputs, and outcomes are broken up by Project and Program Design, which refers to both individual and aggregate team outcomes for the Challenge; and Capacity Building, which refers to both team-level and program- or market-level outcomes. Outcomes are further broken down into short-, intermediate- and long-term. We completed our research near the midline of the Challenge and were only able to observe short- and intermediate-term outcomes for this project. Accordingly, our main observable outcomes are focused on process and expertise-building. We have also included evaluation of installation or customer acquisition effectiveness when possible.

Metrics and Indicators Table

After completion of the logic model, the team used outputs and outcomes included in the model to create a table of metrics and indicators, attached as Appendix C. Each metric has between two and seven indicators assigned to it for measurement. In addition, the table has a detailed description of information sources. This process helped identify key gaps in the data, which we filled using survey data. The survey was designed with these gaps in mind. The primary metrics are as follows:

- Improvement of team expertise
- Knowledge community established
- Project sited
- Project funded
- Agreements with utilities and/or governments set
- Permits acquired
- Technical assistance vouchers used
- Knowledge diffusion
- Initial team diversity
- Development of innovative business models

In general, we used data from the following sources to measure the indicators: team responses to SIYCC questionnaires, coach scoring reports, coach feedback, funding and marketplace data from the Department of Energy, and responses to our survey.

UT Survey

Our survey was designed using each of the previous subsections with a goals of filling gaps in and supplementing the data provided by the DoE. The survey also provided the most up-to-date data for our analysis, allowing a more through picture of the SIYCC teams' efforts through the second quarter of the Challenge. The following table describes our process.

Process Interviews	Used to identify both common and accurate terminology for the Survey and the full range of concepts, activities, and objectives in the SIYCC.
Logic Model	Used to establish causal pathways and question branching and ordering for the Survey.
Metrics and Indicators Table	Used to build questions addressing gaps in existing data and eliminate duplication-of-effort or overlapping questions.
Beta-Testing	Used to optimize the Survey's duration and length for maximum response rate and quality.

We designed the survey using Qualtrics and, after conversion to SurveyMonkey for compatibility with the DoE SIYCC website, launched the survey on March 7th with the following email invitation:

> Hi [NAME or TEAM NAME],
>
> Our partners at the University of Texas LBJ School of Public Affairs would like to invite you to participate in the ongoing improvements to the Solar in Your Community Challenge. The link below will take you to a brief survey where you and your team's feedback will become a meaningful part of our efforts. The survey should take roughly 20 minutes to fully complete.
>
> [SURVEY LINK]
>
> If you or a member of your team fully completes the survey within the next three weeks, by March 28th, we would like to offer you and your team access to selected Challenge-wide data that may help your Challenge efforts.
>
> Thank you for your participation,
>
> [SIGN-OFF]

SIYCC members were reminded to complete the survey at a conference March 13th and 14th, with reminder emails sent the weeks of March 21st and 28th before the survey closed on April 5th. We received 51 responses from the 171 teams, a roughly 30% response rate.

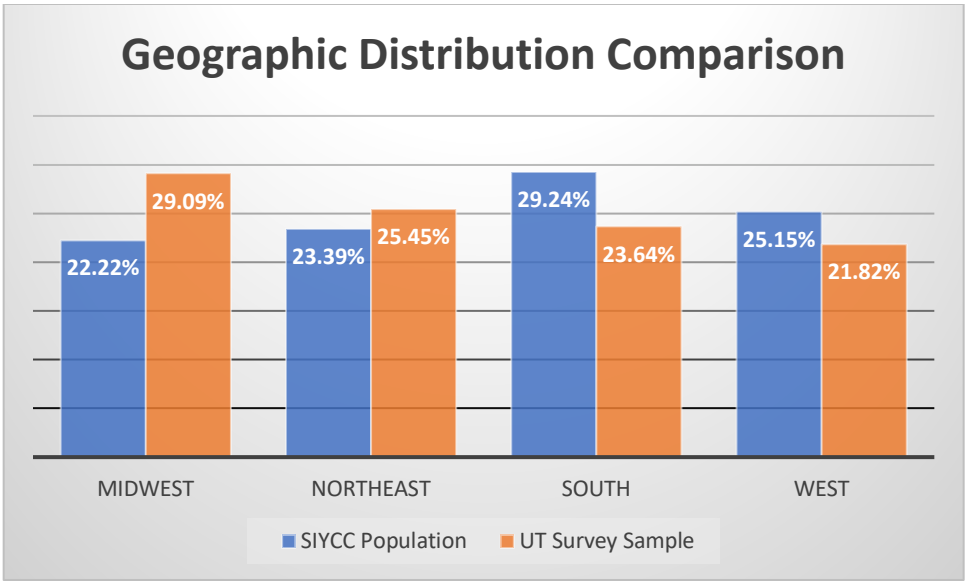
The full survey is attached as Appendix D.

