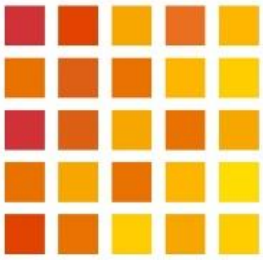

Smart Electric Power Alliance

Final Report on Community Solar Design Models for Consumer, Industry, & Utility Success

Solar Market Pathways
Award #: DE-EE0006909

July 27, 2018

Project Title:	Community Solar Design Models for Consumer, Industry & Utility Success
Project Period:	01/1/15-12/31/17 – extended to 6/30/18
Project Budget:	$899,006
Submission Date:	7/27/18
Recipient:	Smart Electric Power Alliance
Address:	1220 19th St NW Suite 800 Washington, DC 20036-2405
Website (if available)	http://www.SEPApower.org
Award Number:	DE-EE0006909
Project Team:	The Shelton Group CPS Energy Clean Energy Collective Clean Power Finance Community Power Network Duke Energy First Solar Hawaiian Electric Companies (HECO) Interstate Renewable Energy Council Orlando Utilities Commission Pacific Gas & Electric Pedernales Electric Cooperative Portland General Electric Regulatory Assistance Project Rocky Mountain Institute Salt River Project Sacramento Municipal Utility District SunShare The Shelton Group Vote Solar
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DOE Contracting Officer:	Diana Bobo/Jeannette Singsen/Clay Pfrangle
DOE Project Team:	Technology Manager – Odette Mucha Technology Manager2 – Shubha Jaishankar Project Officer – Christian Philipsen

7/27/2018

Signature **Date**

Ken Doyle
Chief Operating Officer - SEPA

Executive Summary:

Since the inception of the first community solar program in 2006, a number of different utility, solar industry and consumer driven community solar program models have emerged across the country with varying regulatory and solar market frameworks behind them. There is little consistency in how programs are administered, participant benefits are assigned, and customers are charged for participation. Further, while it is regularly speculated that community solar programs meet the needs of customers, no such consumer research has been completed against different community solar program models. This collaborative research effort addressed three primary issues:

Program design models are numerous and evolving, with varying degrees of applicability across different state policy, utility regulatory, and solar market types. The agents, transaction methods, and accruing costs and benefits are highly variable and largely built on anecdotally successful model evolution.

'Community solar' (shared/group solar, solar gardens, etc.) has become a catch-all concept that means different things to different stakeholders, limiting constructive program development and growth. Everything from green pricing programs to remote net metering to metering aggregation has been framed as community solar.

Consumer research on individual concepts and program models has been done, but no comprehensive and comparative market research on the broader design models and attributes has been performed.

SEPA's collaborative research effort on Community Solar Design Models for Consumer, Industry, & Utility Success is premised on the principle that greater standardization of community solar models and better understanding of consumer interests are key underpinnings of increased community solar deployment. Utilizing a cross-sectional multi-stakeholder working group, as well as focus groups and surveys, webinars, targeted outreach, and other tools, this project aims to expand the community solar knowledge base, facilitate information exchange, identify opportunities for standardization and improvement, determine what consumers' interests are and how best to message to them, promote the research results within the solar and utility industries, and advance key opportunities for strategic deployment plans for community solar.

A summary of these key takeaways/lessons learned during the grant period include:

- Siting of system should be evaluated up-front in the process
- Engage stakeholders collaboratively and early to help ensure the best chance for a successful program
- IT/billing departments must have a seat at the design table
- Establish upfront target objectives with respect to residential and commercial program access levels helps ensure program success
- Balance trade-offs to manage utility and developer risk with customer participation carefully to optimize pricing and sizing the program offering

Over the course of the 42 month grant period, SEPA and its project team conducted a series of activities all designed to accelerate the number and size of community solar programs across the country. These activities included:

Community Solar Program Design Models (2 reports) – SEPA, in collaboration with its projects team, the Coalition for Community Solar Access, and over 60 administrators of actual community solar programs, developed two reports providing hard data on the developments of community solar. These reports touched on program performance, quantity and type of programs, and program design steps, among other aspects. The reports collectively received over 2000 unique downloads.

Market Research Report – SEPA, in collaboration with The Shelton Group, conducted a series of national surveys and focus groups to identify what customers were looking for in a community solar offering. The resulting report, “What the Community Solar Customer Wants”, received over 1,000 unique downloads.

Technical Assistance Projects – SEPA supported 8 organizations who were pursuing community solar programs. Based on this support, over 5.7 MWs of new solar capacity have been developed.

Technical Assistance Case Studies – SEPA developed two case studies detailing the technical assistance work in Fremont, NE Department of Utilities and the public power arm of Minster Ohio. These two reports have received 1,002 unique downloads.

Webinar – SEPA hosted two webinars on community solar which collectively received 743 participants. The webinars focused on disseminating the findings of the research conducted under this project, as well as the research conducted in separate solar market pathways projects.

