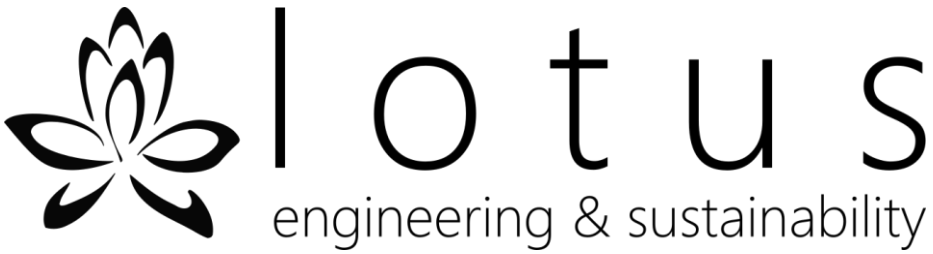
November 2015

Analysis of the Fulfillment of the Low-Income Carve-Out for Community Solar Subscriber Organizations



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This final research report was developed and prepared for the Colorado Energy Office by Lotus Engineering and Sustainability LLC.

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Disclaimer

Some of the information in this report is based on opinions received through various interviews. Every attempt has been made to accurately represent the information shared by each interview participant.

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Analysis Background and Overview

Analysis Background and Objective

On average, low-income households spend a greater portion of their living expenses on utility costs than their non-low-income peers (see Figure 1). In Colorado, approximately 30% of households are considered energy burdened (paying more than 4% of their annual income on utility bills) and of that 30%, 11% are considered energy impoverished (paying more than 10% of their income on utility bills). (Colorado Energy Office, 2015) In some instances, this percentage is even greater. Posada, a non-profit low-income housing organization located in Pueblo, Colorado that is participating in a community solar project, reported several cases in which low-income households paid a utility bill that exceeded the rent payment and at times reached thousands of dollars per month.

	Annual Electricity Expenditure	Mean Individual Burden	Median Individual Burden
United States: All Households	$1,936	7.00%	4.00%
United States: Non-low-income households	$2,087	3.30%	2.90%
United States: Low-income households	$1,679	13.30%	8.30%
United States: LIHEAP- recipient households	$1,364	14.90%	8.90%

Figure 1. Summary of 2011 average annual electricity expenditure by income group (Center for American Progress, 2014)

Recent studies have shown that the price of solar energy is competitive with the price of fossil fuels and many believe that within a few years solar energy could provide cheaper electricity costs than its conventional counterparts. (Cardwell, 2014) If this trend follows projections, solar energy could result in significantly lower utility bills for commercial and residential sectors alike. And, while there are many ways to procure solar power (i.e., power purchase agreements, solar lease, owning the systems, etc.), the structure of community solar gardens is especially attractive to the unique needs of low-income subscribers. Several notable benefits include access to potential immediate cost savings and the ability for households to not host solar panels on their roof.

The Colorado State Legislature and the Public Utilities Commission (PUC) have recognized the potential for community solar to increase solar energy investment, while reducing electricity costs for low-income households. The Community Solar Gardens Act (House Bill 10-1342) requires that community solar garden subscribing organizations (i.e., solar garden

developers) allocate at least 5% of each community solar garden to low-income subscribers (to the extent that there is demand for such ownership).[1]

Although this requirement has been in place since the adoption of the Community Solar Gardens Act in 2010, no comprehensive study exists that evaluates the success of the low-income carve-out requirement. The Colorado Energy Office (CEO) hired Lotus Engineering and Sustainability, LLC (Lotus) to evaluate how the low-income carve-out has and is being implemented, as well as gain a better understanding of best practices to help further the usage of and access to community solar for low-income subscribers.

The CEO is well positioned to support the usage of community solar for low-income households for several reasons:

- The CEO operates a nationally renowned weatherization program that provides services to low-income residents across the state.
- The CEO has in-house experts in policy, finance, and renewable energy that can be tapped to help develop a program or projects.
- The CEO has strong partnerships with many of the organizations that are currently participating or trying to participate in community solar.
- The CEO has recently partnered with the Department of Energy on a new initiative by the White House to increase solar access for all Americans.
- In September 2015 the CEO awarded a $1.2 million grant to GRID Alternatives to implement 5 to 12 community solar system demonstration projects for low-income communities in Colorado.

This analysis will complement the work the CEO is already doing and will help the CEO identify policies and program improvements that will ensure the longevity and sustainability of a low-income community solar program.

Analysis Methodology

To better understand how the Community Solar Gardens Act is being implemented, Lotus completed original research and completed a total of 17 interviews with a variety of individuals (see Table 1) whose organizations have direct experience working with community solar. It should be noted that much of this report is based on opinions received through various interviews. As such, every attempt has been made to accurately represent the information shared by each interview participant.

[1] It should be noted that the 5% carve-out was not included in House Bill 10-1342 but instead in the PUC rule making. See subsection *Overview of House Bill 10-1342 (Community Solar Gardens Act)* for more information.

Table 1. List of interviewees

Company/Organization	Interviewee	Expertise/Role
Black Hills Energy	Kevin Pratt	Utility.
Clean Energy Collective (CEC)	Tom Hunt	Developer.
Department of Corrections	John Gillogley	Helped develop community solar project. Community solar subscriber.
Energy Outreach Colorado	Andy Caler, Jennifer Gremmert, and Luke Ilderton	Non-profit organization providing home energy assistance to low-income Coloradoans. Able to qualify low-income subscribers through Xcel's program.
GRID Alternatives	Chuck Watkins and Tom Figel	Non-profit Organization. Helped subscribe low-income residents to community solar project.
Holy Cross Energy	Lisa Reed	Utility.
Municipal Housing Authority	Christopher Jedd and Barbara Hammond (2 different interviews)	Public Housing Authority. Helped subscribe low-income residents to community solar project. Able to qualify low-income subscribers through Xcel's program.
National Renewable Energy Laboratory	Joyce McClaren	National Laboratory.
Posada	Ann Stattelman	Non-profit Organization. Helped subscribe low-income subscribers to community solar project.
Public Utilities Commission	Bill Dalton	Regulatory authority.
SRA International	Joseph McCabe	Helped write community solar garden legislation in California.
SunShare	Kate Laursen	Developer.
The Atmosphere Conservancy	Alex Blackmer	Non-profit Organization. Able to qualify low-income subscribers through Xcel's program.
Vote Solar	Jessica Scott	Policy Expert.
Western Resource Advocates	Gwen Farnsworth	Policy Expert. Ability to intervene at Public Utilities Commission.
Xcel	Craig Konz	Utility.
* EcoPlexus was contacted various times, but did not respond to inquiries.		

The Community Solar Gardens Act affects only Investor Owned Utilities (IOUs): Xcel Energy and Black Hills Energy. However, there are numerous examples of community solar gardens throughout the state where municipal utilities and co-operative utilities have implemented solar gardens that support low-income households. As such, some of our research led us to look at projects outside of Xcel Energy's and Black Hills Energy's territories.

Overview of House Bill 10-1342 (Community Solar Gardens Act)

Basics

House Bill 10-1342 was signed by Governor Ritter in 2010 as a way to encourage additional investment in solar energy generation by authorizing the creation of community solar gardens. This groundbreaking bill has paved the way for Colorado to become a national leader in community solar. The basics of the bill are as follows:

- Applies only to IOU's
- Renewable Energy Credits (RECs) from the community solar gardens count towards the IOU's Renewable Portfolio Standard[2]
- Solar gardens are required to be 2 megawatts or less
- There must be at least 10 subscribers[3]
- Each subscription must be at least 1 kilowatt (low-income households are exempt from this requirement)
- Subscriptions cannot supply more "than 120% of the average annual consumption of electricity by each subscriber at the premises to which the subscription is attributed, with a deduction for the amount of any existing solar facilities at such premises"
- The subscriber's physical location must be within the same county or the county adjacent to that of the community solar array[4]
- Utility companies must include a provision for low-income customers (see below)

Low-Income Provision

The bill references low-income customers by stating: "Each qualifying retail utility shall set forth in its plan for acquisition of renewable resources a proposal for including low-income customers as subscribers to a community solar garden. The utility may give preference to community solar gardens that have low-income subscribers." In addition, the bill states that the PUC is responsible for formulating and implementing policies that encourage "ownership in community solar gardens by residential retail customers, and agricultural

[2] RECs generated from the community solar gardens cannot be used to achieve more than 20% of the retail renewable distribute generations requirements. (Department of Regulatory Agencies: Public Utilities Commission, 2015)

[3] Pursuant to PUC regulations, no subscriber can own more than a 40% interest "in the beneficial use of the electricity generated by the CSG, including without limitation, the renewable energy and RECs associated with or attributable to the CSG." (Department of Regulatory Agencies: Public Utilities Commission, 2015)

[4] Prior to the passing of House Bill 15-1284, the subscriber was required to be "within either the same municipality or the same county as the community solar garden; except that, if the subscriber lives in a county with a population of less than twenty thousand, according to the most recent available census figures, such physical locations may be in another county, also with a population of less than twenty thousand, within the service territory of the same qualifying retail utility and also adjacent to, that of the community solar garden." (General Assembly of the State of Colorado, 2015) However, House Bill 15-1284 simplified the requirement by saying the subscriber's physical location could be located in the same or adjacent county as the community solar garden.

producers, including low-income customers, to the extent the commission finds there to be demand for such ownership" (General Assembly of the State of Colorado, 2010).