Results

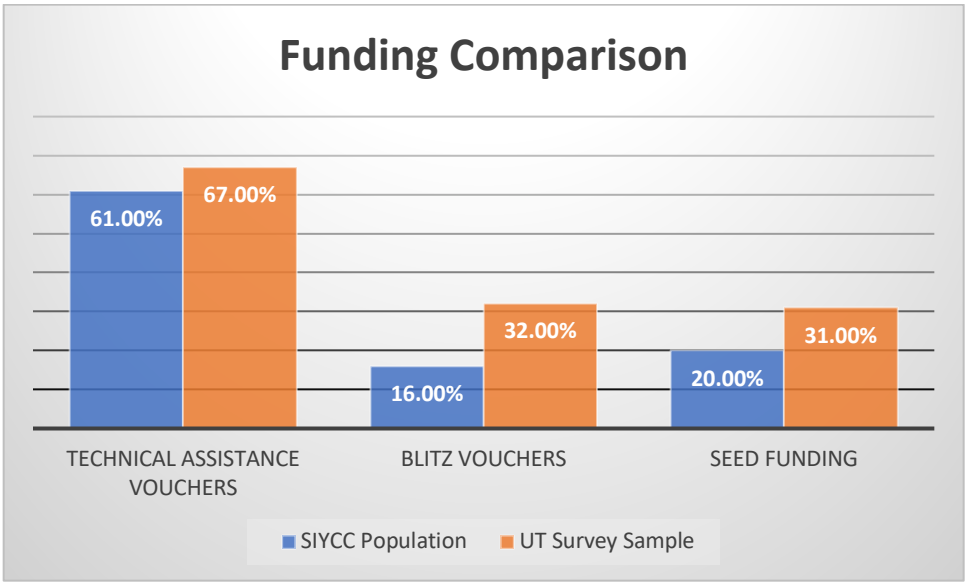
Descriptive Results

There were several differences between the makeup of the 171 teams comprising the SIYCC population and the 55 teams in our UT survey sample. Importantly, the survey sample was largely similar to the SIYCC population and can be used as a representative sample for our midterm evaluation of the program as a whole. The following graphics illustrate interesting areas of comparison between the groups.

Our sample teams had a mean team size of six, with a high of 25.

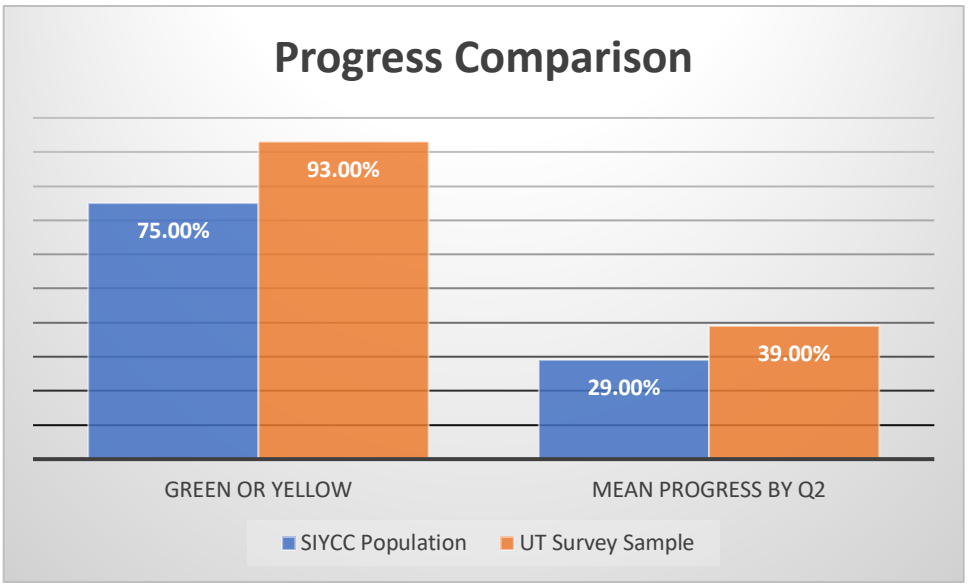


Geographically, our sample never varied more than seven percent from the population, with some overrepresentation of the midwestern and northeastern regions and underrepresentation of the southern and western regions.