Community Solar Design Workshops – 120 registrants learned about the trends in community solar and participated a business case exercise to design their own programs.

Contents

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Disclaimer

Background:

Community solar is one of the most unique and fastest growing solar ownership models. Since this Solar Market Pathways Grant began in 2015, the overall installed capacity has nearly doubled in each year. At the end of 2017 there were a total 228 utilities with programs in their service territory with a total of 734 MW of installed capacity. At the beginning of the Solar Market Pathways grant there were only 48 utilities with programs in their service territory with a total of 85 MW of installed capacity.[1]

SEPA's research into community solar program data and trends, conducted via the SMP grant, remains the most comprehensive database on the community solar market. Few other efforts exist that attempt to characterize the market based on installed capacity, subscription rates, or customer interest as was done in SEPA's project.

Some of the best comparable research was also conducted through SMP grant. The Community Solar Value Project was developed by Extensible Energy, LLC, Cliburn & Associates, Olivine, Inc, and Navigant Consulting. The project's website is a veritable library of community solar resources (including all of SEPA's reports). Research is available on High-Value Solar Design and Specification, High Value Financing and Procurement, Market Development for Community Solar, and Solar Plus Energy Storage.[2]

Interstate Renewable Energy Council (IREC) is another organization conducting excellent research on community solar.[3] IREC's focus is on shared solar policies. Through policy and regulatory engagement, IREC helps states adopt best practices in their policy development which are designed to most benefit customers. Two reports of note produced by IREC are the State Shared Renewable Energy Program Catalog and the National Shared Renewables Scorecard. The latter provides a comprehensive overview of all shared solar policies across the U.S. and detail on the specifics of the policies. The Scorecard evaluates state shared renewables programs using objective criteria based on best practices for program design. Both of these resources informed SEPA's research. However, while IREC focuses on state policies, SEPA focuses on actual programs which may or may not result from the policy.

The National Renewable Energy Laboratory (NREL) provided technical assistance to utilities complementary to SEPA's technical assistance through DOE funding. The comparison and distinction between the two are presented in Table 1.

[1] SEPA, Community Solar Program Design Models. 2018. Available at: https://sepapower.org/resource/community-solar-program-designs-2018-version/
[2] Community Solar Value Project resources can be found at: https://www.communitysolarvalueproject.com/
[3] IREC Shared Renewables resources can be found at: https://irecusa.org/regulatory-reform/shared-renewables/

Table 1 Comparison of SEPA and NREL Technical Assistance

SEPA Community Solar Technical Assistance	NREL Community Solar Technical Assistance
Summary: Characterization of program design decision points with working group of diverse stakeholders	Summary: Characterization of supporting environment (existing solar development, policies, utility readiness, customer base) for community solar in the Southeast
Methods: Focus on customer experience/preference for design features (and trade-offs between) through focus groups and surveys	Methods: In-depth interviews on program designs and experiences to understand how regional context affects these choices
Region: National scope	Region: Southeast U.S.
Overall impact: help community solar program administrators nationwide make programmatic design decisions that accounts for customer preferences based on data from surveys/focus groups (and data on past program successes from survey)	Overall impact: help community solar program administrators in the Southeast (nationwide to a lesser extent) make programmatic design decisions that accounts for regional context based on interviews and experiences from existing program administrators

Introduction:

The growth of community solar has benefited from the research conducted in SEPA's project as well many of the sources discussed in the previous section. SEPA's project design was informed by the 19 member working group, who identified five tasks that were most needed to assist the community solar market. These tasks are summarized below.

Task 1 – Research and Characterize Community Solar Models
This task will complete a comprehensive assessment, cataloguing, prioritization, and establishing baseline metrics of the various types of community solar models in different types of program design configurations, solar markets and electricity markets.

Task 2 – Conduct Consumer Market Research on Prioritized Models
This task focuses on conducting qualitative and quantitative research to determine how typical customers view the community solar models and their attributes, and to identify potential differences in perceptions that may occur by customer class, demographics, sociographics, industry/sector, and/or geography.

Task 3 – Disseminate and Actualize Models in Utility and Solar Industries
This task focuses on disseminating and applying the research and products generated in Tasks 1 and 2 to educate and provide technical assistance to potential program development and influencing organizations, such as electric utilities, solar companies, non-profit organizations, government agencies, policy organizations and community leaders, general awareness actions, educational forums, one-on-one advisory efforts, and case studies. This task will also perform follow-up research originally benchmarked in Task 1.5 to measure programmatic and market impacts from the utilization project deliverables and activities.

Task 4 Project Management
This task will ensure overall project management success, including timely completion of deliverables, proper management of budget, and appropriate transparency and reporting both amongst SEPA's partners/consultants and to DOE and DOE's selected National Coordinator.

Task 5 Participating in the Solar Market Pathways Network: Common Activities
This task entails SEPA's engagement in network communications and knowledge dissemination with other Solar Market Pathways awardees. As part of this task, SEPA participated in SMP meetings and affinity groups.

