Solar Case Studies

NRECA

A Touchstone Energy® Cooperative

Table of Contents

Summary 3
Tri-County Electric Cooperative. 4
Southern Maryland Electric Cooperative 8
San Miguel Power Association 13
Okanogan County Electric Cooperative 19
Green Power EMC 25
Cherryland Electric Cooperative 29
Kit Carson Electric Cooperative 38
Great River Energy 46

Summary

Fast evolving technologies and policy initiatives are transforming all sectors of the electric utility industry, including electric cooperatives. No energy source is changing faster or generating more questions than solar energy.

Promoted by federal and state mandates and financial incentives, the use of photovoltaic panels to produce electricity is surging. Declining system costs have made the technology more affordable and further juiced the solar surge. That growth, however, is not without consequences for how cooperatives do business. There are serious implications, financial, technical and strategic.

As solar generation's capacity grows and solar power's cost continues to decrease, non-utility providers are inviting consumers to choose solar for a portion of their electric power needs. Many electric cooperatives are wrestling with the question of how to respond. Is solar a promising opportunity for future growth? Or is it a competitive threat to cooperatives' core business?

Electric cooperatives are embracing the challenge and in many places leading the way in bringing solar energy to people. Across the country, co-ops have almost 240 megawatts of solar capacity online or on the drawing board. By empowering their consumer-members to have a role in determining how their energy needs are met, cooperatives provide innovative solutions that balance their business priorities and consumer goals while ensuring reliable, affordable and sustainable electric power for all.

The following eight case studies illustrate some of the innovative ways cooperatives are satisfying member-consumers' demand for solar-derived electricity. These profiles run the gamut—from generation and transmission cooperatives to small distribution cooperatives, from Washington state and New Mexico to Minnesota and Georgia.

You'll find that the solar solutions they've devised are equally diverse.

NRECA®
A Touchstone Energy® Cooperative

Solar Case Study

Tri-County Electric Cooperative

NRECA

A Touchstone Energy® Cooperative

1. Company Profile

Tri-County Electric Cooperative (Tri-County) serves approximately 13,000 meters in the southeastern corner of Minnesota. Tri-County is an all-requirements member of Dairyland Power Cooperative, its power supplier. Dairyland's policy allows an exception to its All Power Requirements Contract that affords its member cooperatives the opportunity to own or contract for a set capacity of utility-scale distributed generation. Tri-County's service territory has a challenging topography and is heavily wooded. The member composition is mainly residential and farmland, averaging about four members per mile of line, and agriculture is the primary economic driver in the area. About 20 percent of Tri-County's load is for resale to municipal utilities under contract.

2. Renewable Profile

The cooperative has constructed a community solar array of 73.8 kw. Tri-County selected tenKsolar's RAIS XT-28 photovoltaic system (www.tenKsolar.com), an integrated system whose components are designed to work together. The reputation and Minnesota roots of tenKsolar played a large role in its selection.

This array consists of 180 modules of 410 watts each, and 10 6 kw RAIS inverter buses. They were ground mounted using Hubbell Helical Coil foundations on a tenKsolar-rail mount-system. The system is projected to produce 107,651 kwh annually. The footprint of the array is about 107 feet by 78 feet. The co-op had been considering a solar project for three years prior to the project's commissioning on July 22, 2014, and it took approximately one year from Board approval to final construction of the project.

3. Financing and Rate Design

Local control and ownership was a primary goal of the co-op. Tri-County considered various financing and ownership models before deciding on the tax equity flip model, facilitated by the National Renewables Cooperative Organization (NRCO). Federated Rural Insurance Exchange served as the tax equity investor.

Under the tax equity flip model, the cooperative forms a taxable subsidiary, and this subsidiary and the tax equity investor form a special purpose entity (SPE). The SPE constructs, owns and operates the array, and has a purchase power agreement with the cooperative for the output. In the first stage of five or more years, all distributions and tax benefits (investment tax credits, accelerated depreciation, etc.) from the SPE are distributed to the owners in a 99 to 1 split: 99 percent to the tax equity investor and 1 percent to the cooperative subsidiary. After the initial term, the split ratio "flips": 95 percent to the cooperative subsidiary and 5 percent to the tax equity investor. At that point, the cooperative subsidiary can buy out the tax equity investor at fair market value. For more detail on this model, please see the NRECA SUNDA Business and Financing Field Manual.