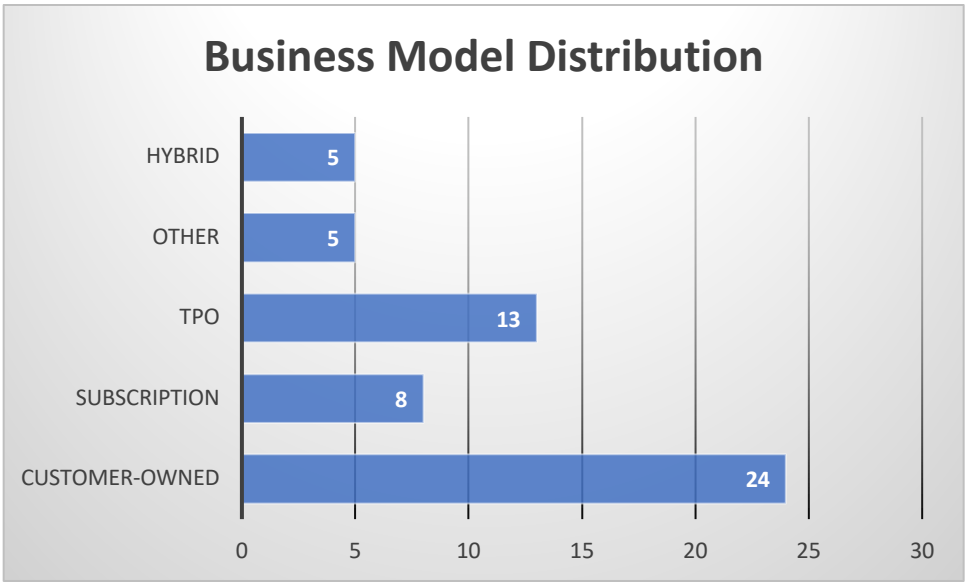


Our sample strayed further from the SIYCC population in funding, over representing teams who received all three types of funding. This could be expected. Teams who received funding of any type, but especially seed funding, seemed likely to be successful and engaged in the SIYCC. Engaged teams are more likely to respond to voluntary surveys like ours and request additional funding, like the blitz vouchers.

Following our over representation of engaged teams, our sample comparatively outperformed the SIYCC population in our two key progress metrics, as shown below. We were pleasantly surprised to receive completed surveys from teams who were red-rated by their coaches, as these teams have been very poorly engaged in the SIYCC overall.



Overall, we can conclude that our survey sample consisted of more high quality and better-funded teams than the overall population, but not remarkably so. This is not surprising, as low-achieving teams who are already not communicating with coaches and who may be in danger of dropping out (red-rated teams and those with low progress scores) were both less likely to see the survey and stood to receive fewer potential benefits from participating in the survey. The final graphic, below, shows the distribution of business models within our sample.



Regression Analysis

Hypothesis 1: Internal Team Diversity Impact on Team Performance

Hypothesis one was designed to understand how initial expertise affects performance and knowledge acquisition. Our goal was to demonstrate the effects of diverse expertise on program performance across the board, including how much expertise a team seeks out and how quickly and effectively it accomplishes project milestones.

$$\text{Null Hypothesis: } H_0 : Y_{1.1\text{-}1.6} \neq IDS + X + e$$

$$\text{Alternative Hypothesis: } H_1 : Y_{1.1\text{-}1.6} = IDS + X + e$$

Our regression model was not a fit for all variables. The descriptive statistics, along with regression results for Hypothesis 1.1 and 1.3, are shown below.

Hypothesis 1.1:

- 65% of teams contacted external knowledge resources within their region. This had a very low correlation with team diversity.
- 35% of teams contacted external knowledge resources outside their region. Team diversity (as measured by number of team members with different expertise areas) was statistically significant, meaning that a more diverse team was more likely to contact external help outside the region.

Hypothesis 1.2:

- There was a very low correlation between team diversity and quarterly status as indicated on the Green-Yellow-Red status coach score.

Hypothesis 1.3:

- 64% of teams have signed agreements with city officials, 89% of teams had identified a project site, and 49% of teams had secured at least some financing but none of these three metrics were statistically significant with team diversity.

- 45% of teams had at least some of their permits approved, and mean project progress scores were 39%, both showing a low correlation with team diversity.
- Solar installations also had a low correlation with team diversity. Most teams have not started installing PV units, while two teams had installed 34 and 171 units, respectively.

Overall, team diversity did not seem closely connected with project progress, shovel readiness, or PV installations. It did somewhat predict a team's likelihood to seek external consultants outside of their region.