All of the milestones achieved in the project, by quarter, are depicted in Table 2. All the go / no-go decisions, by budget period, are depicted in Table 3.

Table 2. Project Milestones

Quarter 1	M1 Complete formation of working group M2 Hold WG meeting #1 to establish project objectives and process M3 Develop draft community solar (CS) model comparison framework M4 Hold WG meeting #2 to review CS model comparison framework and prioritization of comparison attributes M5 Finalize CS model comparison framework M6 Hold Quarterly Team meeting M7 Submit Quarterly Report and Invoice
Quarter 2	M1 Research at least 5 CS models for comparison M2 Solicit WG feedback on draft CS model research M3 Finalize CS model comparison M4 Prioritize CS models with WG feedback M5 Develop consumer and business focus group (FG) recruitment and discussion guides M6 Hold WG meeting #3 to review recruitment and discussion guides and selection of cities for FG sessions M7 Revise and finalize recruitment and discussion guides for FG sessions M8 Schedule and confirm logistical details for 4 FG sessions M9 Hold Quarterly Team meeting M10 Submit Quarterly Report and Invoice
Quarter 3	M1 Write first draft of CS models report M2 Solicit WG feedback on first draft of CS models report M3 Complete final CS models report M4 Publish CS models report publically M5 Recruit participants and conduct 12 FG sessions M6 Develop report summary of FG sessions M7 Hold WG meeting #4 to review FG sessions report summary M8 Finalize FG session report summary (in PowerPoint) M9 Hold Quarterly Team meeting M10 Submit Quarterly Report and Invoice

Quarter 4	M1 Develop draft baseline CS program survey M2 Solicit WG feedback on draft CS program survey M3 Finalize CS program baseline survey M4 Distribute baseline CS program survey among CS program managers M5 Summarize baseline CS program survey results M6 Finalize project impact goals with DOE based on CS program survey results M7 Develop draft residential and business surveys for national survey M8 Solicit WG feedback on national survey drafts M9 Incorporate WG feedback and finalize survey drafts M10 Conduct surveys with 1500 consumers and 200 businesses M11 Tabulate and analyze results M12 Develop draft report on national survey results (in PowerPoint) M13 Distribute CS model paper to at least 5,000 solar stakeholders through electronic communications M14 Write and distribute press release on CS model paper to at least 10 media outlets M15 Hold at least 1 public online webinar for CS model paper M16 Publish at least one article on CS model paper M17 Hold Quarterly Team meeting M18 Submit Quarterly Report and Invoice M19 Submit Annual Report to National Coordinator
Quarter 5	M1 Hold WG meeting to review report summary and consumer research feedback on CS model profiles from national survey M2 Finalize report summary and CS research findings on CS models from national survey (in PowerPoint) M3 Draft narrative summary report of combined CS consumer research efforts - FG sessions and national survey (in Word) M4 Solicit WG feedback on narrative summary report of combined CS consumer research efforts M5 Finalize and release CS consumer research paper publically M6 Distribute CS consumer research paper to at least 5,000 solar stakeholders through electronic communications M7 Write and distribute press release on CS consumer research paper to at least 10 media outlets M8 Develop process and criteria for soliciting technical assistance (TA) applicants and review with working group and DOE M9 Solicit technical assistance applicants and choose 4 for year 2 consultation M10 Hold Quarterly Team meeting M11 Submit Quarterly Report and Invoice
Quarter 6	M1 Hold at least 1 public online webinar for CS consumer research paper M2 Publish at least one article on CS consumer research paper M3 Hold Quarterly Team meeting M4 Submit Quarterly Report and Invoice

Quarter 7	M1 Complete 2 technical consultations M2 Hold Quarterly Team meeting M3 Submit Quarterly Report and Invoice
Quarter 8	M1 Hold at least 2 conference sessions for CS project M2 Hold at least 1 workshop of at least 3 hours M3 Complete 2 technical consultations M4 Solicit technical assistance applicants and choose 4 for year 3 consultation M5 Hold Quarterly Team meeting M6 Submit Quarterly Report and Invoice M7 Submit Annual Report to National Coordinator
Quarter 9	M1 Select four programs for in-depth case study publication in consultation with working group M2 Hold Quarterly Team meeting M3 Submit Quarterly Report and Invoice
Quarter	M1 Complete 2 technical consultations M2 Hold Quarterly Team meeting M3 Submit Quarterly Report and Invoice
Quarter	M1 Complete first draft of case study publication as per Subtask 3.4 and review with working group M2 Hold Quarterly Team meeting M3 Submit Quarterly Report and Invoice
Quarter 12-14	M1 Complete 2 technical consultations M2 Complete final case study publication and release M3 Write and distribute press release on case study publication release to at least 10 media outlets. M4 Send electronic communications on case study publication release. M5 Re-distribute baseline survey among CS program managers from Subtask 1.5 or new programs deployed since the original survey M6 Summarize survey results and measure project success M7 Hold Quarterly Team meeting M8 Submit Final Invoice M9 Submit Final Report to National Coordinator