Tri-County, through the SPE, owns, maintains, operates and insures the array. Units are sold to members for $1,400 each. Members do not own a specific module of 410 watts, but rather a 180th interest in the output of the total array. Members who purchase a unit receive a 1-to-1 kwh credit for their share of kwhs produced by the array against those kwhs consumed by the member. This credit will be applied monthly to the members' electric bill over the next 20 years. This is accomplished through software provided by the National Information Solutions Cooperative (NISC), which also provides the billing software to Tri-County. The member does not receive rebates or tax benefits for participating. Any Renewable Energy Credits stay with the cooperative to offset future costs associated with the array.

4. Project Development

Site visibility was of primary importance. The co-op's headquarters campus was a suitable location for the array. Winona Renewable Energy, LLC, a local PV contractor with experience in this type of project, performed a yield projection of the site. Star Energy Services, which is owned by a consortium of cooperatives, performed the engineering review.

Permitting and licensing required coordination with the local city regarding ordinances (zoning), as well as some discussion with the local electrical inspector about the need for running low-voltage cable through a conduit and for fencing the array. A compromise was reached to avoid fencing by relocating the low-voltage cables away from areas where someone could reach them. The array is a single-phase interconnection, which was interconnected directly to Tri-County's three-phase distribution feeder at a primary voltage of 12.47 kV and not net-metered to the adjacent headquarters building. The PV contractor was responsible for conducting acceptance testing and commissioning.

5. Operations and Maintenance

Operations and maintenance procedures and schedules are still under development. Warranties on the components of the array are 12 years on the panels, 25 years on the inverter bus and 25 years on the panels for kwh production degradation below 92.5 percent. The only unscheduled maintenance issue was from a rock thrown by a lawnmower, which broke the glass on one module, which was replaced by the contractor. Given the loading of the feeder that the array was connected to, initial calculations showed that no operational issues would be anticipated, and none have been observed. No changes to the electric distribution system, mitigation techniques, or technologies were required.

6. Telemetry

The cooperative does not utilize SCADA technology, and none was required for this array. Output of the array is monitored and posted in real time on the co-op's website through the use of a third-party vendor, Solar Edge, using its eGauge system. Tri-County does have an advanced metering infrastructure system, but it is not currently being used to actively manage DG on its system.

7. Administrative Impacts

No additional personnel were required; however, the marketing and member services departments were overwhelmed at first by questions from members. That has since scaled back to a manageable level. Accounting personnel worked with their software provider, NISC, to accommodate changes needed in order to bill purchasers of units in the array; the changes related to being able to apply the kwh credit for production from the array. Some additional work on the cooperative's website was required to accommodate the program. Tri-County communicated this project through newsletters, press releases, social media, its website, and other normal communications channels.

8. Renewable Policy Development

Tri-County has had DG policies in place for some time. Minnesota has a mandated 25 percent renewable energy generation requirement by the year 2025. In addition, a state-mandated DG renewable connection policy was developed in conjunction with cooperatives in Minnesota. Cooperatives are required to net meter accounts up to 40 kw.

9. Member Interest in Solar

Over the years, the cooperative has used surveys to ask members about their interest in renewables. Recent surveys showed a 10 percent to 20 percent interest in solar. Small-scale solar is becoming more affordable with more installers to choose from and, as a result, member interest is increasing. The Board decided to move forward as a result of a strategic planning initiative. The board wanted member support and involvement, so the cooperative utilized its standing Member Advisory Committee as a sounding board for this project. The Advisory Committee endorsed it enthusiastically.

The initial plan was to develop a 40-kw array, but because of member interest, it was soon expanded to a 73.8-kw array prior to construction. So far, 88 percent of this new total array has been sold. Members pay $1,400 per unit of interest in this array, which amounts to 180th interest in the output (kwh) of the total array on a pro-rata basis. The share is then credited against the consumption on their electric bill on a one-to-one basis. The cooperative currently has approximately 100 participating members, with several purchasing more than one unit, further indicating member interest in renewable energy. An expanded special section on Tri-County's website is devoted to the "Renewable Rays" program. The section includes background on the project, answers to a number of frequently asked questions and photos of the array both while under construction and upon completion.

As a point of reference, about 50 members (approximately 1 percent) of Tri-County have on-site DG systems.

10. Business Options

Tri-County decided to utilize a community solar concept to maximize visibility and to give members the opportunity to have solar without investing a lot of money or locating a panel at the members' location. Some members do not have the appropriate topography (too hilly or too many trees) or the right building type to accommodate a solar panel on site, yet they still want to participate in solar. The cooperative also determined early on that it would be beneficial to control the project and not utilize a third party to own or market the array. The final installed cost of the array was about $2.76 per watt.