After receiving community feedback (Public Utilities Commission, 2011), the PUC provided the final rules for low-income subscribers of community solar gardens as follows: "In each plan to acquire renewable energy and RECs from CSGs[5], the investor owned QRU[6] shall reserve, to the extent there is demand for such ownership, at least five percent of its renewable energy purchases from new CSGs for eligible low-income CSG subscribers." The ruling goes on to state that the utilities should "Plan to encourage eligible low-income customer subscriptions in CSGs." (Department of Regulatory Agencies: Public Utilities Commission, 2015)

Per interviews and research, it is clear that there is demand for low-income community solar garden subscriptions. Therefore, both Xcel Energy and Black Hills community solar programs require that participating solar garden developers have a minimum of 5% of the garden kW allocated to low-income subscribers. This requirement must be met prior to the production meter installation and project completion.

Definition of Low-Income

The PUC ruled that, "CSG subscriber organizations and investor owned QRUs may rely on certification by the Colorado Department of Human Services for acceptance in the Colorado Low-Income Energy Assistance Program (LEAP) as evidence of eligibility as an eligible low-income CSG subscriber in a CSG." (Department of Regulatory Agencies: Public Utilities Commission, 2015) However, they did not provide any further clarification on how to define low-income households. Many interviewees expressed frustration that there was not a clearer definition for low-income households. As such, each utility is required to define what constitutes as low-income.

Xcel Energy states that for the purposes of the community solar program, any subscriber that is a member of one of the following groups qualifies as a low-income subscriber:

- Energy Outreach Colorado
- The Atmosphere Conservancy
- Colorado LEAP Program
- Municipal Housing Authority (ex: Denver Housing Authority)

[5] CSG is a community solar garden.
[6] QRU is a qualifying retail utility (IOUs).

However, each qualifying agency uses their own criteria to define low-income. All low-income subscribers must complete a Low-Income Verification Form[7], signed by a representative of one of the aforementioned organizations in order to qualify. For more information on the Xcel Energy requirements and Xcel Energy's methodology see *Appendix A.*

Black Hills Energy did not provide any feedback on how they define low-income community solar customers.

[7] The Low-Income Verification Form can be found on Xcel Energy's website (http://www.xcelenergy.com/staticfiles/xe/Marketing/Files/co-sr-community-Low-Income-Verification-Form.pdf)

Solar Gardens and Subscribers

Roles and Responsibilities

Conversations with both utility companies and solar garden developers indicated that it is the solar garden developers, and not the utility companies, who run the various programs. The solar garden developer performs marketing, outreach, administration, utility bill analyses, subscriber enrollment, and helps complete the subscriber's application. They also track program metrics. The utility companies are responsible for providing utility incentives and verifying compliance with the PUC's solar garden rules and regulations. The non-profit or housing authority identifies low-income subscribers, verifies eligibility, and may help with outreach and marketing.

The Process for Enrolling Low-Income Subscribers

Typically there is a six-step process for enrolling low-income subscribers (see Figure 2).

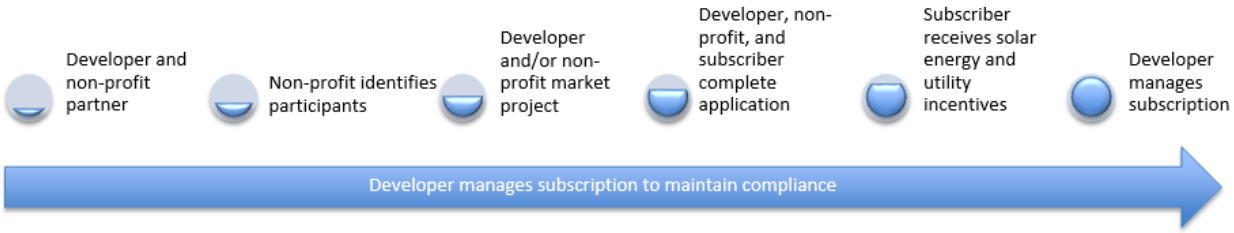

Figure 2. Example of the process for acquiring solar energy for low-income subscribers

Step 1: Solar garden developers and non-profits and/or public housing authorities partner to bring community solar to low-income subscribers.

Depending on their goals, a non-profit or public housing authority may wish to either reach a small set of subscribers by providing enough electricity to cover 100% of each household's needs or they may wish to reach a larger number of subscribers by covering a smaller percentage of a household's needs. Developers indicated that a subscriber's bill could be offset anywhere from 40% to 100%.

Step 2 and Step 3: Non-profits and public housing authorities provide the developers with a list of potential candidates, and depending on the partnership, either the developer or the non-profit organization or both, conduct marketing. Marketing may be in the form of email blasts, phone calls, mailers, community meetings, and/or door-to-door sales.

Step 4: The developer and/or partner organization works with low-income households to sign up and work through the required paperwork. For the Xcel Energy Solar*Rewards

Community program, once contact has been initiated, subscribers, developers, and non-profit organizations complete several rounds of paperwork to complete the application, including: (a) letter of interest; (b) utility bill release request form; (c) low-income verification form verified by one of Xcel Energy's approved organizations (see *Appendix A*), and (d) community solar contract.[8] According to Denver Housing Authority, the application process takes approximately six weeks to complete. The final application is submitted by the developer to Xcel Energy's internal portal, which verifies that the sum of the energy generated dedicated to low-income subscribers meets the 5% low-income requirement. The 5% requirement must be met prior to the production meter installation and project completion. Specifics were not provided by Black Hills Energy on the steps required for a low-income subscriber to sign up.

Step 5: The next step is subscribers receive the benefit of community solar. Many of the interviewees believe that many (if not all) of the low-income subscribers do not qualify for financing and/or cannot receive financing; therefore, the developers are forced to give panels away for free to maintain compliance with the low-income carve-out. The developers may give these panels or the electricity generated by the panels directly to the low-income subscribers or directly to a non-profit or public housing authority, who then allocates the generated electricity to low-income households.

There three common types of incentives: a utility incentive distributed as a utility bill credit, a REC[9], and a one-time lump sum. It should be noted that while there are three primary incentive options, not all incentives may be available to each subscriber and these incentives play very different roles in the pro forma of the project. Typically, the incentive of most financial significance is the bill credit. Since panels are given away for free and there is no initial investment, the incentives will immediately offset a portion or all of the electricity costs. According to the developers, subscribers may not begin to see utility incentives for an additional eight to ten months after completing Step 4.

Step 6: The developers manage the subscription and maintain compliance with the low-income requirement. The low-income subscribers can receive their credits for up to 20 years.

[8] It should be noted that the low-income subscribers do not sign a binding contract with the developer. The low-income subscribers signs the Subscriber Agency Agreement with Xcel which states that the developer will act as their agent to ensure the client receives their credits.

[9] For more information on RECs, see Lotus's blog titled *Renewable Energy Credits (RECS): A Review of the Basics and Questions to Ask before Utilizing RECs as a Way to Meet Renewable Energy Goals* at http://www.lotussustainability.com/blog/.

Program Metrics for Investor-Owned Utilities

To date, Xcel Energy is the only IOU that has active community solar gardens and, as such, is the only IOU that has fulfilled the 5% low-income carve-out. While Black Hills Energy has not had any active community solar gardens, they are currently working with Clean Energy Collective (CEC) on a project for Pueblo residents. (Black Hills Energy, 2015)

Each IOU pre-qualifies and selects community solar developers to operate within their respective territory. The community solar developers that are currently approved to work within Xcel Energy's territory include CEC, SunShare, and Community Energy Solar. CEC and SunShare are by far the most active developers. CEC is the only community solar developer approved to work within Black Hills Energy's territory. According to information shared by Community Solar Hub[10], there are 20 solar gardens with a generation capacity of 17,687 kilo-watts (kW) located within IOU Colorado territories (see Table 2). Of this capacity 890 kW (5.03%) is dedicated to low-income subscribers.