Hypothesis 2: Technical Voucher Effects on Marketplace Usage
This hypothesis evaluates funding models' influence on teams' utilization of the marketplace. Our goal was to show how the three types of DoE funding affect teams' likelihood to use the marketplace. This would illuminate teams' propensity to engage with program resources and to what extent funding is tied to those motivations.

$$\text{Null Hypothesis: } H_0 : Y_{2.1} \neq FT + X + e$$

$$\text{Alternative Hypothesis: } H_2 : Y_{2.1} = FT + X + e$$

Our model showed that in our survey sample, as compared to the SIYCC population, had higher marketplace interaction (42% to 26%). Voucher and blitz funding were statistically significant predictors of the number of service requests a team put into the SIYCC marketplace for both groups. Unique to our survey sample, though, is that seed funding was a statistically significant predictor of marketplace activity only when combined with voucher and blitz funding. The amount of money teams received as vouchers was a better predictor of the number of service requests than whether or not teams received vouchers at all.

As might be expected, voucher allocation—both regular and blitz—were statistically significant indicators for whether teams used the marketplace. Seed funding had some effect on the number of service requests but not on amount spent, and did not have an effect when the model was run on the entire SIYCC population.

Hypothesis 3: DoE Funding Effects on Team Performance Outcomes
Hypothesis 3 seeks to determine how different types of funding can impact team performance.

$$\text{Null Hypothesis: } H_0 : Y_{3.1\text{-}3.4} \neq FT + X + e$$

$$\text{Alternative Hypothesis: } H_3 : Y_{3.1\text{-}3.4} = FT + X + e$$

Our regression model was not a fit for all variables. The descriptive statistics, along with regression results for Hypothesis 3.1 and 3.2, are shown below.

Hypothesis 3.1:

- Most teams met either weekly or less than monthly.
- Blitz funding was a statistically significant predictor of how often teams met.

Hypothesis 3.2:

- Seed funding was the only statistically significant funding type correlated with project progress.
    - This effect remains when controlled for team's initial application rank.
    - This effect also remains when this model was run on the SIYCC population data set.

Hypothesis 3.3:

- Funding was not correlated with PV installation.

Because blitz vouchers were distributed on a first-come, first-served basis, it makes sense that teams that met more often may have been more organized, engaged, and able to respond to a call for applications. These early results indicate that seed funding may be an effective way to help teams make meaningful progress, and so may be a worthwhile metric for the DoE to track as the SIYCC moves toward completion.

At the time of the survey, March 2018, very few teams reported starting or completing any PV installations. It may be worth continuing to track this association as the program matures despite no correlation being observed during this midterm evaluation.

Hypothesis 4: Business Model Impacts on Program Outcomes

The aim of Hypothesis 4 was to describe the effects of interaction between business model type and funding type as they influence key outcomes. By comparing and analyzing the business models across a variety of performance metrics, we aimed to determine both which business models are most suited to succeed in SIYCC-type programs and which business models thrived in combination with which funding strategies.

$$\text{Null Hypothesis: } H_0 : Y_{4.1\text{-}4.6} \neq FT + BM + X + e$$

$$\text{Alternative Hypothesis: } H_4 : Y_{4.1\text{-}4.6} = FT + BM + X + e$$

Our regression model did not work for all variables. The descriptive statistics, along with regression results for Hypothesis 4.3 and 4.4, are described below.

Hypothesis 4.1:

- Voucher funding, but not blitz or seed funding, was found to be statistically significant for teams' likelihood to contact external consultants within their region.
    - No type of funding was statistically significant for teams' likelihood to contact external consultants outside of their region.
- Business model type was not correlated with external knowledge acquisition either within or outside of teams' regions.

Hypothesis 4.2:

- Funding type and business model type were not correlated with coach score status in the survey sample. However, seed funding and blitz vouchers were statistically significant for coach score status in the overall SIYCC population.
    - Seed funding was statistically significant even when controlled for teams' initial application rank.

Hypothesis 4.3:

- There was a low correlation between funding type and business model with agreements signed with city officials, site identification, and whether teams had secured financing.
- Blitz funding and voucher funding were statistically significant for permit approval.

Hypothesis 4.4:

- Seed funding was statistically significant for project progress. However, business model type was not statistically significant for project progress.

Hypothesis 4.5:

- Funding type and business model type were not correlated with PV installation.

Examining these findings, we can conclude that teams who received vouchers may have initially looked to the marketplace for expert help, but having not found the expertise they wanted, then began to contact outside consultants since they had already identified internal knowledge gaps.

Interestingly, seed funding was not statistically significant at the 0.05 level for coach score status for the survey sample but was statistically significant at the 0.10 level. In the population dataset, it was statistically significant at the 0.05 level. This indicates that there is some connection even within the survey sample. This tracks with the result in Hypothesis 3 that seed funding was statistically significant for project progress, which, like the status scores, are provided by the SIYCC Coaches.