Table 3. Project Go / No-Go Decisions Criteria

BP 1 to BP 2	Completed community solar model research report Completed baseline survey and received DOE approval on project metrics Distributed community solar model paper Submit Annual Report for Year 1 to National Coordinator

BP 2 to BP 3	Completed community solar model consumer research report Distributed community solar consumer research paper Completed technical assistance selection criteria and completed first process to select 4 clients Completed 4 technical consultations Completed 2 conference sessions Completed 1 workshop Completed second process to select 4 clients Submit Annual Report for Year 2 to National Coordinator

Project Results and Discussion:

The first task involved researching and characterizing community solar models.

SEPA acquired the commitment of 18 organizations for its working group efforts. The group includes a diverse range of organizations. On March 5, 2015, SEPA held its first all-day working group meeting in Phoenix, Arizona. Ten organizations attended this meeting in-person, seven attended via conference, and two working group organizations were not able to attend. Prior to the meeting, SEPA drafted a model comparison framework for the primary topic of discussion during the meeting. During the meeting, the team discussed working group expectations, project goals, and then held a detailed discussion about the SEPA's draft model framework, which highlighted community solar design attributes that are most appropriate to make the core focus of standardization and/or consumer testing efforts. The team agreed upon a list of 10 attribute categories and helped SEPA to finalize the community solar model comparison framework. The working group committed to a "homework assignment" where each organization would further prioritize and comment on each attribute category to further assist the SEPA team to begin drafting model community solar programs.

On May 21, 2015, SEPA held its second all-day working group meeting in Phoenix, Arizona. Twelve organizations, including SEPA, attended this meeting either in-person or via conference. Prior to the meeting, SEPA a guiding presentation summarizing the previous meeting and plan for the current meeting. During the meeting, the team reviewed the results of the attribute survey, discussed the community solar design attributes, discussed tradeoffs between attributes, and the consumer research effort plan. Note: The meeting slides from the first working group meeting are included as attachments, below.

SEPA completed databasing all existing community solar programs. From this database SEPA was able to draw statistics on the most common community solar models, and has used these to inform the consumer research efforts. Throughout the entire SMP project, SEPA continuously updated this database.

SEPA developed a community solar program and market data collection survey. A total of 25 program administrators responded to the survey, providing information on their programs subscription rates, development times, and costs. SEPA effort was the first time that this type of information was collected for community solar programs, and provides a set of baseline metrics for evaluating the overall progression and future trends in community solar program design, implementation, and performance. The findings from these efforts have all been included in the Community Solar Design Models report.[4]

[4] Report available at: https://sepapower.org/resource/community-solar-program-design-working-within-the-utility/

Two years after the initial survey, SEPA partnered with the Coalition for Community Solar Access to conduct a second survey of program administrators. A total of 66 program administrators who represent over 300 MW of installed community solar programs provided responses to the second survey. The analysis of this data is included in the Community Solar Design Models: 2018 Version report.[5]

The second task involved conducting consumer market research on prioritized models

SEPA held a kick-off meeting on February 5, 2015, with the Shelton Group to discuss project expectations, detailed project timeline, and working group commitments. The Shelton Group attended the March working group meeting to begin listening to the team's priorities and concerns as background research into developing focus group guides (one representative attended in-person and another attended virtually). The Shelton Group also attended the May working group meeting to propose the community solar research plan to working group members and gather feedback. From this meeting, a final set of cities for the focus group, and key questions to be asked were developed.

SEPA and the Shelton Group planned focus groups in four cities: Fort Lee, NJ; Atlanta, GA; Denver, CO; Chicago, IL. Chicago was selected so that members from the Cook County SMP project could attend and observe. The team completed recruitment and the set of questions to be developed at each focus group session.

SEPA and the Shelton Group conducted 12 focus group sessions with potential customers who expressed interest in learning more about their options for solar energy ownership. Three focus groups – a residential renter, residential owner, and small commercial owner – were conducted in each of Atlanta, Chicago, Fort Lee, and Denver. The focus groups were one of the first, national efforts to gather the voice of the customer with regards to community solar.

In 2016, the Shelton Group and SEPA completed the survey of 2,001 residential and 250 commercial participants to identify what community solar models are most intriguing to different customer bases. We summarized the results in a narrative report and publicly published it in August, 2016.[6] This narrative report is a graphic-heavy discussion of the findings. Below are several of the most surprising findings of the surveys.