Table 2. Community solar gardens located within IOU territories (Community Solar Hub, 2015)

Project Name	Location	Utility	Solar Garden Developer	Size (kW)
Aurora/Arapahoe Community Solar Array	Aurora	Xcel Energy	Clean Energy Collective	498.01
Aurora/Arapahoe Community Solar Array 2	Aurora	Xcel Energy	Clean Energy Collective	499.90
Boulder County Community Solar Array 2	Boulder	Xcel Energy	Clean Energy Collective	499.90
Boulder Cowdery Meadows Solar Array	Boulder	Xcel Energy	Clean Energy Collective	496.46
Breckenridge Sol Array	Breckenridge	Xcel Energy	Clean Energy Collective	499.52
Breckenridge Ullr Solar Array	Breckenridge	Xcel Energy	Clean Energy Collective	497.97
Denver County 2	Denver	Xcel Energy	Clean Energy Collective	499.17
Denver County 3	Denver	Xcel Energy	Clean Energy Collective	497.35
Denver/Lowry Community Solar Array	Denver	Xcel Energy	Clean Energy Collective	400.08
Jefferson County 1	Golden	Xcel Energy	Clean Energy Collective	115.15
Jefferson County 2	Golden	Xcel Energy	Clean Energy Collective	569.17
Lake County Community Solar Array	Leadville	Xcel Energy	Clean Energy Collective	499.90
Community Solar Garden	Pueblo	Black Hills Energy	Clean Energy Collective	120.00
Lafayette	Lafayette	Xcel Energy	Community Energy Solar	1,000.00
Mesa	Grand Junction	Xcel Energy	Ecoplexus	1,997.00
Logan	Sterling	Xcel Energy	Ecoplexus	1,997.00
Denver Solar Garden	Denver	Xcel Energy	SunShare	1,000.00
Jefferson	Golden	Xcel Energy	SunShare	1,500.00
Adams Imboden Solar Garden	Watkins	Xcel Energy	SunShare	4,000.00
Arapahoe Solar Garden	Watkins	Xcel Energy	SunShare	500.00
			Total size (kW) for solar gardens located within IOU	*17,686.55*
			Total size (kW) dedicated to low-income subscribers	*890.33*
			Percentage dedicated to low-income subscribers	*5.03%*

It should be noted that these figures vary slightly with Xcel Energy's values, which state a total generating capacity of 17,400 kW of which 856 kW is dedicated to low-income subscribers (4.92%). Both SunShare and CEC confirmed the values included Table 2 and noted that it has been difficult to reconcile their estimates with Xcel Energy.

[10] Community Solar Hub in a collaboration between CEC and the U.S. Department of Energy.

Xcel Energy has stated that their community solar garden program includes 1,010 subscribers, of which 349 qualify as low-income. This equates to the average low-income household receiving 2.55 kWs and other subscriber's subscriptions averaging approximately 25.4 kWs.[11] While SunShare was willing to share their number of subscribers, CEC was not; therefore, the total number of subscribers provided by Xcel could not be confirmed with the developers.

Because Black Hills Energy's program is not yet active the number of subscribers is not available.

Program Metrics for All Utilities

According to Community Solar Hub an additional 18 community solar gardens are active in municipal and co-operative utility territories within Colorado (see Table 3). This equates to an additional generating capacity of 12,644 kW, making up approximately 42% of the total community solar garden market (see Table 4). Municipal and co-operative are not required to maintain compliance with the PUC's community solar regulations; therefore, it is unknown how much, if any, of the solar energy is allocated to low-income subscribers.

Table 3. Municipal and Co-operative projects (Community Solar Hub, 2015)

Project Name	Location	Utility	Solar Garden Developer	Size (kW)
Colorado Springs Community Solar Array	Colorado Springs	Colorado Springs Utilities	Clean Energy Collective	497.25
Good Shepherd Solar Garden	Colorado Springs	Colorado Springs Utilities	SunShare	500.00
Pikes Peak Solar Garden + Colorado Springs Solar Gardens	Colorado Springs	Colorado Springs Utilities	SunShare	3,200.00
Venetucci Farm	Colorado Springs	Colorado Springs Utilities	SunShare	576.00
Montrose Location	Montrose	Delta Montrose Electric Association	Atlasta Solar	10.00
Read Facility Location	Montrose	Delta Montrose Electric Association	Atlasta Solar	10.00
Solar Assist Cooperative Garden	Cortez	Empire Electric Association	Empire Electric Association	20.00
Fort Collins Utilities Solar Array 1	Fort Collins	Fort Collins Utilities	Clean Energy Collective	620.68
Solar Farm	Grand Junction	Grand Valley Power	GRID Alternatives	20.68
Garfield County Airport Solar Array	Rifle	Holy Cross Energy	Clean Energy Collective	858.00
Mid Valley Solar Array	Carbondale	Holy Cross Energy	Clean Energy Collective	77.74
Sunnyside Ranch Community Solar Array	Carbondale	Holy Cross Energy	Clean Energy Collective	1,792.57
LPEA Solar Garden	Durango	La Plata Electric Association	Undefined	2,000.00
PVREA Headquarters Solar Array	Ft. Collins	Poudre Valley Rural Electric Association	Clean Energy Collective	116.09
PVREA Solar Array 2	Fort Collins	Poudre Valley Rural Electric Association	Clean Energy Collective	631.82
Paradox Valley Solar Array	Bedrock	San Miguel Power Association	Clean Energy Collective	1,124.24
Sol Partners	Brighton	United Power	United Power	10.00
Yampa Valley Community Solar Array	Craig	Yampa Valley Electric Association	Clean Energy Collective	579.08
			Total size (kW) for all solar gardens	*12,644.14*

[11] Note that the aforementioned numbers are averages. However, there is likely to be a large range of kWs allocated per low-income subscriber and non-low-income subscriber.

Table 4. All community solar gardens located within the state of Colorado (Community Solar Hub, 2015)

Project Name	Location	Utility	Solar Garden Developer	Size (kW)
Adams Imboden Solar Garden	Watkins	Xcel Energy	SunShare	4,000.00
Arapahoe Solar Garden	Watkins	Xcel Energy	SunShare	500.00
Aurora/Arapahoe Community Solar Array	Aurora	Xcel Energy	Clean Energy Collective	498.01
Aurora/Arapahoe Community Solar Array 2	Aurora	Xcel Energy	Clean Energy Collective	499.90
Boulder County Community Solar Array 2	Boulder	Xcel Energy	Clean Energy Collective	499.90
Boulder Cowdery Meadows Solar Array	Boulder	Xcel Energy	Clean Energy Collective	496.46
Breckenridge Sol Array	Breckenridge	Xcel Energy	Clean Energy Collective	499.52
Breckenridge Ullr Solar Array	Breckenridge	Xcel Energy	Clean Energy Collective	497.97
Colorado Springs Community Solar Array	Colorado Springs	Colorado Springs Utilities	Clean Energy Collective	497.25
Community Solar Garden	Pueblo	Black Hills Energy	Clean Energy Collective	120.00
Denver County 2	Denver	Xcel Energy	Clean Energy Collective	499.17
Denver County 3	Denver	Xcel Energy	Clean Energy Collective	497.35
Denver Solar Garden	Denver	Xcel Energy	SunShare	1,000.00
Denver/Lowry Community Solar Array	Denver	Xcel Energy	Clean Energy Collective	400.08
Fort Collins Utilities Solar Array 1	Fort Collins	Fort Collins Utilities	Clean Energy Collective	620.68
Garfield County Airport Solar Array	Rifle	Holy Cross Energy	Clean Energy Collective	858.00
Good Shepherd Solar Garden	Colorado Springs	Colorado Springs Utilities	SunShare	500.00
Jefferson	Golden	Xcel Energy	SunShare	1,500.00
Jefferson County 1	Golden	Xcel Energy	Clean Energy Collective	115.15
Jefferson County 2	Golden	Xcel Energy	Clean Energy Collective	569.17
Lafayette	Lafayette	Xcel Energy	Community Energy Solar	1,000.00
Lake County Community Solar Array	Leadville	Xcel Energy	Clean Energy Collective	499.90
Logan	Sterling	Xcel Energy	Ecoplexus	1,997.00
LPEA Solar Garden	Durango	La Plata Electric Association	Undefined	2,000.00
Mesa	Grand Junction	Xcel Energy	Ecoplexus	1,997.00
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Venetucci Farm	Colorado Springs	Colorado Springs Utilities	SunShare	576.00
Yampa Valley Community Solar Array	Craig	Yampa Valley Electric Association	Clean Energy Collective	579.08
			Total size (kW) for all solar gardens	*30,330.69*
			Total size (kW) for all solar gardens within IOU	*17,686.55*
			Total size (kW) for solar gardens not located within IOU	*12,644.14*

Compliance with the Low-Income Carve-Out Requirement

The developers are responsible for maintaining the 5% carve-out requirement. For Xcel's program, the developers enroll low-income subscribers by submitting the subscribers' applications to Xcel Energy's internal portal. This portal automatically sums the low-income subscriptions and verifies that each garden is maintaining compliance.

