Low-Income Community Solar Demonstration Project Case Study: Holy Cross Energy

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COLORADO
Energy Office

Project Details

Holy Cross Energy's Demonstration Project Highlights

- The project is part of Holy Cross Energy's larger renewable energy strategy, which aims to increase the amount of solar on its grid by 40% by 2025.
- Subscribers receive project benefits on two-year terms.
- Subscribers are capped at 5kW due to the small size of the system, which will allow for an average project cost savings of 46%.
- Holy Cross Energy will work with GRID Alternatives, CEO's weatherization assistance program and local partners to ensure that clients receive energy efficiency education. and services.

INTRODUCTION

Approximately 30% of Colorado households pay more than 4% of their annual income on energy bills. Although several financial assistance programs exist to relieve high energy burden for low-income households, additional opportunities remain to achieve deeper cost savings by specifically targeting reductions in electricity costs.

The Colorado Energy Office's (CEO) Weatherization Assistance Program is committed to improving energy affordability for low-income households. Guided by this commitment and in response to a gap in electricity cost reduction programs, CEO launched the Low-Income Community Solar Demonstration Initiative in 2015. The Holy Cross Energy demonstration project is part of the statewide initiative that aims to reduce electricity costs for low-income households by offering community solar options to households that are eligible for weatherization services.

OBJECTIVE

The demonstration project has eight utility partners, including Holy Cross Energy (HCE), a cooperative utility that provides electric services to more than 55,000 customers located in the counties of Eagle, Garfield, Gunnison, Mesa and Pitkin. This case study describes HCE's income-qualified community solar project and informs utilities, governments, and policy makers how community solar projects can impact low-income communities.

PROJECT PARTNER ROLES

HCE partnered with CEO and GRID Alternatives (GRID) to develop a 145 (kilowatt) kW community solar array that will support up to 45 low-income co-operative members at a time. The primary goal of the project was to reduce costs for low-income households and increase the amount of renewable energy on HCE's grid.

Each partner played a key role and will continue to play a key role moving forward:

- CEO provided project evaluation and funding support.
- GRID provided the design and implementation framework; designed and led the installation of a new 145 kW system; provided everything "behind-the-meter" including all equipment panels, inverters, balance of systems, and labor; developed workforce` training program; and provided communication and outreach support. Moving forward GRID will maintain equipment warranties.
- HCE provided funding support; the land and interconnection; conducted outreach; and managed subscriptions. Moving forward HCE will provide program administration, maintain full ownership, and conduct all operation and maintenance (O&M) activities.

PROJECT IMPLEMENTATION

The HCE Board has publicly supported and aggressively pursued renewable energy for more than a decade. In 2004, HCE committed to 20% renewable energy by 2020 (which they

met in 2015) and, in 2016, HCE committed to 35% renewable energy by 2025, which they are close to achieving. In 2016, 34% of the electricity came from clean or renewable energy sources. Of that 34%, wind accounted for 13%, followed by solar (9%), biogas and biomass (7%), hydro (3%), and coal mine methane (2%). "Our ratepayers are large advocates of renewable energy, especially energy that is produced locally" said Chris Hildred, Power Supply and Special Projects Supervisor at HCE. In 2010, HCE partnered with community solar developer Clean Energy Collective (CEC) to provide the first third-party-owned community solar project in Colorado that provides renewable energy produced locally.

In 2015, GRID proposed working with HCE on the Demonstration Project. The project was introduced to HCE's Board of Directors in October 2015 and was approved for its ability to meet HCE goals of helping low-income members and increasing the amount of renewable energy on the grid. The solar garden was interconnected with HCE's grid in December 2016. The first subscriber was approved in December 2016 and the array was almost completely subscribed within three months. Subscribers began seeing cost savings in March 2017.