1. Survey participants' interest in community solar was greatly affected by the information they had on the business model. Participants were asked their interest level in joining a community solar program. 20% of participants were familiar with the concept and 14% were seriously considering it. Of the participants who had existing knowledge on what community solar is 70% were considering participating in a program. For those that did not know what community solar was, additional information on the business model was provided

[5] Report available at: https://sepapower.org/resource/community-solar-program-designs-2018-version/
[6] Report available at: https://sepapower.org/resource/what-the-community-solar-customer-wants/

via the survey mechanism. After this information was provided, 47% of all participants were interested in the concept. This shows two things. First, the market potential is huge. As this survey is representative of all ratepayers in the US, this suggests up to half of Americans could participate in a program. Second, because few have existing knowledge of community solar, education has a significant impact on early efforts when developing a program need to go to awareness campaigns.

2. Participants view the project term as being highly influential in whether they will or will not join a community solar program. Most listed it was the 2nd most important design element next to financial considerations. What is desired is dependent on how the participant pays for their share of the program. For programs that are paid for through a $/kWh rate, participants wanted the flexibility to enter and leave whenever desired. Existing community solar programs of this design offer significant flexibility, though not to the level desired. Most programs allow customers to leave whenever they want after a minimum term. For programs that are paid for through a $/W upfront payment, participants wanted program terms to be in the 2 to 5 year range. This would mean that the participant pays less to “lease” the panel and only get the benefit of the output for the term. Participants suggested that they though community solar product was most similar to a car lease or cell phone contract. They didn’t want to sign up for the same product – whether it be solar panel, car, or phone – for 20 to 25 years, which is the terms for existing community solar programs of this financial structure.
3. A vocal minority of participants had a strong interest in being able to access production data on the solar asset. They wanted to be able to easily see information on the kWh produced by the asset over time, the instantaneous kW, and the cumulative financial savings. Though this was not a concern of all participants, providing the interested participants this information can have an outsized benefit in terms of customer protection. By allowing the participants who want to monitor production data to do so, these participants can verify that claims of generation and financial savings made by program administrators match actuality.

Suzanne Shelton from the Shelton Group and Dan Chwastyk from SEPA provided a public webinar to discuss the findings of this research report on December 1, 2016.

The third task involved disseminating and actualizing models in utility and solar industries

SEPA’s launched the technical assistance portion of the project by identifying community solar programs that would participate in this effort. To do so, SEPA developed selection criteria that could be used to identify community solar programs in need of assistance. SEPA presented the selection criteria to working group members and the DOE. Based on feedback from these parties, SEPA finalized the selection criteria which reads as follows:

1. Is the technical assistance supporting a new or an expanded community solar offering?
2. Is the community solar offering of significant size (>200kW)?
3. Has significant information been provided suggesting the entity is committed to developing community solar?
4. Is the project being implemented new and innovative, i.e. in terms of program administrator, geographic region, program design.
5. Is it likely that this project will move forward (have participants been surveyed, are they in a later stage of project development)
6. Is the market represented by other technical assistance projects? Market is defined by the following characteristics
   a. Renewable Energy Policy
   b. Community Solar Policy
   c. Utility Solar Experience
   d. Utility Type

SEPA created an online application for interested parties to use to apply for the technical assistance. SEPA hosted the online application on our website at the following url: http://www.solarelectricpower.org/discover-resources/community-solar-technical-assistance-opportunity.aspx. The application was designed to be able to completed in under 10 minutes so as to not deter any interested parties. The application covered contact information, description of the technical assistance need, the anticipated community solar program capacity, that stage of program development, if stakeholders have been engaged in the development to date, and if there are any comparable programs.

SEPA announced the technical assistance opportunity in our March 15th 2016 member newsletter. The member newsletter was distributed to 1,081 member organizations, 560 of which were utilities. SEPA confirmed 9 recipients of technical assistance (though only 7 turned into substantial projects). The recipients and a brief overview of the each TA project is provided in Table 4.

Table 4. Summary of Technical Assistance Projects

Recipient	Type	Description
Duke Energy	*Custom Marketing Plan*	In collaboration with Duke staff, SEPA developed a marketing plan for Duke's planned 1 to 2MW community solar program in North Carolina. SEPA understands that Duke has limited funds to market the program, thus focused on developing a custom plan that utilizes low cost approaches to inform constituents about the program. The plan was in part based on actions SEPA employed when launching the Orlando Utilities Commission's community solar program – this program was fully subscribed six days after launch with a marketing budget under $50,000.