Xcel Energy's internal portal will signal the developer if their garden is out of compliance with the low-income requirement. This may happen for a variety of reasons - most commonly the subscriber moves to a different home and terminates the system without notifying the solar garden developer. If the garden falls out of compliance, the developer has 30 days to reach compliance or the solar garden is effectively shut off. To quickly enroll new subscribers, each developer manages a wait list for new subscriptions.

Since Black Hills Energy program is brand new, little information was provided on compliance.

Additional Program Metrics

Upon receipt of the original draft report submitted to the CEO October 26, 2015, the CEO requested additional program metrics during a project review call on November 10, 2015. The request for additional program metrics included:

1. Length of time subscribers participate in the program.
2. Estimated monetary savings if a developers' portfolio complied with the 5% carve-out rather than the developers' individual systems.
3. Estimated monetary savings per participating household.
4. Estimated electricity savings per participating household.
5. Percentage of electricity bill covered by community solar share.
6. Other, supporting program metrics.
7. Financial impact to the developers of negative RECs.

Lotus re-contacted CEC, SunShare, GRID Alternatives, and Denver Housing Authority for additional information. All parties were contacted multiple times. CEC provided comments in response to the bulleted list of questions above. CEC's response is summarized as:

1. First customer joined the program April 2013.
2. In theory, savings could be achieved, but this would be difficult to quantify. The system would also have to be implemented by an advocacy group, nonprofit, or government organization.
3. Data is not tracked and CEC is unable to aggregate this information.
4. Data is not tracked and CEC is unable to aggregate this information.
5. Data is not tracked and CEC is unable to aggregate this information.
6. None
7. Not provided; REC prices are confidential.

SunShare's response is summarized below:

1. First customer joined the program the winter of 2013/2014 with the bulk of low-income subscribers signing up in the spring of 2015; however, all subscribers did not start seeing credits on their bills until October 2015. Technically, the subscriber could get the financial benefits for up to 20 years as long as they stayed at their household for 20 years. However, the subscription lengths really depend on the unique organizations SunShare works with.
2. In theory, savings could be achieved because it would save SunShare an enormous amount of time, but this would be difficult to quantify. SunShare also noted that "Unfortunately at this time, it is unlikely SunShare would re-invest any of that money into more low-income clients because in the end, we would still be losing money on those clients because we would still be paying for the subscriptions."
3. Data is not tracked and SunShare is unable to aggregate this information.
4. Data is not tracked and SunShare is unable to aggregate this information.

5. Data is not tracked and SunShare is unable to aggregate this information; however generally community solar covers about 30 to 120% of each household's electricity use.
6. None
7. Not provided; REC prices are confidential. However, SunShare noted that if RECs were to become negative, they would at least like to see RECs be valued at zero for the low-income carve out.

While SunShare was unable to provide specific numbers, Lotus was able to track down some partial data from one of their projects. In 2013, SunShare partnered with Academy 360 to provide 125 charter school families with 6/10ths of a kW of free solar energy for their homes (total of 75 kW). (Cotton, 2014) The solar was expected to provide participating families with 20-30% discounts on their electricity bills. (Schimke, 2014)

Questions 3 through 5 were asked to Denver Housing Authority via email and phone calls with Chris Jedd, Portfolio Energy Manager at Denver Housing Authority. Chris states that "since the accounts are in the resident's name, DHA does not have access to nor is able to track their bills, rates, credits, consumption, etc." However, estimates provided in a press release for the Denver Housing Authority and CEC project state that the 70 kWs given to the Denver Housing Authority support "approximately 35 families living in DHA facilities" and will "generate more than $7,700 in bill credits for DHA housing residents in the first year and nearly $230,000 over the 20-year program." (Clean Energy Collective, 2013) It is unknown how many kWs each family received and what percentage of their bill the electricity offset. However, if the panels were allocated evenly, each of the 35 households would have received approximately 2 kWs and $220 in savings in the first year.[12]

Chuck Watkins, Executive Director of GRID Alternatives Colorado provided answers via email and a phone call for questions 3 through 6. GRID Alternatives does not have any specific metrics for their project with SunShare; however, Chuck noted that each household had 120% of their average annual consumption of electricity offset. In addition, GRID Alternatives provided a spreadsheet[13], which estimates expected savings for a low-income household participating in community solar. The spreadsheet estimates that the average low-income family in Xcel territory:

- Uses 5,819 kilowatt hour (kWh) per year
- Pays $0.112 per kWh
- Pays approximately $733/year for electricity

[12] CEC assumes a 4% escalation rate in electricity costs and bill credits. Therefore, the savings escalate 4% per year resulting in $7,700 savings in Year 1 and approximately $16,223 savings in Year 20 (total of $230,000 savings over 20 years).

[13] The spreadsheet provided by GRID was created to calculate an array out on the Western slope; however, Chuck noted that there were "pretty minor production differences between the two regions so I feel comfortable with you using these calculations." This spreadsheet was created by GRID Alternatives, therefore Lotus does not take any responsibility for its accuracy.

- Receives a $0.07445 solar credit per kWh
- Pays a monthly $6.75 customer access charge

Using GRID Alternatives spreadsheet, you are able to calculate the following estimates for questions 3 and 4:

Percentage of annual consumption covered by Community Solar Garden	Percentage of Annual Electricity Bill Offset by Community Solar Garden	Estimated Savings
120%	71%	$520
100%	59%	$433
80%	47%	$347
60%	35%	$260

The reason that only 71% of the electricity bill is offset even though 120% of the annual consumption is covered by community solar can be explained by two factors:

1. There is a monthly customer access charge of $6.75 ($81/year). Using the averages above the access charge ($81) is approximately 11% of the annual electricity costs ($733) for a low-income family.
2. The solar credit ($0.07445 per kWh) is approximately 65% of the retail rate of electricity ($0.11 per kWh).

If the estimated savings provided by GRID Alternatives were to be applied to all low-income subscribers, it can be assumed that community solar has saved 349 households a total of $90,740 to $181,480 in Year 1.[14] Assuming that electricity rates escalate at 3%[15] per year this equates to a total savings over a 20-year contract period of $2,438,217 to $4,876,435.

[14] Assumes a range of savings of $260 (60% of electricity consumption covered by Community Solar) to $520 (120% of electricity consumption covered by Community Solar) for 349 participating households.

[15] A 3% escalation rate is based on experience within the energy industry and observation of electricity rates for Xcel Energy's territory. Note: these rates may be conservative and are lower than estimates commonly provided by developers.

Program Hurdles

While every developer, non-profit organization, and utility company fully supports the inclusion of low-income subscribers, each stakeholder faces many challenges when delivering the community solar program to low-income subscribers. The following is a list of challenges highlighted by interviewees and discovered through research (note that some of the following challenges are not necessarily unique to the low-income market):

Table 5. Program hurdles

Program Hurdles
Marketing and Communication Challenges
Distrust
Privacy concerns
"Nothing is free" mentality
Lots of paperwork
Time delay between signing up for the program and receiving benefit
Multilingual and multicultural households
Multiple parties in deal
Environmental benefits do not always resonate
Foreign terminology
Email and phone calls not always the most effective modes of communication
Demographic Challenges
High mobility of low-income residents
Multifamily buildings with one meter
Requirement limited to IOU territories
Financial Challenges
Higher costs to developers and non-low-income subscribers
Interest in immediate cost savings versus long-term cost savings
Variability in utility bill costs
Lack of upfront capital and inability to get financing
Programmatic Challenges
Current approach to maintaining compliance creates an artificial cap
Developers offsets lost investment with larger subscribers
A majority of subscription management is the responsibility of developers

Marketing and Communication Challenges

The following are challenges listed by interviewees that relate to marketing and communication:

- **Distrust:** Every interviewee that directly works with low-income residents mentioned that distrust was a large issue. It takes time and many interactions to become a trusted partner for low-income households. As such, unless a prior and trusting relationship is in place it is hard to have low-income residents be willing to engage, let alone sign a contract.