"This project is a win-win, it helps Holy Cross members who are having a hard time making ends meet and adds more renewable energy to our power supply mix."
– HCE former CEO Del Worley

The project was implemented using a turn-key installation in a "barn-raising" community development model, where subscribers donated 16 hours of sweat equity and worked alongside GRID, HCE staff, local elected officials, schools, and other community members to install 546 solar panels. The panels were installed on HCE property adjacent to a large warehouse.

ENERGY GENERATION

HCE could directly connect their existing community solar garden to the grid, saving costs and time. Under most circumstances, HCE would have gone through the local jurisdiction to get electrical permits, but the Town of Gypsum waived the electrical permit since the array was connected directly to a utility resource on utility property.

Additionally, due to the array's small size, it is recognized as a qualifying facility under Public Utility Regulatory Policies Act (PURPA). A qualifying facility can either be a small power production facility (under 80 MW) or a cogeneration facility. This means that HCE did not have to get Xcel's permission to install an array, which would have required more time and costs.

PROJECT COSTS

The project cost $400,099, with $174,000 covered by CEO's grant and $226,099 cash and internal time contributed by HCE for equipment ($194,300) and a line extension plus HCE staff time ($31,799). Direct project costs including equipment, construction materials and GRID staff time accounted for approximately 96% of total project costs, while outreach and administration accounted for approximately 1% and 3% of project costs, respectively. HCE also provided in-kind support including the donation of land, billing software, and ongoing program administration.

HCE believes that GRID's project was on par with other similar sized project costs. CEO's financial support was critical to the implementation of the project. However, even with CEO's support, HCE paid $226,099 that HCE does not expect to recoup.

"Without the CEO grant, the project would not have moved forward."
-Chris Hildred, Power Supply and Special Projects Supervisor

Moving forward, the project will include administration and recruitment costs. HCE is unsure how much it will cost to recruit new subscribers; however, it has built approximately $2,627 into the budget for admin and O&M costs each year with an annual increase of 3%.

PROJECT PRODUCTION

HCE plans to provide the benefit of community solar for 20 years. During that time, it expects the array to produce 5.37 million kWh and reduce costs for subscribers by more than $500,000.

The estimated annual kilowatt-hour (kWh) production of the solar garden was modeled using PVSyst. Long-term degradation is assumed to equal 0.5% per year. In Year 1, the system is expected to produce 228,147 kWh. Actual production data from mid-December through May show that the system produced 86,830 kWh, while estimated production during that same period was 106,231 kWh. During this timeframe, the system has produced 17% less electricity than expected. This is partially due to a conductor fault in one of the project's service panels on May 15th which knocked the array offline for more than a month. In addition, the array produced less electricity then expected in January

and February due to abnormally high amounts of snow and clouds.

Solar produces energy while the sun shines and provides the most energy during peak solar radiation (which occurs at solar noon when the sun is highest in the sky). The low angle of the sun at sunrise and sunset results in the atmosphere filtering the sunlight more and results in less energy. Solar does not act as a peaking resource for HCE. In the winter, demand peaks from 7 p.m. to 10 p.m. when snowmaking is occurring at ski resorts and restaurants are open. In the summer, demand peaks between 5 p.m. and 7 p.m., which has minimal overlap with solar resources.

PROJECT OUTREACH

HCE and GRID used a variety of marketing platforms including program brochures, radio ads, promotion on HCE's website, and direct outreach to members. Due to its diverse membership, HCE and GRID also hosted five informational workshops in five separate communities (Aspen, Avon, Carbondale, Gypsum, and Parachute). Attendees were asked to bring their 2015 Federal Income Tax Return or other proof of income and a recent HCE energy bill. At the end of the workshop, attendees could sign up.

"While only a few people showed up to each workshop, they were worthwhile since we were able to help subscribers with their paperwork – which proved to be one of the hardest parts of attaining participants."
-Chris Hildred, Power Supply and Special Projects Supervisor

To qualify, subscribers had to be in good standing with HCE and have a total household income at or below the 80% Area Median Income (AMI) levels for their corresponding county (Eagle, Garfield, Gunnison, Mesa, or Pitkin).