The lack of correlation with business model type may be significantly affected by the timing of the survey—very early in the SIYCC timeline. Additionally, ten teams answered "Other," or had a model that could not be categorized, so this may have affected our analysis.

Hypothesis 5: Direct Impact Factors on Knowledge Flows

Our final hypothesis measures how business model type, region, internal diversity scores, and market characteristics impact knowledge flows. This analysis is intended to build understanding of what influences knowledge flows.

$$\text{Null Hypothesis: } H_0 : Y_{5.1\text{-}5.3} \neq BM + IDS + R + MC + e$$

$$\text{Alternative Hypothesis: H5: } Y_{5.1\text{-}5.3} = BM + IDS + R + MC + e$$

Unfortunately, our model did not return any statistically significant results. Descriptive statistics for these variables are below.

Hypothesis 5.1:

- The relationship between external knowledge acquisition and team diversity and business model type was explored in Hypotheses 1 and 3. The only statistically significant impact was of team diversity on teams' decision to seek external consultants outside of their region.
- Region did not have a significant correlation with external knowledge acquisition.

Hypothesis 5.2:

- 65% of SIYCC teams had reached out to other teams, but there was only a low correlation of team diversity, region, business model type with knowledge flows.

Conclusion

The team at UT Austin took on this project at close to the midway point of the SIYCC. The data used in the analysis was from either the second or third quarter of the project, meaning that the conclusions found here are preliminary, and should be explored further by the DoE as the SIYCC reaches completion. In particular, it seems worth noting that many teams had not yet started building any photovoltaic solar units, and that teams' exact business models may still be in flux. Data collected on these two variables may be interesting but should be considered a preliminary result; the lack of results from the statistical models for these two variables may simply be a consequence of the lack of data for these two variables. However, the analysis found team diversity to fairly conclusively be unrelated to team performance and knowledge flows, so this may be an area where the DoE does not need to continue its research.

Going forward, the DoE can utilize the survey and other tools to continue to assess team progress. Furthermore, our analysis did show that statistical models comparing coach status scores and progress scores to funding type yielded significant results, so this may be a worthwhile area of further exploration. Finally, the DoE may consider looking more in depth at state or community-level comparisons, which may illuminate more than the region-to-region comparisons in this analysis was able.

References

Asheim, B. T., & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research policy*, *34*(8), 1173-1190.

Capello, R., & Faggian, A. (2005). Collective learning and relational capital in local innovation processes. *Regional studies*, *39*(1), 75-87.

Gök, A. (2013). The impact of innovation inducement prizes. In *NESTA working paper series, No 13/18*.

Hamwi, M., & Lizarralde, I. (2017). A review of business models towards service-oriented electricity systems. *Procedia CIRP*, *64*, 109-114.

Hauser, Christoph, Gottfried Tappeiner, and Janette Walde. "The learning region: the impact of social capital and weak ties on innovation." Regional studies 41, no. 1 (2007): 75-88.

Howells, Jeremy RL. "Tacit knowledge, innovation and economic geography." *Urban studies* 39, no. 5-6 (2002): 871-884.

Huijben, J. C. C. M., and G. P. J. Verbong. "Breakthrough without subsidies? PV business model experiments in the Netherlands." Energy Policy 56 (2013): 362-370.

Kalil, Thomas. *Prizes for technological innovation.* Brookings Institution, 2006.

Makkonen, Teemu, and Tommi Inkinen. "Innovation quality in knowledge cities: Empirical evidence of innovation award competitions in Finland." *Expert Systems with Applications* 41, no. 12 (2014): 5597-5604.

Moodysson, Jerker. "Principles and practices of knowledge creation: On the organization of "buzz"and "pipelines" in life science communities." Economic Geography 84, no. 4 (2008): 449-469.

Richter, Mario. "Business model innovation for sustainable energy: German utilities and renewable energy." Energy Policy 62 (2013): 1226-1237.

Yusuf, Shahid. "Intermediating knowledge exchange between universities andbusinesses." *Research Policy* 37, no. 8 (2008): 1167-1174.