Clean Energy 4 All	*Electricity Price Guidance*	SEPA developed a guidance document on how to price the energy sold from CleanEnergy4All to City of Dayton. This guidance examined prices through two lenses: 1) value to City of Dayton based on avoided costs as well as reduced demand with and without storage; and 2) price hurdle to CleanEnergy4All to cover costs and need to provide immediate financial benefits to charity subscribers.
Village of Minster	*Customer Survey*	SEPA develop, distributed, and analyzed a web-based customer survey that explores members' interest in a community solar program. The survey gauged initial interest as well as explore the program design elements that most influence members' interest in the program. Additionally, the survey educated members on the community solar business model. SEPA received 80 responses to the survey
Fremont Department of Utilities	*Customer Survey*	SEPA develop, distributed, and analyzed a web-based customer survey that explores members' interest in a community solar program. The survey gauged initial interest as well as explore the program design elements that most influence members' interest in the program. Additionally, the survey educated members on the community solar business model. SEPA received 427 responses to the survey
Indianapolis Power and Light	*Customer Survey & Focus Groups*	SEPA develop, distributed, and analyzed a web-based customer survey that explores customers' interest in a community solar program. The survey gauged initial interest as well as explore the program design elements that most influence members' interest in the program. Additionally, the survey educated members on the community solar business model. SEPA received 4379 responses to the survey, 53 of which were from commercial customers. SEPA conducted focus groups with two dozen home owners, renters, and business owners.
Montana Dakota Utilities	*Customer Survey*	SEPA develop, distributed, and analyzed a web-based customer survey that explores members' interest in a community solar program. The survey gauged initial interest as well as explore the program design elements that most influence members' interest in the program. Additionally, the survey educated members on the community solar business model.
Middle Tennessee Electric Membership Corporation	*Customer Survey*	SEPA develop, distributed, and analyzed a web-based customer survey that explores members' interest in a community solar program. The survey gauged initial interest as well as explore the program design elements that most influence members' interest in the program.

		Additionally, the survey educated members on the community solar business model. SEPA received 233 responses to the survey
Memphis Light Gas and Water	*Customer Survey*	SEPA develop, distributed, and analyzed a web-based customer survey that explores members' interest in a community solar program. The survey gauged initial interest as well as explore the program design elements that most influence members' interest in the program. Additionally, the survey educated members on the community solar business model. SEPA received 629 responses to the survey

SEPA hosted a series of community solar workshops to discuss findings from this effort as well as other pressing community solar needs. The first workshop was held in Denver Colorado on April 11, 2016. Over 70 participants registered for this workshop.. Participants from all Solar Market Pathways recipients working on community solar projects were invited to present on their findings. The second workshop was held in Atlanta, Georgia on May 9, 2018. A total of 67 participants registered for this workshop. The third and final workshop was held outside of Austin, Texas on June 6, 2018. A total of 56 participants registered for this workshop.

The fourth and fifth tasks were project management and participating in the Solar Market Pathways network common activities.

SEPA held regular check in calls and meetings with Shelton Group to discuss progress on the survey and focus groups throughout the period of performance. The working group met through two in-person meetings and a series of conference calls to provide feedback on progress made in throughout the project.

SEPA was an active participant in all the SMP calls and community solar affinity group calls. Two members from SEPA's team, Dan Chwastyk and Ted Davidovich, attended the annual Solar Market Pathways workshop in Boston in 2016. Dan and Jen Szarro, another member of the team, attended the National Community Solar Partnership meetings in Boston and Atlanta, respectively, both in 2016. Two separate members from SEPA's team, Erika Myers and Nick Esch attended the 2017 Solar Market Pathways Leadership Academy in Sacramento.

SEPA submitted an invoice for efforts spent on project negotiations and scope revisions within the allowable 90 calendar days prior to award contract execution. SEPA held quarterly coordination calls with the National Coordinator and DOE team throughout the life of the project.

Conclusions

At the start of the project, SEPA developed a set of highly ambitious objectives. These objectives and progress made towards each are discussed below.

Objective: Engage at least 20 solar stakeholders in a project advisory working group.
Status: Achieved
Summary: SEPA recruited 20 stakeholder organizations to advise on this project. These stakeholders met at a pair of in person meetings in 2015 and then via conference call on an as-needed basis. The advisory working group identified the most important decisions administrators make when designing a community solar program – these decisions were discussed at length in the Community Solar Program Designs report. The advisory working group developed the list of criteria for selecting technical assistance recipients. Finally the advisory working group provided feedback and edits on all reports generated in this project.

Objective: Identify, with support of the stakeholder group, existing and theoretical community solar model types and analyze them across a comparative framework of attributes
Status: Achieved
Summary: SEPA developed four community solar model types in the Program Designs report. They were labeled as the "Utility-Led Pilot Program, Utility-Led 2nd Generation Program, 3rd Party-Led For Profit Program, and 3rd Party-Led Not for Profit Program. SEPA analyzed each based on elements such as generation capacity, customer mix, and subscription rates. A key finding of this work was that while community solar programs are all very unique, there are distinct differences between programs voluntarily implemented by utilities and those implemented by 3rd party companies.

Objective: Test at least 4 models and their comparative attributes with at least 1500 residential consumers and 150 businesses
Status: Achieved
Summary: SEPA and Shelton Group surveyed 2,001 residential consumers and 252 businesses to determine their interest in different types of community solar programs. Input from an additional 64 residential consumers and 32 businesses was gathered through focus groups. The results of this research are covered in the "What the Community Solar Customer Wants" report.