SUBSCRIBER STATISTICS

The solar garden will serve up to 45 subscribers at a time, with each utilizing varying amounts of solar energy from the garden. In 2017, system sizes range from 0.53 kW to a maximum of 5 kW, with an average system size of 3.33 kW. Subscribers will receive benefits for a two-year period and can reapply for participation in the future.

Twenty-two of the 43 accounts had been previously served by CEO's Weatherization Assistance Program. The remaining 21 were eligible for weatherization or Energy Outreach Colorado program called Colorado's Affordable Residential Energy.

HCE's goal was to offset approximately 75% of each household's electricity use, based on the subscribers' previous 12-month electricity consumption, resulting in approximately 50% cost savings. However, many subscribers used electric heat that drastically increases electric demand. For example, the range of annual electricity used by subscribers ranged from 988 kWh to 39,823 kWh/year. To offset 75% of an electric-heated household demand, HCE would have had to allocate a much larger amount than the 5kW maximum.

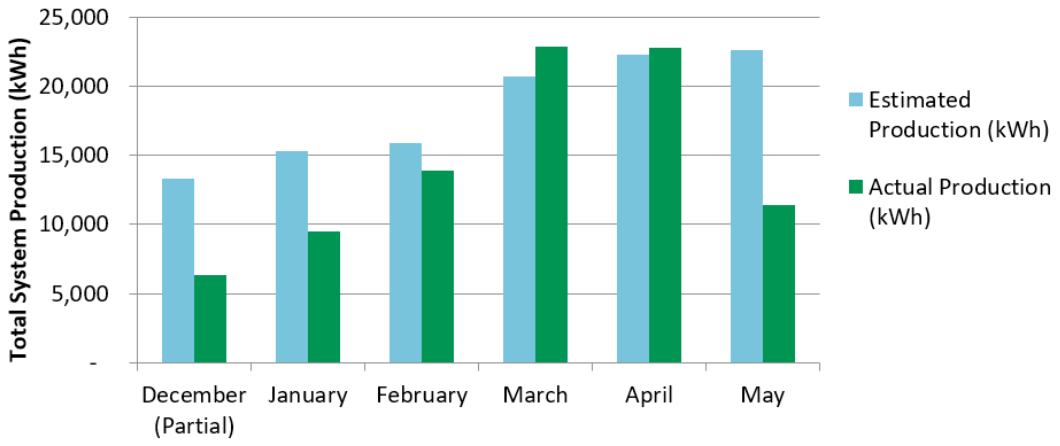
Sixteen of the 43 accounts receiving credits were at the 5kW program cap and will have less than 50% of their electricity cost offset. Due to the broad range of electricity use, the expected savings range for subscribers ranges from 15% to 57%.

COST STRUCTURE

The subscriber pays HCE the retail rate for electricity consumed plus fixed monthly charges. In return, HCE provides a bill credit to subscribers for the electricity produced by their panels.

The 2017 base residential retail rate is $0.0985/kWh and is expected to continue to increase. The bill credit is the difference between the retail rate and the amount HCE is

FIGURE 1: ESTIMATED VERSUS ACTUAL SYSTEM PRODUCTION



charging for solar electricity ($0.02/kWh). In 2017, the bill credit is $0.0785. Subscribers will pay HCE $0.02/kWh for solar electricity consumed plus fixed monthly charges of $9. The solar payment will remain fixed for the term of the contract. Fixed charges include a monthly base charge, taxes, and a franchise fee. Taxes, franchise fees, and the WE CARE surcharge are all calculated as a percentage of base bill charges (consumption, service charge, etc.) and, therefore, they are largely tied to volumetric billing units.

This model provides subscribers insulation against rising electricity costs and helps subscribers budget for long-term energy costs. In addition, subscribers can carry credits forward on a monthly basis through the end of the subscription period.