Zhang, Sufang. "Innovative business models and financing mechanisms for distributed solar PV (DSPV) deployment in China." Energy Policy 95 (2016): 458-467

Appendixes

Appendix A: Process Interview Guide

	Main Questions	Probes
Background	To start off, please tell us a bit about your background at the agency, and your involvement in the Solar in Your Community Challenge.	Background of the individual we're interviewing, Role/function in development of project
Activities	To the best of your understanding, please give us an overview of the expected project activities, from beginning to end. (What are teams expected to do, and what ongoing role does DoE have)	Were any activities you or others expected to be part of the program not ultimately included? Why?
		What is the expected enforcement mechanism if teams fall out compliance?
		What activities did DoE undertake to recruit teams?
		Why did you decide to use a prize challenge structure for this project?
Outputs	Please tell us about the various outcomes associated with the program activities (Every possible output for every participant (coaches, consultants, teams)).	What performance outputs do you expect to see by the midline?
		Which team outputs do you want to see related to knowledge and network building?
		Are there different expected outputs for project vs program teams?
		How did they expect to recruit technical assistance consultants and what were the incentives provided?
		what types of consultants did the teams get?
Outcomes	What outcomes did you expect from this (in the short term, within the scope of the project, and also long term, after the project has finished)?	
Barriers	What did they see as the major barriers to getting LMI adoption underway?	

Appendix B: Logic Model

Activities	Project, program development	Capacity building
Barriers	**Regulatory:** Lack of or burdensome interconnection standards; environmental permitting; homeowners' association covenants or design review requirements that prohibit or restrict solar panel installation; zoning ordinances that restrict the types of districts in which solar facilities are allowed; height restrictions; lot coverage limitations; setback requirements that do not allow for the placement of solar panels on existing rooftops or building sites; screening requirements for rooftop equipment; landscaping requirements; **Financial:** access to cost-effective transmission and interconnection; FICO credit score restrictions; cost of equipment; lack of access to capital; split incentives between building owners and tenants; high transaction costs for making small purchases; nonequal government subsidies and taxes; high upfront costs	Lack of communication between teams; Lack of knowledge base and expertise; Lack of funding; Geographic concentration of expertise
Outputs	Teams selected, awards announced; Pitch-a-thons completed; Teams selected for final prize consideration; Permits acquired; Financing obtained; Teams made contact with coaches on once a month basis; Coaches provided guidance on regular basis; coaches filled out quarterly status reports; teams completed and submitted work plans quarterly; teams achieved goals indicated on work plans; Team questionnaires completed; Additional DoE funding secured after milestone completion	Marketplace of consultants, services created; Consultants, coaches recruited into marketplace; Technical assistance vouchers used; knowledge sharing workshops, conferences held; Cross-team learning/collaborations established; Cross-market learning/collaboration established; Team expertise improved to desired level; Teams developed adaptability; Teams completed online coursework; Online discussion forum created; Access to knowledge resources/DoE curriculum made available
Short term outcomes - Teams (Midline)	Permitting plans developed; project siting initiated; customers acquistion plans developed; funding plan developed; term sheets developed; investor contacts made or letters of intent secured; program or project design completed	Expertise gaps identified; Marketplace services utilized; Cross-team linkages utilized; Cross-market linkages utilized; Team expertise and know-how improving
	Projects attract media attention; public outreach initiated; local stakeholders informed of project	
Intermediate term outcomes - Teams (Endline)	kw installation goals met; project siting complete; customers acquired; approval of program design by governing board or authority; legal agreements with utilities or governments (programs); interconnection granted, permits acquired, access to sufficient capital to continue to fund projects attained	Teams identified experts and contacted via Marketplace; teams contacting teams with relevant expertise regularly; teams utilized coaches to create further linkages
	Projects/programs serve at least 50% LMI households; local stakeholder feedback incorporated into plans	
Long term outcomes - Teams (Post-competition)	At least 25-5000kw installed; valid interconnection agreement established and connected to the distribution grid	Knowledge bases / community established
	Ongoing feedback with local stakeholders established	
Long term outcomes - Aggregate (Post-competition)	Greater LMI access to solar power established; Increasing demand for community solar in less-developed markets; Replicable business models established; Widespread diffusion of innovative models achieved	