Likewise, a few organizations also expressed skepticism and caution when entering into and supporting community solar agreements. They have seen electricity costs increase after participation in a solar agreement (albeit a rooftop arrangement) and they received little outside assistance when requested.

- **Privacy concerns:** Several interviewees mentioned their hesitation to share their list of low-income households to developers due to privacy concerns.

- **"Nothing is free" mentality:** To date the subscriptions have always been given to low-income households for free. In return, many households questioned the value of the subscriptions and whether or not there were any hidden costs. Other interviewees noted that when panels are given away it is hard to prove their worth and they caution that subscribers may not fully realize the value of the system; thereby, subscribers may be more likely to terminate service or violate terms of the agreement.

- **Lots of paperwork:** The amount of paperwork and the rounds of separate paperwork can be intimidating, unapproachable, and burdensome. Many of the contracts include legal jargon that can turn off many potential subscribers. Also, once the paperwork has been completed the process can be significantly delayed if there are issues with the form and/or if data was not properly provided.

- **Time delay between signing up for the program and receiving benefit:** Multiple examples were provided when the subscribers signed up for the program months before they received the benefit. Also several examples were provided where the low-income families signed up but then were told the project was not done or they were put on a wait list. This led to some distrust of the program. It was noted that once the benefit/credit started to be received this distrust was lessened.

- **Multilingual or multicultural households:** Many low-income households are multicultural or multilingual leading to potential communication breakdowns and/or struggles.

- **Multiple parties in deal**: Since many of the projects involved a non-profit or housing authority selling/allocating the subscriptions on behalf of a developer, there is the potential for a household to be confused over whom they are really working with. There has to be a very strong connection between the developer and non-profit or housing authority to ensure that they are both communicating the same benefits and project details to each potential subscriber.

- **Environmental benefits do not always resonate:** There are many benefits for subscribers to participate in community solar. However, many of these benefits do not resonate with the low-income subscribers who are mostly (according to some interviewees only) concerned with monetary savings.

- **Foreign terminology:** Marketing materials for community solar may use terminology like "kilowatts", "kilowatt hours" or "solar panels". Many households do not know what these terms mean. There is also confusion over the differences between energy (i.e., electricity versus natural gas) and electricity.

- **Email and phone calls are not always effective modes of communication:** Email and phone calls are a very common and cost-effective way to reach consumers. However, many low-income households do not have regular access to email. In addition, several interviewees noted that phones were sometimes shut off and phone numbers changed regularly. Instead it was noted that the only way to reach many households was knocking on doors, a time-consuming approach.

Demographic Challenges

The following are challenges listed by interviewees that relate to general demographics:

- **High mobility of low-income residents:** Many low-income subscribers are tenants and they move every few years. When they move they may turn off their service and, often, developers are not notified, which causes the solar garden to fall out of compliance. Also, since tenants do not own the premise location to which the community solar is connected they may be less concerned with long-term energy savings.

- **Multifamily buildings with one meter:** Many low-income households live in multifamily housing where there is only one-meter for the entire building. As the program is currently administered, these households do not qualify for the program because the benefit must be connected directly to low-income subscriber meter.

- **Requirement limited to IOU territories:** Forty-two percent of community solar programs are located in territories outside of IOU's with no requirement to serve low-income households, even though many of these utilities serve significant populations of low-income households. Even within IOU territories the number of low-income subscriber served is limited.

Financial Challenges

The following are financial challenges listed by interviewees:

- **Higher costs to developers and non-low-income subscribers:** Developers invest time to partner with non-profit organizations, conduct marketing to potential subscribers, complete the subscriber's application, and to maintain compliance with the 5% carve-out. And to recoup the costs of the solar panels that were given away for free, developers increase costs to their non-low-income subscribers.
- **Interest in immediate cost savings versus long-term cost savings:** Depending on the structure of the deal between developer and subscriber, the payback timeline can vary (sometimes greatly). Long-term savings are not a motivator for low-income households. Instead it is critical that cash flows are positive from day one.
- **Variability in utility bill costs:** Once households start receiving a monthly credit, it should be noted that even if the solar garden is aiming to cover 100% of the electricity usage at a household, the monthly credit will fluctuate and therefore the utility bill will fluctuate as well.
- **Lack of upfront capital and inability to get financing:** Low-income households rarely have upfront capital to support a project and many low-income households are unable to get financing due to low or no credit scores. Developers are then forced to give panels away for free.

Programmatic Challenges

The following are programmatic challenges listed by interviewees:

- **Current approach to maintaining compliance creates an artificial cap:** Free subscriptions discourage developers from exceeding the low-income carve-out, thus creating an artificial cap. There is only one instance in the state where the 5% requirement has been exceeded: Posada has been given a 10% share in the Black Hills Energy-CEC garden.[16] The garden is located on land owned by Posada and the garden will provide electricity to buildings owned by Posada that provide housing for low-income residents. It is not clear why the 5% requirement was exceeded for Posada (neither Black Hills Energy nor Posada knew why and CEC was unwilling to share detailed information), but it may be that the land lease played a role.

[16] While the press release announcing the project states that Posada received the panels at a "significantly reduced rate", it was confirmed that the panels were given away at no charge or were possibly exchanged for the land lease on which the panels are located. (Black Hills Energy, 2015)

- **Developers offset lost investment with larger subscribers:** Community solar was designed as an alternative option for subscribers that did not want to or could not host rooftop solar. This was primarily directed at residences with poor roof spaces, renters, and those with a limited budget. Yet, because developers spend significant time managing these small and individual accounts (of which 5% are dedicated to low-income), they are incentivized to offset this time by enrolling larger commercial and industrial subscribers. As such, the original intent of the community solar garden legislation may be circumvented.

- **A majority of subscription management is the responsibility of the developers:** Developers spend significant time and money on low-income administration and management. This increases costs and contributes to the artificial cap.

Best Practices for Achieving Low-Income Participation in Solar Gardens

The following is a menu of best practices from a marketing, programmatic, and financing perspective that may help more efficiently reach the low-income market. Not all of these practices need to be pursued to ensure a successful program, but a combination of these practices may strengthen the existing community solar offering. Table 6 outlines a list of best practices and parties that may be responsible for implementing the best practice.

Table 6: Best practices

Best Practices	Potential Responsible Party				
Marketing and Communication Best Practices	***Developer***	***Non-profit/Public Housing***	***Utility Company***	***CEO***	***Financing Agency***
Co-Brand	X	X			
Direct marketing materials at low-income communities' priorities	X	X			
Clearly state cost savings	X				
Clearly outline consumer protections	X				
Minimize legalese	X		X		
Create a waitlist	X	X			
Get them at "move in"	X	X			
Use multiple modes of communication	X	X	X		
Simplify billing and have transparency in bills	X		X		
Highlight energy justice issues	X	X			
Programmatic Best Practices	***Developer***	***Non-profit/Public Housing***	***Utility Company***	***CEO***	***Financing Agency***
Create long-term partnerships with mission driven organization	X	X	X	X	X
Respect privacy	X	X	X		
Provide a clear and flexible definition of low-income			X		
Spread the wealth	X	X			
Trade off the wealth	X	X			
Allocate a little more then 5%	X				
Increase transparency	X		X		
Financial Best Practices	***Developer***	***Non-profit/Public Housing***	***Utility Company***	***CEO***	***Financing Agency***
Provide financing options	X		X	X	X
Impact investing				X	X
Provide long-term funding support	X	X	X	X	X
Provide grants for outreach	X			X	X
Contribution from the subscriber	X	X		X	

Marketing and Communication Best Practices

The following are marketing and communication best practices that could help create efficiencies by improving marketing material, clearly identifying savings opportunities and consumer protection issues, and highlighting energy justice.