Since HCE solar payments do not escalate, even though electricity retail rate costs do, the savings will grow over time as solar payments stay constant and the retail rate increases. For example, HCE subscribers in 2017 will save $0.0785 per kWh (they pay $0.02, compared to retail rate of $0.0985), while subscribers in 2041 could save approximately $0.121 per kWh, if retail rates escalate approximately 1.5% per year.

Using 2016 usage numbers, HCE's project is expected to save a total of $18,500 for all subscribers. Assuming an average annual electric cost of $49,000, subscribers will save on average of 40%. In addition, HCE has committed to encourage non-weatherized households participating in the program to reduce electricity use through CEO's Weatherization Program and the Energy Outreach Colorado program, Colorado's Affordable Residential Energy. With these factors, the impact could be much greater than 40%.

HCE'S NEXT STEPS

The community solar project is part of HCE's larger renewable energy strategy. In 2017, HCE issued a request-for-proposal for up to 5 MW's of photovoltaic electric generation located within HCE's certificated service territory and interconnected with its generation system. If the project moves forward, the amount of solar on HCE's grid will increase by 40%, and the amount of renewable energy will increase by 3%. This project is part of a larger plan to increase the amount of renewable energy and clean fuels on the grid, while reducing HCE's carbon footprint. HCE will also continue to encourage and deploy energy efficiency technologies throughout their territory.

Subscriber Spotlight: John and Amalia Castilla

John and Amalia Castilla are extremely busy parents of five growing children and are always looking for ways to reduce costs. Although they live in an energy efficient, Habitat-for-Humanity LEED-certified silver house, they are always proactively looking at ways to reduce their energy costs through energy conservation measures and behavioral change. Multiple times John and Amalia considered putting solar on their house to save money; however, they found solar to be too expensive. When John heard of the HCE Community Solar Garden project, he quickly jumped at the opportunity.

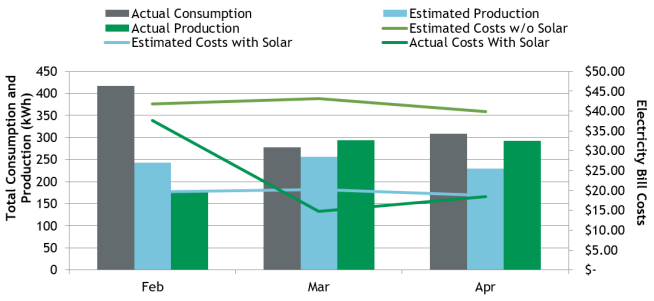
"The Community Solar project is a worry-free, win-win situation for us. The program is a great alternative to rooftop solar. We will see significant cost savings and reduce our environmental impact which is a wonderful blessing all around." – John Castilla, subscriber

John attended the HCE information workshops, reviewed the handouts, and signed up immediately. Even though their home is energy-efficient, John believed his family could see significant electricity savings of almost 50% a year by participating. While the sign-up process was smooth, there was a large gap between signing up in November and receiving credits in March.

"Once the credits started to arrive on our bill, there was great educational material provided that explained how the program worked, why credits might fluctuate due to weather and time of year." -John Castilla, subscriber

The educational materials were especially helpful in explaining how important it is for the Castillas' house to be as energy-efficient over the summer when the solar array is producing the most electricity. As a reward for being energy efficient, the excess solar credits are rolled over month-to-month and can be used in the winter when the array is not producing as much electricity.

FIGURE 2: ESTIMATED VERSUS ACTUAL SYSTEM PRODUCTION FOR THE CASTILLAS



Estimated Versus Actual Performance

In 2016, the Castillas' household used 3,806 kWh and spent $487 on electric bills. To offset usage, the Castillas' household was allocated 1.9 kW of solar energy. The Castillas expected the solar to offset approximately 75% of their electricity usage and about 47% of their costs.