Objective: Consult with at least 8 potential community solar projects that will directly lead to the development of at least 4 megawatts of new solar capacity
Status: Achieved
Summary: SEPA provided technical assistance to 8 organizations: 7 utilities and 1 non-profit community organization. As of the summer of 2018, two technical assistance recipients, Fremont Department of Utilities and Village of Minster, have developed 5.7 MW

of new solar capacity. A third technical assistance recipient, Duke Energy, has plans to develop 2 MW of new community solar capacity in the upcoming year.[7]

SEPA satisfied all milestones and go/no-go decision points associated with this project, listed in Table 2 and Table 3.

[7] "Duke Energy proposes 'community solar' and other renewables programs for N.C." January 15, 2018. https://www.bizjournals.com/charlotte/news/2018/01/25/duke-energy-proposes-community-solar-and-other.html

Budget and Schedule

The Community Solar Design Models for Consumer, Industry & Utility Success project initiated on January 1, 2015. The project was originally designed to have three budget periods and complete at the end of 2017. The budget periods corresponded with calendar years, with budget period 1 in 2015, budget period 2 in 2016, and budget period 3 in 2017. In December of 2017, SEPA was awarded a non-cost extension extending the project to June 30, 2018. The total project budget was $899,006 with a DOE share of $705,830 and a cost share of $193,176. This cost share amount corresponds to 21.5% of the total project budget

The original project budget was reallocated among the approved cost categories, but with no change in total contract amount or cost-share percentage. Specifically, reallocations of budget items among the Direct Charges were completed with DOE notification and acknowledgement on July 16, 2018. In addition, per DOE approval on July 19, 2018, $10,000 was reallocated from the Direct Charges to the Indirect Charges under Contract Term 32 c. The total amount of Direct Charge funds reallocated through these actions was $33,713.62, or 5% of the original budget. This amount is within the 10% cap specified by Term 32 b.

The original project budget, the reallocated budget, and the actual spend are depicted in Table 5.

Table 5 Program Budget and Spend

Categories Per Approved Budget	Original Budget	Reallocated Budget	Actual Spend
a. Personnel	$ 192,734.00	$204,511.02	$204,511.02
b. Fringe Benefits	$ -	$0.00	$0.00
c. Travel	$ 34,050.00	$28,637.74	$28,637.74
d. Equipment	$ -	$0.00	$0.00
e. Supplies	$ -	$0.00	$0.00
f. Contractual	$ 497,234.00	$480,789.45	$480,789.45
g. Construction	$ -	$0.00	$0.00
h. Other	$ 15,000.00	$15,079.79	$15,065.78
i. Total Direct Charges (sum of a to h)	$ 739,018.00	$729,018.00	$729,003.99
j. Indirect Charges	$ 159,988.00	$169,988.00	$169,764.61
k. Totals (sum of i and j)	**$ 899,006.00**	**$899,006.00**	**$898,768.60**
DOE Share	$ 705,830.00	$705,830.00	$705,533.35
Cost Share	$ 193,176.00	$193,176.00	$193,235.25
Cost Share Percentage	21.5%	21.5%	21.5%

There was one schedule modification made to this project. A no-cost schedule extension was made pushing the end date of the project to June 30, 2018. This extension was requested as:

- The draft of the final report needed additional time for peer review as most reviewers were not available at the end of the year.
- SEPA began two additional technical assistance projects with Memphis Gas Light and Water and Middle Tennessee Electric Membership Corporation in October of 2017. These projects both include surveys, which closed on December 4th. Additional time was need to analyze the data and incorporate the findings in the final report.
- As part of the case study development process there were some slowdowns on getting the raw video from the local videographer. Additionally, SEPA had trouble scheduling interviews during this holiday season with people we want to include in the case study.
- SEPA had the opportunity to conduct workshops in the spring and summer of 2018 to get a broader distribution of the lessons learned in this project

The extension was approved on December 11, 2017.

Lessons Learned

Community solar offerings have evolved significantly over the duration of the Solar Market Pathways grant. The range of contracting, delivery, and subscription models deployed to date represents an increasing expansive resource of options available to fit a wide-range of unique requirements. Despite this broad deployment, a couple of reoccurring traits continuously rise to the surface as industry best practices. SEPA's top five lessons learned through this process, in no particular order, are summarized below:

- **Project Siting**
    - Siting plays a key role in the overall success of a community solar program, with potentially significant impacts on both pricing and customer marketing. Confirming system siting early in the process will help avoid last minute surprises and potential deal-killers such as last minute security requirements and aesthetic covenants.
- **Stakeholder Engagement**
    - Embracing a collaborative design strategy that brings a wide range of Stakeholders (e.g. utility, regulatory, developers, customer advocates, etc.) to the table may result in some delays in the launch of new offerings, but in most cases the effort pays off in securing final approvals and overall success of the program.
- **IT/Billing Coordination**
    - More than one community solar program has been indefinitely shelved by not understanding the potential impacts and changes needed within a utility's billing system to be able to seamlessly process and incorporate the terms of a community solar program offering. Bringing this topic to the table early allows for appropriate planning timeframes or alternative strategies to be incorporated successfully.
- **Target Market Identification**
    - Often times there is a desire or need for a particular market sector driving the development of a community solar program. These can range from viable solutions for solar for non-owner occupied homes and apartments dwellers, to improved low-income customer access to solar, to new renewable energy options to help business customers meet their sustainability targets. Understanding these drivers up-front and designing the program to ensure their success, whether through targeted marketing, subscription caps/reservations, or otherwise helps to ensure a successful program offering and to pave the way for expanded or additional programs down the road.
- **Balancing Risk**