Appendix C: Metrics and Indicators Table

Metrics	Indicators	Baseline Data Source	Performance Data Source
Team expertise improved	Marketplace expertise utilized	Team Application #145, 146, 168; Questionnaire "Getting Started" #2	Marketplace data; UT Survey
	External support identified		UT Survey
	Non-marketplace expertise acquired		UT Survey
	Coach-team meetings assess SWOT		UT Survey
	Expertise gaps identified		UT Survey
	Team adaptability improved		UT Survey
	Team has the following expertise: solar development, community organizing/outreach, marketing, finance, legal, engineering		UT Survey
Permits acquired	Relevant authority contacted	Questionnaire "Site Selection, Zoning and Permitting" #2, 5	Coach Quarterly Report 578, 679; UT Survey; Seed funding info from DoE
	Relevant paperwork completed		Coach Quarterly Report 578, 679; UT Survey; Seed funding info from DoE
Knowledge community established	Cross-team learning established	N/A	UT Survey
	Cross-market learning established		UT Survey
	Teams use online discussion forum		Forum data (i.e. # of posts)
	# of conferences held		Info from DoE
	# of teams that attended conferences		Info from DoE
Technical assistance vouchers used	Service requests submitted through marketplace	Team Application #401	Marketplace data
	Marketplace service contract set		Marketplace data; UT Survey
	Marketplace services received		Marketplace data; UT Survey
Project sited	Project site identified	Questionnaire "Site Selection, Zoning and Permitting" #1	Coach Quarterly Report 578, 679; UT Survey; Seed funding info from DoE
	Relevant authority contacted		Coach Quarterly Report 578, 679; UT Survey; Seed funding info from DoE
	Relevant paperwork completed		Coach Quarterly Report 578, 679; UT Survey; Seed funding info from DoE
Knowledge diffusion with coaches	Coaches contact teams once a month	N/A	Coach Quarterly Report 675; Coach monthly status report
	Teams complete questionnaire		Questionnaire submission status
	Coaches submit quarterly status report		Coach Quarterly Report submission status
Project funded	Investor contacts acquired	N/A	Coach Quarterly Report 570, 681
	Letter of intent from investor received	N/A	Coach Quarterly Report 570, 681
	Financing obtained (yes/no)	Team Application #253	Coach Quarterly Report 570, 681
	Type of program funding received	Info from DoE	Info from DoE
	Amount of program funding received	Info from DoE	Info from DoE
	Amount of capital available	Team Application #253, 254, 255; Questionnaire "Financing/Procurement" #6	UT Survey
	Type of credit mechanism used	Questionnaire "Financing/Procurement" #4	UT Survey
Program/project design completed	Customer acquisition plan developed	Questionnaire "Customer Acquisition and Program Design" #1, 5, 6, 7;	Coach Quarterly Report 577, 680
	# customers	Questionnaire "Customer Acquisition and Program Design" #7;	Coach Quarterly Report 577, 680; UT Survey
	Teams submitted work plan	N/A	Info from DoE
	Teams attended online webinars	N/A	UT Survey
Outreach goals met	Feedback from stakeholders received	N/A	UT Survey
	# of LMI households served	Team Application #247; Questionnaire "Getting Started" #1d	Coach Quarterly Report 571, 682
	# of nonprofits served	Team Application #246; Questionnaire "Getting Started" #1c	Coach Quarterly Report 571, 682
	Stakeholders contacted	N/A	UT Survey
Kw installation goal met	# of kwh installed	Team Application #243; Questionnaire "Getting Started" #1a-b	Coach Quarterly Report 572, 683; UT Survey
	# of solar installations	Team Application #248; Questionnaire "Getting Started" #1e	Coach Quarterly Report 572, 683; UT Survey
	Electricity savings per household	Team Application #249; Questionnaire "Getting Started" #1f	UT Survey
	% LMI households served	Team Application #247; Questionnaire "Getting Started" #1d; Questionnaire "Project Design and Installation" #6	Coach Quarterly Report 571, 682
Agreement with utility/government set	Familiarity with local policies (zoning, permitting)	Questionnaire "Getting Started" #3; Questionnaire "Site Selection, Zoning and Permitting" #2	UT Survey
	Familiarity with local building codes	Questionnaire "Site Selection, Zoning and Permitting" #3	UT Survey
	Met with or are familiar with local leaders or city officals	N/A	UT Survey
	Relevant authority contacted	N/A	UT Survey
	Relevant paperwork completed	N/A	UT Survey
Interconnection granted	Contacted utility about interconnection	Questionnaire "Interconnection" #2, 3	Coach Quarterly Report 573, 685
	Relevant paperwork completed	N/A	Coach Quarterly Report 573, 686
Development of innovative business model	Scaling plan completed	N/A	Coach Quarterly Report 576, 684; UT Survey
	Market research completed	N/A	Coach Quarterly Report 577, 680
	Business plan developed	N/A	Coach Quarterly Report 572, 683
	Amount of media attention	N/A	# of articles, etc. about project