However, in the first full month of benefits they saw 100% of their electricity usage offset and their electricity costs offset by 61%. The remaining 39% of costs on their bill was from the fixed monthly costs and a WE CARE surcharge – a non-voluntary program run by HCE to reduce carbon emissions.

Utility data show that the Castillas' consumption to date was slightly higher (around 3%) than it was during the same time last year, and their solar allocation produced 11% less electricity than expected to date. The system may have produced less electricity than expected due to secondary fault in one of the panels which knocked the array offline and lower solar radiation then expected in December, January, and February.

Even if the solar array produces more electricity, subscriber costs will never be fully offset. Subscribers are required to pay a monthly fixed charge and if a subscriber lives in an incorporated area, they are required to pay a franchise fee of 3%. For example, the Castillas' average annual consumption is 3,806 kWh and they spend on average $487. If their system were to produce 100% of their usage, the Castillas will be required to pay an annual solar payment of $76.12 (3,806 kWh at $0.02/kWh), 12 monthly charges for WE CARE program of $9.64 (12 months at approximately $0.80) and 12 monthly charges of $108 (12 months at $9 each month) for a total annual payment of $194. In this example, the most that the Castillas could save would be 60%.

Next Steps

The Castillas used their first month's savings to replace their CFLs with LEDs through the HCE rebate program. They hope to use additional savings to purchase the next energy-efficient upgrade – window shades -that keep out the cold during the winter and keep the home cool during the summer.

"Everywhere we can save money from natural gas to electricity to water, we do."- John Castilla, subscriber

Lessons Learned

SUCCESSES

- The project has low operating costs and minimal O&M.
- The project aligned with HCE's core values of reducing costs for low-income members and increasing the amount of renewable energy on the grid.
- Subscriber electricity costs were reduced.
- Lower electricity costs will help reduce the number of non-payments that HCE will receive.

CHALLENGES

- The project had a high capital cost.
- The avoided wholesale costs were lower than HCE would have liked since solar only meets Xcel's peak demand about an hour a day during the summer.
- Without the CEO grant, the project would have been too expensive for HCE to pursue.
- The qualification process took multiple months.

BEST PRACTICES

HCE's case study provides insight on how to optimize future low-income community solar garden projects.

Install the array on utility-owned land. Installing the array on land owned by the utility and adjacent to utility headquarters can simplify interconnection and reduce costs.

Partner with established community organization that work with low-income community. HCE stated the importance of working with community organizations that were trusted by low-income communities. Working through these organization allowed for easier, targeted marketing. The trust that these organization had already established resulted in subscribers being less hesitant to sign up for such an innovative program.

Be flexible with AMI requirements. Several utilities in the program used an AMI requirement of 200% or below. In HCE territory, this would significantly reduce the pool or potential candidates that could really benefit from the program. They believe an AMI requirement of 80% or below is more reasonable.

Set a realistic expectation of savings. HCE believes that you must provide a realistic expectation of cost-savings from the program upfront. They would recommend having a calculator out during the qualification process to make sure each household has an accurate estimate of savings.

Ensure consistent communication and expectations throughout the construction period. There were several constructions delays due to miscommunication and potentially mismatched expectations upfront.

Test out billing software in advance. HCE noted the importance of testing the system before sending out the first round of bill credits.

Make the connection between energy efficiency and savings. Subscribers will receive marketing materials for energy efficiency programs. HCE hopes that subscribers will take advantage of these programs to ensure that they still experience utility cost savings, once they are termed out after 2-years from the community solar program.

Put a cap on the amount of solar each participant can subscribe to. Due to the small size of the array, HCE thought it was important to put a cap on how much solar each participant could be allocated. For example, to offset 75% of one participant's electricity demand, HCE would have had to allocate 24 kW (about 17% of the total array) instead of the capped 5 kW to that household. By keeping the distribution small, more households can benefit.