- Within the available program design parameters available in the market today, there exists a fairly robust toolbox of options to help strike the best balance of risk between utilities, developers, and subscribers. Those risks and their impact on program pricing and economics must be considered early in the design process, however, to ensure that the optimal size program results. A program that requires customers to shoulder a larger portion of the risk will typically see higher subscriber costs, meaning program participation rates will likely be smaller and the size of the installation should reflect that intended participation rate. The inverse is also true to ensure that programs don't sell out too quickly and create negative public relations problems for the electric utility.

Path Forward

The community solar market is continuing to grow and evolve. At the start of the Solar Market Pathways grant, before 2015, there were less than 50MW of community installed in the U.S. By the end of the grant, at the end of 2018, there were 734 MW. This is remarkable growth, over 1400% in three years. And the future looks equally as bright. GTM Research estimates that community solar will represent upwards of 25% of the entire non-residential solar market by 2020.[8]

But to realize this type of growth there will need to be continuing research and development support. SEPA plans to build off the work conducted under the Solar Market Pathways grant in the future years in order to support the further development of the market. At the moment, SEPA has three specific efforts that are direct outputs of the Solar Market Pathways grant.

First, SEPA will continue to research and track community solar programs. The current dataset, developed through the SMP project, is the most robust community solar program database. Data from it has often been requested and used by utilities as well as reporters to benchmark the industry's progress. SEPA has plans to make the dataset more granular and include information on how existing and proposed community solar programs are contributing to grid reliability. This data set will continue to be used to benchmark community solar costs with other solar approaches, creating a pathway toward lower costs.

Second, SEPA created a community solar working group as part of the SMP. At first, this working group consisted only of the 20 organizations on the SMP Project Team and served an advisory role for the project. Over the course of the last three years the working group has greatly evolved. There are now 112 individuals in the working group

[8] US Community Solar Outlook 2017. GTM Research. February 2017. Available at: https://www.greentechmedia.com/research/report/us-community-solar-outlook-2017

from 90 different organizations. The working group has produced webinars, provided data for the Community Solar Program Design Models report, and served as a forum for discussion regarding developments in community solar programs. In the future SEPA plans to continue to facilitate this working group. The projects recently proposed for working group effort includes researching topics such as subscriber cost/compensation as program expands, subscriber cost/compensation that work with TOU rates, program evolution as solar PPA rates potentially drop below avoided cost, threat of SEC labeling community solar a security, viable path for involving low-income subscribers, policy language that all agrees with, techniques for designing programs to optimize benefits/economics, resolving billing challenges, differentiating a program for residential versus commercial/industrial subscribers, leveraging “anchor tenants” to lower risk and program costs, and overcoming challenges of leveraging utility owned generation for community solar.

Third, SEPA will use the resources developed through the SMP grant to provide direct support to utilities and other organizations looking to develop community solar program. SEPA has already assisted over a half dozen utilities, both via the technical assistance portion of the SMP project and outside of the SMP project. SEPA will continue to provide program design support and market research support. The program design support is structured largely on the decision tree and program database developed in the SMP project.

References

GTM Research. (2017) *US Community Solar Outlook 2017*. Boston, MA. Available at: https://www.greentechmedia.com/research/report/us-community-solar-outlook-2017

Kauffman, K. (2018). *Solar-Powered Yogurt And Pop Tops: How Solar+Storage Helps A Rural Village To Thrive.* Washington, DC. Available at: https://sepapower.org/knowledge/solar-powered-yogurt-pop-tops-solarstorage-helps-rural-village-thrive/

Kruger, M. (2017*). Nebraska Town Can't Get Enough Of Community Solar: Smart Program Design Drives Sold-Out Project*. Washington, DC. Available at: https://sepapower.org/knowledge/nebraska-community-solar/

Smart Electric Power Alliance. (2018) *Community Solar Program Design Models: 2018 Version*. Washington, DC. Available at: https://sepapower.org/resource/community-solar-program-designs-2018-version/

Smart Electric Power Alliance. (2016) *Community Solar Program Design Models: Working Within the Utility*. Washington, DC. Available at: https://sepapower.org/resource/community-solar-program-design-working-within-the-utility/

Smart Electric Power Alliance. (2017) *What the Community Solar Customer Wants*. Washington, DC. Available at: https://sepapower.org/resource/what-the-community-solar-customer-wants/