- **Co-Brand:** Developers should partner with a trusted, known organization such as GRID Alternatives and Denver Housing Authority. Once the partnership is formalized create co-branded materials that outline community solar's benefits.
- **Direct marketing materials at low-income communities' priorities:** Marketing materials must be targeted to low-income households and highlight the priorities for that community. Marketing materials should be multicultural and multilingual, as needed.
- **Clearly state cost savings:** Expected cost savings and the specifics of the cost savings (i.e., timeline, estimated amount) should be clearly laid out and easy to understand. Any financial contribution from low-income subscriber must be clearly outlined.
- **Clearly outline consumer protections:** Several interviewees highlighted the importance for low-income households to have strong consumer protection clauses. For example, low-income households might need extra clauses that protect them from hidden fees, fines, and/or penalties (i.e., late payment, contract termination, rate escalators, etc.) that they are unable to pay.[17]
- **Minimize legalese:** The contracts should be easy to understand.
- **Create a waitlist:** if possible, developers, non-profits, and housing authorities should create multiyear agreements to increase efficiencies. If possible, build a waitlist.
- **Get them at "move in":** The Denver Housing Authority mentioned that one of the most effective ways to get a household to sign up is to provide materials when a qualifying resident moves in.
- **Use multiple modes of communication:** In order to get a household to sign up use several modes of communication (i.e., phone, email, mail, knocking on doors).
- **Simplify billing and have transparency in bills:** If possible, work with utility to make sure that benefit is clearly highlighted in monthly bill. If the credit is not highlighted then the

[17] This project did not cover best practices for consumer protections and best practices did not arise in our interviews; therefore, we are not able to include a list of best practices in this paper. However, GRID Alternatives recommendations can be found in *Appendix B: GRID Alternatives List of Essential Consumer Protections for Low-income Customers*. Please note that Lotus does not support or disagree with any of their recommendations.

households might not understand whether or not they are benefiting from community solar.

- **Highlight energy justice:** Many of the non-profits are passionate about energy justice issues and therefore are interested in the ability for community solar to help reduce the cost of electricity for low-income households. Marketing materials could potentially include this as a benefit of community solar.

Programmatic Best Practices

The following are programmatic best practices that could help create efficiencies by creating long-term partnerships, respecting privacy, clarifying low-income eligibility requirements, spreading and trading the wealth, and improving transparency.

- **Create long-term partnerships with "mission-driven" organizations:** Many partnerships have developed between developers and non-profits and housing authorities who work directly with low-income communities. Many of these organizations have missions to work with and directly support low-income households. As such, they already have connections into low-income communities and in most cases had developed a strong trusting relationship with individual households, which takes time and consistent communication. Long-term partnerships will increase the efficiency of the process. For example, GRID Alternatives already has a long wait-list of Colorado low-income households that are interested in solar energy.

  Many of these organizations are also already aware of which households pay their utility bills and therefore qualify for the program. Non-profits focused on energy security know how to explain energy issues to households that are unfamiliar with them. Housing authorities also track the movement of their tenants. As such, they are able to alert the developer if a low-income participant vacates the house and therefore a subscription becomes available. They are also able to provide information regarding community solar to incoming residents that might be interested.

- **Respect Privacy:** Many of the partner organizations (not developers) mentioned their concern over the privacy of low-income residents and that they were not comfortable handing out address and contact information to developers. Some of this concern came from not fully understanding the potential risks for low-income residents if they signed up for community solar. As such any program must clearly lay out comprehensive consumer protection benefits for low-income residents.

- **Provide a clear and flexible definition of low-income:** Several interviewees expressed frustration that there is not a more definitive definition for low-income. This has led to some inconsistency over how households are qualified. For example, one of the qualifying entities, The Atmosphere Conservancy, uses a variety of methods to qualify including looking to see whether a family with schoolchildren qualifies for the "free and reduced lunch benefit" at school and/or whether an individual lives in communities with certain income thresholds.

- **Spread the wealth:** Current practices suggest that most of the low-income households benefiting from community solar have the maximum or close to maximum percentage of their annual consumption of electricity covered by community solar. Several interviewees mentioned that a simple way that more low-income households could benefit from community solar is to cover less than the maximum percentage allocated for each low-income subscriber. For example, a low-income subscriber could have 50% of their annual consumption of electricity covered instead of 120% allowing more households to participate.[18] Note that one interviewee said that you would need to cover at least 50% of a household's utility bill otherwise a household will not receive a "substantial benefit" and therefore not be interested.

- **Trade off the wealth:** GRID Alternatives Colorado partnered with Grand Valley Power on a 29 kW DC community solar project, which was allocated exclusively to low-income customers for 20 years. Uniquely, every 4 years customer participation is relocated giving more families the opportunities to subscriber. (GRID Alternatives, 2015)

- **Developer benefit: Allocate a little more than 5%:** Current practice has shown that the developers usually advocate exactly 5% of an array to low-income subscribers to ensure they meet the requirement. However, if even one of the low-income subscriber's moves or drops out of the program then the developer is considered out of compliance with the utility (if they do not fill the spot within 30 days). By subscribing a little more than 5%, developers are able to have a little coverage to avoid being out of compliance if a low-income subscriber drops out. Note that this best practice clearly adds costs to developers and therefore would most likely not be supported by developers even if it does create some program efficiencies.

- **Increase transparency:** Many interviewees mentioned the lack of transparency about whether or not the 5% requirement was being made and who was benefiting. It was

[18] The current legislation states that a community solar garden cannot provide more than 120% of a subscriber's average annual consumption of electricity, with a deduction for the amount of any existing solar facilities at such premises (i.e. if a household already has PV panels on their roof). The 120% rule is based off the Solar*Rewards rules and accounts for variations in annual production and utility based incentives (i.e., bill credits).

recommended that more transparency be integrated into the reporting requirement for developers to utilities.

Financial Best Practices

The following are financial ideas and best practices that could help create efficiencies by providing financing options, impact investing, providing long-term funding support and grants, and through a subscriber contribution. [19]

- **Provide financing options:** It should be noted that attaining financing is probably unrealistic for most low-income subscribers as they are considered "unbankable". To reach these subscribers consider a revolving fund, financial backing, green banks, or credit reserve fund. Here are some considerations if financing is considered:
  - The lender will need to provide (very) low interest loans.
  - The lender might also need to not require minimum income requirements or credit scores.
  - The lender should be comfortable lending very small amounts.
  - Because many times a household signs up for a project months before they receive a benefit the loan will need to align with the start of the benefit.
  - The lender should be comfortable with a long-term agreement.
  - Include a clause that allows households to exit the loan if they leave the community solar program.
  - The lender might also look into earning redevelopment points, which are necessary to comply with the Community Reinvestment Act.

- **Impact Investing:** Impact investing has become a very powerful tool for catalyzing investment in renewable energy and energy efficiency. While no examples were found in Colorado where impact investing was used to support community solar, there is potential for this mechanism to support projects.

- **Provide long-term funding support:** Provide compensation to developers for low-income subscriptions. Approximately 890 kW has been given away to low-income subscribers. Based on estimates of community solar at $3.00 per watt (W) to $3.50 per W, free community solar equates to a cost range of $2,670,000 to $3,115,000.

  Several potential sources of funding support are listed in the following section *Potential Policy Changes and Improvements* and include: a) dedicated revenue stream from RECs

[19] Since the panels are currently being given away for free, there have been no examples of how to finance or support low-income households.

paid by the utility; b) statewide electricity tax; c) portion of Low Income Home Energy Assistance Program (LIHEAP) or Home Energy Assistance Program (HEAP) funds; and d) dedicated utility Renewable Energy Standard Adjustment (RESA) funds.

- **Provide grants for outreach:** Grants could be provided to developers or non-profits/housing authorities to do the outreach to low-income households helping reduce operational costs.
- **Contribution from the subscriber:** Require the subscriber to make a small payment towards the cost of the panels. Consider dedicating a portion of the utility bill credit to pay for a portion of the cost of the panels.

Potential Policy Changes and Improvements

Across the board all interviewees believed that the 5% carve-out is working well but there is room for improvement. The following policy changes were brought up during interviewees and through research. All policy recommendations (see Table 7) outlined in this section would need to be fully vetted before implementation for potential costs and program, policy, and political implications. Some of the following policy changes would take a legislative change and PUC ruling, while others would require a change in internal policies for the utility. However each of the following is expected to increase the number of low-income households that would benefit from low-income solar.