POLICY CONSIDERATIONS

Lessons learned from the HCE community solar garden present the following policy considerations.

Wholesale costs can be the largest financial hurdle on whether a project is cost-effective for a utility. Where and how a co-operative utility purchases its power can greatly affect its ability to provide community solar. For example, HCE currently purchases a large share of their electricity from Xcel Energy but are not able to sell any additional power they create to other utilities. In the future, HCE hopes to participate in a market where they could sell surplus solar power to other utilities during the summer when HCE electricity demand is lower but electricity demand is higher for other utilities which experience higher air-conditioning needs. In addition, HCE could buy other renewable energy such as wind, hydro, and biomass to help offset their peak demand during the winter snow-making and tourism season.

Fixed charges play a significant role in the potential for reducing energy costs. Community solar incentives are typically provided as bill credits – credits on utility bills – and are issued as a dollar per kWh amount at a value less than retail rates. Fixed charges are not affected. While a subscriber's bill will be reduced by the bill credit amount, the subscriber will always be responsible for paying fixed

Lessons Learned

charges. The degree to which a subscriber's energy costs are reduced is a direct function of the amount of fixed charges relative to the cost of electricity. In the HCE solar model, subscribers have a very low monthly fixed cost of $9. This can lead to a very high reduction in costs, for example one subscriber experienced a 77% reduction in utility costs in one month. If the fixed costs do not completely cover the costs to serve a customer and the community solar program offsets all electricity costs, then the additional costs that are not covered to serve that subscriber will potentially be covered by non-participating members. On the flip side, low monthly fixed costs may disincentive utility from moving forward with a similar program due to a lower return-on-investment of a project.

The solar payment structure affects subscriber's total cost savings. The amount that each subscriber pays to participate in community solar and associated escalation rates affect the subscriber's total savings. HCE solar payments do not escalate even though electricity retail rate costs do. Therefore, the savings will grow over time as the solar payments stay constant and the retail rate increases. For example, HCE subscribers in 2017 will save $0.078 per kWh, while subscribers in 2041 could save approximately $0.121 per kWh.

Capping the size of a subscriber's portion of the project will affect high-electricity user's potential savings. HCE capped every subscriber at the less of 75% of their previous 12-month electricity use or 5kW. One subscriber's consumption would require a 24-kW system allocation using that sizing guidance. In return, the subscriber received only a 5% reduction in costs during the first month. Sixteen of the forty-three accounts that received credits were capped at the 5kW program cap.

Project Snapshot

QUICK STATISTICS

- 144.69 kW solar garden
- 43 subscribers
- 99.9% subscribed
- About half of subscribers have received Weatherization services

UTILITY TYPE

- Cooperative Utility
- Serves 56,000 meters located in the counties of Eagle, Garfield, Gunnison, Mesa, and Pitkin
- Receives wholesale electricity from Xcel Energy

ENERGY BURDEN

- Approximately 8% of residents in Eagle County, 10% in Garfield County, 13% in Gunnison County, 14% in Mesa County, and 7% in Pitkin County live below the poverty line, compared to a statewide average of 12%.

PROJECT GOALS

1. Reduce members' energy costs, specifically low-income households
2. Provide a local, resilient electricity source
3. Provide locked-in, predictable energy prices
4. Provide renewable energy and diversify energy supply
5. Enable HCE's staff to get hands-on experience
6. Support HCE's mission and ratepayer's values of renewable energy and energy justice

PROJECT PERFORMANCE

- On average, project expects approximately 46% cost savings and 53% electricity offset by solar
- Expected to produce 228,147 kWh annually
- To date, the system has produced 18% less electricity than expected

PROJECT COSTS

- Total project cost $400,099
- CEO grant $174,000
- HCE contribution $226,099, plus in-kind support

SUBSCRIBER PAYMENT STRUCTURE

- Retail rate $0.0985/kWh
- Monthly fixed charges $9
- Subscriber solar payment $0.02/kWh

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