Appendix D: Variable and Regression Tables

Table 1: Y-Variable Descriptions

H#	Var ID	Var Name	Description	Data Source
H1	1.1	External knowledge acquisition	How often teams use expertise resources from outside of the program	S 30-37
H1	1.2	Coach scores	Quarterly scores based on progress towards program milestones.	C 570-8
H1	1.3	Shovel readiness	Progress toward the development of plans for siting, customer acquisition, obtaining permits and/or contracts, and financing.	S 38
H1	1.4	Project progress	Progress toward implementation of siting, customer acquisition, obtaining permits and/or contracts, and financing plans.	C
H1	1.5	Installed capacity	Team's expected installation capacity, including expected LMI served.	S 41, 42
H2	2.1	Marketplace usage	How often teams submitted service requests and how much money was spent in the marketplace per team	M
H3	3.1	Team vigor	How active teams are by looking at how frequently teams meet and meet with coaches	S 12-14
H3	3.2	Project progress	Progress toward implementation of siting, customer acquisition, obtaining permits and/or contracts, and financing plan.	S 40, 43, 44, 45, 46
H3	3.3	Installed capacity	Team's expected installation capacity, including expected LMI served.	S 41, 42
H4	4.1	External knowledge acquisition	How often teams use expertise resources from outside of the program	S 30-37
H4	4.2	Coach scores	Quarterly scores based on progress towards program milestones.	C 570-8
H4	4.3	Shovel readiness	Progress toward the development of plans for siting, customer acquisition, obtaining permits and/or contracts, and financing.	S 38, 57
H4	4.4	Project progress	Progress toward implementation of siting, customer acquisition, obtaining permits and/or contracts, and financing plans.	S 40, 43, 44, 45, 46
H4	4.5	Installed capacity	Team's expected installation capacity, including expected LMI served.	S 41, 42
H5	5.1	External knowledge acquisition	How often teams use expertise resources from outside of the program	S 30-37
H5	5.2	Cross-team learning	Knowledge flows between different teams in the SIYCC.	S 20-24

Table 2: Data Source Key

Code	Data Source Name
S	UT Survey and question number
C	Quarterly Coach Scores
M	Marketplace Data
D	Data provided by the DoE when returning the survey

Table 3: Independent Variables

Variable ID	Variable Name	Description	Data Source
IDS	Internal diversity score	Composite score based on teams' initial expertise in six areas: solar development, legal, financing, engineering, community outreach and marketing	S 9-11
FT	Funding type	Combination of program funding teams received, including technical vouchers, seed funding, and 8-blitz technical vouchers	D
BM	Business models	Team business model they utilize, in ten total categories under three main areas: subscription model, customer-owned, and TPO.	S 5-8
PRU	Program resource usage	How often teams used internal program resources: webinars, the rulebook, the discussion forum, and free marketplace resources.	S 25-29
TS	Team size	Number of full-time team members.	S 9
R	Region	Region where team is located.	D
MC	Market characteristics	Utility type, presence of solar tariffs and shared solar options, and rebates available.	D

Table 4: Regression Results

	Team Diversity-People	Team Diversity - Years	Voucher Funding	Blitz Funding	Seed Funding	Business Model	Region
External knowledge-in region	N/A	N/A	-2.661 (.939) R2: 0.203	-0.337 (.685)	0.973 (.752)	1.626 (1.093)	N/A
External knowledge – out of region	0.175 (.077) R2: 0.100	-0.006 (.006)	-0.993 (.599) R2: 0.039	N/A	N/A	N/A	N/A
Coach scores	N/A	N/A	N/A	N/A	1.518 (.822) R2: 0.051	N/A	
Shovel readiness: contacted city officials	0.041 (.057) R2: 0.037	0.007 (.005)	N/A	N/A	N/A	N/A	
Shovel readiness: Site identified	0.129 (.106) R2: .049	0.018 (.011) R2: .093	N/A	N/A	N/A	N/A	
Shovel readiness: Permits approved	N/A	N/A	-2.267 (.870) R2: 0.182	1.582 (.728)	1.572 (.811)	0.943 (.956)	
Shovel readiness: Financing secured	0.086 (.053) R2: 0.040	N/A	N/A	N/A	N/A	N/A	
Project progress	N/A	N/A	-6.443 (7.931) R2: 0.153	3.138 (7.023)	23.768 (8.040)	N/A	
Installed capacity	N/A	N/A	N/A	N/A	N/A	N/A	
Marketplace usage: Number of service requests			2.108 (.600) R2: 0.445	2.573 (.531)	-1.369 (.608)		
Marketplace usage: Dollars spent			479416.4 (194092.5) R2: 0.406	855356.4 (171869.2)	-14569.33 (196759.9)		
Team vigor			N/A	-0.962 (.561) R2: .017	N/A		
Cross-team learning	N/A	N/A				N/A	N/A
Number of observations	55						

Note: "N/A" marks instances where the proposed model did not fit, and so no usable results were produced.