Table 7. Potential policy changes and improvements

Potential Policy Changes and Improvements	Potential Responsible Party(ies)		
	IOU	*Legislation*	*PUC*
Apply the 5% requirement to the developer's portfolio	X	X	X
Increase the 5% low-income carve-out requirement	X	X	X
Guarantee the bill credit	X		X
Increase low-income participation statewide		X	X
Require that utility companies pay for RECs		X	X
Implement a statewide electricity tax to fund low-income subscriptions		X	X
Invest a portion of LIHEAP funding into low-income solar installations		X	
Require that utility RESA programs dedicate a portion of funds to support low-income solar installations		X	X
Develop legislation that supports low-income specific solar gardens		X	X
Encourage the community solar arrays to be located on brownfields	X		

The following is a list of potential policy changes and/or improvements:

- **Apply the 5% requirement to the developer's portfolio:**[20] Currently the PUC rules are written that each project must have 5% allocated to low-income households. The majority of interviewees believed that the 5% quota would be much more effective and efficient if the 5% requirement was instead applied to the entire portfolio. Using data provided by Xcel, 349 low-income subscribers have subscribed to 890.33 kWs (approximately 2.55 kWs per household). The smallest community solar project on-line is 115.15 kWs[21], in which approximately 5.76 kWs is allocated to low-income households. Using the aforementioned 2.55 kW per household average, the CEC could have subscribed about 2 to 3 households.[22] In comparison, CEC's entire portfolio is approximately 5,692.55 kWs, in which 284.63 kWs must be

[20] Note that this policy change would most likely effect the current requirement that the subscribers physical location must be within the same county or the county adjacent to that of the community solar array.
[21] Jefferson County 1 project developed by Clean Energy Collective (see Table 2 Table 2)
[22] Note that the Clean Energy Collective did not share specific data with us regarding subscribers per project. Instead these numbers are based off of averages.

allocated to low-income households. Once again using averages, this equates to about 112 low-income households receiving 2.55 kWs each.

Applying 5% to the entire portfolio would enable the developer to have more freedom and creativity in figuring out how to get enough households signed up through creative financing and long-term partnerships. For example, the developer could put one project on line that is only for low-income households, which would allow them to look into specific low-income grants and government incentives. The developer could also potentially "bank" extra kWs. For example, if the developer allocates more kW then required to low-income one year, they could potentially use the extra kW to meet future year requirements.

CEC noted that although it would be hard to quantify savings from reduced administration and outreach costs, it is possible that developers could see some level of cost savings. CEC assumed that in a best case scenario developers may see a 5% reduction in costs, but this would only be achieved if an advocacy group, nonprofit organization, or government organization conducted implementation. SunShare noted that while they would see savings "it is unlikely SunShare would re-invest any of that money into more low-income clients because in the end, we would still be losing money on those clients because we would still be paying for the subscriptions."

Lastly, allowing developers to allocate larger amounts of kW's at a time would allow partner organizations to set up a better system/program to market to low-income households. Instead there is a very sharp learning curve for non-profits and housing authorities to learn about community solar and reach out to their networks – especially if they are signing up very few families at a time.

- **Increase the 5% low-income carve-out requirement:** Many interviewees (not developers) would like to increase the 5% carve-out and encourage developers to creatively work with low-income households. This could be done by the PUC or the utility. The PUC could increase the minimum carve-out to encourage additional participation by low-income households. Alternatively the changes could be done by the utility. For example, Black Hills in their most recent RES plan addressed the increase in low-income participation in two ways. First they requested design an acquisition process for solar gardens that "gives weight in the evaluation process to bids that propose to exceed the low-income set aside." Secondly, they are allowing bidders to "propose higher subscribed REC prices for low-income subscribers and

lower subscribed REC prices for other subscribers, as long as the average aggregate of all subscribed REC prices for the project meets the avoided cost cap for subscribed REC prices indicated in the RFP solicitation." (Public Utilities Commission, 2015)

- **Guarantee the bill credit:** The bill credit is generally the most financially significant benefit to community solar participants. Yet, bill credits are not guaranteed and may vary each month and year. If possible, the bill credit should be guaranteed during the contract term and at the full retail rate (i.e. takes into account transmission, generation, and distribution).

- **Increase low-income participation in community solar across the state:** Reach more low-income subscribers across the state by including municipal utilities and cooperative utilities in the low-income carve-out requirement.

- **Require that utility companies pay for RECs**: Require that utilities pay REC payments to developers for community solar projects and/or link REC payments to low-income subscriptions. In recent years the value of RECs has dramatically declined and as a result, developers are receiving less financial incentives from utility companies. In fact, recent proposals to Xcel Energy's community solar garden project submitted negative REC payments, in which the developer paid Xcel Energy for the REC. This resulted in an additional financial loss to the developers. See subsection *Potential Upcoming Program and Policy Changes* for more information.

- **Implement a statewide electricity tax to fund low-income subscriptions:** Through the California Solar Initiative, the state of California has collected 10%, or $216 million, of a general electricity charge to help fund solar installations for low-income subscribers. California then partners with mission based organizations, such as GRID Alternatives, to install low-income solar systems across the state. (Center for American Progress, 2014)

- **Invest a portion of LIHEAP funding into low-income solar installations:** The state of California implemented systems for 1,482 low-income households using LIHEAP ($14.7 million) funds and a match from outside partners ($3.5 million). (Center for American Progress, 2014)

- **Require that LIHEAP/HEAP recipients are enrolled in community projects**: The state of New York has recently proposed that all recipients of LIHEAP automatically become enrolled in community solar projects. This has allowed them to access a

previously defined market of low-income subscribers and reduces administration and outreach costs. (Franklin, 2015)[23]

- **Require that utility RESA programs dedicate a portion of funds to support low-income solar installations:** All utility customers are required to pay a small fee to support utility renewable energy programs (e.g., Xcel Energy's RESA fund). Yet, a majority of these funds subsidize projects for non-low-income subscribers since it is these subscribers that are more likely able to afford the high capital cost of solar installations and/or receive financing. Require that utility companies dedicate a portion of these funds to support low-income specific solar installations.
- **Develop legislation that supports low-income specific solar gardens:** Develop a structure to allow developers, non-profit organizations, or utility companies to offer a low-income specific solar garden.
- **Encourage community solar arrays to be located on brownfields:** Brownfields are lands that are too polluted for conventional uses and are left undeveloped. Many brownfields are found in or near low-income communities. These plots of land could be an ideal location for a large-scale solar array and if they are leased to the developers at a reduced rate the developers could pass along these savings to subscribers, specifically to low-income subscribers.

[23] New York has a Home Energy Assistance Program (HEAP) which utilizes LIHEAP funds. The terms are used interchangeably.

Other Notable Trends

Potential Upcoming Program and Policy Changes

Neither Xcel Energy nor the PUC indicated that changes to the low-income requirement are likely in the coming years, but the PUC did indicate that each utility company is able to suggest program changes on an annual basis. For instance, the geographic requirement was slightly modified last year with House Bill 15-1284.

In their latest renewable energy plan filing, Black Hills Energy has requested adding a low-income subscriber weighting factor when evaluating developers' program proposals. For example, solar garden developers that only meet the minimum 5% low-income requirement will be scored lower than solar garden developers that exceed the minimum low-income requirement. The PUC has yet to approve Black Hills Energy's plan, but if it is approved than this weighting factor has the potential to change the way solar garden developers engage low-income subscribers in Black Hills Energy's territory.

Xcel Energy has not indicated that they would give preference to solar garden developers that enlist a greater number of low-income subscribers.

In addition, several interviewees mentioned that the door is open for Xcel Energy to file a Phase II rate case where they could request a new rate structure that could affect solar users. For example, one of the non-profits interviewed for this effort said that Xcel Energy plans to petition the PUC to increase the electricity rate for all solar energy subscribers. This is an effort to capture "lost" fees that were not recovered from their recent proposal to change the net metering structure. Both Xcel Energy and the PUC were asked about this proposal but neither organization could confirm or deny this proposed petition. If this were to be pursued by Xcel Energy the increase in electricity costs could greatly discourage low-income subscribers from pursing solar energy. In addition, Xcel could charge more fees that directly affect solar users such as charging higher fees for new meters or annual solar customer fees.

Negative REC Payments

The PUC recently allowed Xcel Energy to accept negative REC bids for community solar projects. Historically, RECs have acted as a revenue stream for the developers and utilities utilize these to meet their RPS requirements. If utility companies do not pay developers for their RECs, developers fear that they will lose one of their potential revenue streams. (Trabish, 2015) As noted by Karen Gados from SunShare "If negative RECs continue, it will be difficult to invest in Colorado as we have in the past." (Lacey, 2015) When negative RECs are combined with the loss of solar panels for low-income subscribers, developers

experience two financial losses. In addition, there is concern that allowing a negative REC payment undermines the concept of a REC and many question how this will affect other state's renewable energy policies.

*Solar*Connect*

To date, no utility provider owns any community solar assets. However, utility providers are not restricted from offering their own community solar garden projects. Xcel Energy is exploring the community solar market with the development of the revised Solar*Connect program. This program would be the first community solar garden program owned and operated by Xcel Energy. Unlike community solar gardens offered by private developers, Solar*Connect would allow subscribers to maintain ownership of their RECs and the incentives would not be subsidized by non-participants. Xcel Energy will file their application for Solar*Connect in late 2015. It should be noted that Xcel Energy filed an application for a similar Xcel Energy-owned and operated community solar project in 2014 and this application was rejected by the PUC.

While the current version of Solar*Connect has not yet been commented upon by the developers, the 2014 Solar*Connect was opposed by the developers. According to written testimony submitted to the PUC by Tom Hunt, Vice President of Corporate Development for CEC, Solar*Connect could violate state law and prevent community solar gardens from expanding in the marketplace. The primary reasons cited include:

- Solar*Connect would compete with private community solar gardens and would provide a significant and an unfair competitive advantage.
- Solar*Connect would not be limited to the same restrictions as private community solar gardens: capacity (as kW), *adherence to the low-income carve-out requirement*, and siting within the same or adjacent county where the subscriber resides.
- Xcel Energy would be subject to pricing advantages not available to private developers.

SunShare also noted that they would be nervous that Solar*Connect would be structured like Xcel's Wind Source, in which Xcel charges a premium for renewable energy. Charging a premium would automatically bar low-income households from participating.

Moving Away from Small Customers

Several interviewees mentioned that the intent of the Community Solar Gardens Act was to allow renters, smaller households, low-income customers, and commercial facilities with inadequate roof space the ability to participate in solar.[24] However, some interviewees

[24] Per language from House Bill 10-1342 the reasoning behind the bill is as follows "It is in the public interest that broader participation in solar electric generation by Colorado residents and commercial entities be encouraged by the development and deployment of distributed solar electric generating facilities known as community solar gardens, in order to:

questions whether the intent of the bill is being circumvented by the new trend by developers to sell to mostly large users. The bill requires that each community solar garden has a minimum of 10 subscribers and none of the subscribers can have more than a 40% share of the garden. As such, developers can technically allocate 5% of the garden to low-income subscribers and the remaining 95% between 3 subscribers (as long as there are at least 7 low-income subscribers). Due to the costs of sales, it is more cost effective for developers to work with the least amount of subscribers possible. In return, many interviewees expressed concern over the increasing trend towards fewer customers benefiting from community solar.[25]

Increasing Interest in Becoming Community Solar Garden Developer by Non-profits and Public Housing Authorities

Several interviewees expressed interest in taking the "middle person" (i.e., the developer) out of the deal by becoming solar garden developers on their own. They hoped that in return they would be able to offer the benefits of community solar to a greater amount of low-income customers. While GRID Alternatives and Energy Outreach Colorado expressed interest, the Denver Housing Authority is currently moving forward with their plan to become a community solar garden developer through the Xcel Solar*Rewards Community program. On September 17, 2015 the Denver Housing Authority released a Request for Proposal for "Consulting Services for the Development and Operations and Maintenance of a DHA Community Solar Garden."

GRID Alternatives' new initiative with the CEO to utilize $1.2 million in grants is another example of non-profits trying to utilize community solar as a way to bring solar to low-income households. GRID Alternatives plans to build up to 12 solar PV projects ranging in size from 50 to 500 kW, with a total capacity over 1 MW.

Missing Connection between Energy Efficiency and Renewable Energy

Several interviewees mentioned that there is a missing connection between energy efficiency and renewable energy for both low-income households and developers. Energy

(i) Provide Colorado residents and commercial entities with the opportunity to participate in solar generation in addition to the opportunities available for rooftop solar generation on homes and businesses;
(ii) Allow renters, low-income utility customers, and agricultural producers to own interests in solar generation facilities;
(iii) Allow interests in solar generation facilities to be portable and transferrable; and
(iv) Leverage Colorado's solar generating capacity through economies of scale." (General Assembly of the State of Colorado, 2010)

[25] Lotus was not able to confirm this trend with the developers or Xcel.

efficiency is still considered the most cost effective way to reduce utility bills; therefore it should be encouraged in conjunction with (or prior to) renewable energy.

Renewable Energy May be Only Option that Offers Financial Assistance to Decrease Electricity Costs

In addition, it was mentioned by several interviewees that much of the low-income weatherization and utility bill assistance and funding was for heating costs. In Colorado, heating is usually through natural gas, not electricity. Therefore, renewable energy was considered even more valuable because many low-income households receive minimal or no funding support for the electricity side of the meter. Community solar enabled non-profits and housing authorities to provide a more holistic utility bill reduction.

Conclusion

Community solar has been very active in the State of Colorado and continues to expand at a rapid pace. This growing market suggests that there is significant potential to expand the community solar market with low-income subscribers.

The major stakeholders within the community solar market have identified a series of program hurdles that may limit the growth potential for community solar within the low-income market. Through a series of interviews with participating solar garden developers; utility companies; regulatory authorities; nonprofits; and housing authorities and through original research on Colorado's solar garden program, Lotus has identified a menu of program best practices and policy recommendations. The CEO is encouraged to explore these options and vet each one for cost, feasibility, ease of implementation, relative magnitude of impact, and any other factor that affects CEO's goals. By implementing the right combination of program best practices and policy improvements low-income subscribers will be better served and the strength and sustainability of the community solar program will be improved.

Lastly, conversations with interviewees have indicated that Colorado is leading this discussion. As the CEO develops policy and program changes other states will be looking to Colorado for guidance. The CEO is encouraged to share these best practices and policy recommendations and to work with national partners to streamline the program improvement process.

Appendix A: Xcel Energy's Guidelines for Low-Income Subscribers

Xcel Energy's Solar*Rewards Community program requires each participating solar garden to have a minimum of 5% of the garden kW allocated to low-income subscribers. This requirement must be met prior to the production meter installation and project completion.

For the purposes of the program, any subscriber that is a member of one of the following groups qualifies as a low-income subscriber:

- Energy Outreach Colorado
- The Atmosphere Conservancy
- Colorado LEAP Program
- Municipal Housing Authority (ex: Denver Housing Authority)

All low-income subscribers must have a completed Low-Income Verification Form, signed by a representative of one of the above organizations.

Qualifying New Organizations:

From time to time, additional organizations will come up that would or could participate in the program. They will need to be treated on a case by case basis. As with the organizations listed, a quick discussion with Pat Boland, the Company's low-income organization subject matter expert, will help in determining whether the organization should be added to the list. The criteria we used:

- Does the organization work help pay energy bills or house low-income constituents?
- Is the organization a reputable, widely known organization with a strong history of aiding low-income constituents?
- Does the low-income constituent served at a least have an Area median income (AMI) of 60% or less of the Colorado median income?

If the answer to all three is yes, then their constituents should be allowed to participate in the program.

The third item in the list is up for interpretation and it is more of a guideline based on past decisions than a hard and fast criteria. The logic for including this criteria is that DHA and HUD use AMI to determine participation in their program. DHA has housing for constituents that are 60-40% AMI or less. We agreed to allow the housing authorities into

the program so it seems fair to allow others that meet this requirement and the others listed.

AMI is the area median income level in the state. The AMI in Colorado is:

Number of Persons in Household	CO Median income	DHA (up to 60% AMI)
1	$55,600	$33,360
2	$63,500	$38,100
3	$71,400	$42,840
4	$79,300	$47,580
5	$85,700	$51,420
6	$92,000	$55,200
7	$98,400	$59,040
8	$104,700	$62,820

(Xcel Energy, 2015)

Appendix B: GRID Alternatives List of Essential Consumer Protections for Low-income Customers

The following is a list of consumer protections taken verbatim from a memo that GRID Alternatives sent to the State of New York Public Service Commission (GRID Alternatives, 2015):

- Clear review of the terms of the agreement and make sure those terms are included in the official signed contract.
- Guaranteed long-term bill credit.[26] Clear explanation of assumptions and estimates versus guarantees when it comes to electricity usage and prices over time.
- Clear review of qualifications for subscriber organization(s) and developer(s).
- Clear review of maintenance or outage issues at a Community DG project and what that means for the subscriber's bill if generation is impacted.
- Point of contact for the subscriber.
- Appropriate steps, fees, or implications for the customer to end their subscription early.
- Protections against hidden fees (late payment, contract termination, etc.) or unreasonable fee or rate escalators.
- Community solar is independently run and managed by each solar garden developer with few, if any, checks and balances for the subscribers. Provide checks and balances for each developer's program and provide statewide assistance to subscribers as requested.

[26] This would not apply to the current Xcel program structure because a bill credit is not guaranteed.

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