11. Lessons Learned

Co-ops do not need to start from scratch. There are many co-op-based models to choose from that can fit your needs, so find one that you are comfortable with.

Based on the installed cost, especially the soft costs associated with the contracts and agreements required, Tri-County would have opted for a larger array to leverage economies of scale. It is about the same amount of work to develop a 100-kw array as a 10-kw array.

The board kept it in perspective that a 74-kw array was going to be less than the cost of a new large bucket truck, and would provide value to the members over the 20-plus-year life of the project.

Location, location, location: The location of the cooperative's campus was also a big plus that solidified the tie between the co-op and the solar array, and it is suitable for another array expansion in the future.

In the end, Tri-County affirms that the array was a good decision, and that it has been a success for the cooperative and its members on many levels.

For additional information, contact:

Brian Krambeer
CEO, Tri-County Electric Cooperative
bkrambeer@tec.coop
Ph: 507-864-7783

Ted Kjos
VP Marketing/External Relations,
Tri-County Electric Cooperative
Ph: 507-864-9232

Solar Case Study

Southern Maryland Electric Cooperative

NRECA

A Touchstone Energy® Cooperative

1. Company Profile

Southern Maryland Electric Cooperative (SMECO) serves approximately 160,000 meters in an area that includes south and southeast of Washington, D.C. The 1,150-square-mile service area is a mix of rural and suburban areas, most of which is within commuting distance of Washington, D.C., and Baltimore. The service territory lies entirely within the PJM control area and is bounded by water on three sides: the Chesapeake Bay to the east and south, and the Potomac River to the west. It has a clearly defined service boundary with the adjacent investor-owned utilities: Potomac Electric Power Company on one side and Baltimore Gas & Electric on the other. The area has a history of significant weather events including hurricanes, tropical storms and ice storms. Numerous areas have considerable tree canopies, and a substantial portion of SMECO's operations budget is devoted to right-of-way (ROW) maintenance.

About two thirds of SMECO's load is residential and one-third is commercial, most of which is to retail stores. The cooperative is unaffiliated with a G&T cooperative and, as such, must manage its own power supply portfolio. SMECO utilizes the services of ACES Power Marketing to assist in this task. The SMECO system is comprised of 230-kilovolt transmission, 69-kV subtransmission and 12.47-kV distribution circuits. SMECO has about 11,600 miles of distribution line and averages about 14 members per mile.

The cooperative's peak system load is bimodal in nature, with annual peaks alternately occurring in both the winter and summer seasons. Solar offers no apparent peaking capacity in winter months and little apparent peaking capacity in summer months, as system peaks occur later in the day than the peak output of the solar array. The cooperative's average system load is approximately 400 megawatts.

2. Renewable Profile

In December 2012, SMECO completed construction of a 5.5-MW solar array, located on 33 acres of a 47-acre parcel owned by SMECO that is adjacent to its engineering and operations center in Hughesville, Maryland. The capacity factor of the array is estimated to be 18.5 percent. The duration of the project, from start to finish, was just under two years. The construction and commissioning period took approximately five months.

The 23,716 MEMC 280-W DC module solar array is connected to the local electric distribution system using 11 Advanced Energy 500-kW inverters. All components were specified by the developer, Sun Edison. Total output of the array is 5.5-MW AC. This project fits into the cooperative's overall power portfolio needs both for energy and for Maryland state mandates for renewable energy. The array provides a small percentage of energy but a large percentage of solar renewable energy credits to meet a portion of SMECO's renewable portfolio standard (RPS) requirements.

3. Financing and Rate Design

First, the cooperative performed its due diligence. It met with the Rural Utility Service (RUS), National Renewable Cooperative Organization (NRCO), and legal, technical and financial consulting firms prior to issuing a request for proposal (RFP). The cooperative created a for-profit subsidiary, SMECO Solar, to take advantage of grants provided under Section 1603 of the American Recovery and Reinvestment Act (ARRA) of 2009, which substantially reduced the cost of the project. A main goal was to minimize the impact on rates, as this project is folded in as part of SMECO's power portfolio. As part of the RFP process, the cooperative, with assistance from NRCO, received bids from 18 developers for 29 potential projects throughout southern Maryland. Sun Edison was selected from this group to construct the array on SMECO property as a turnkey project. The project represents a $20 million investment. SMECO Solar qualified for a $6 million ARRA grant, for a net investment of about $14 million, or $2.55 per watt AC, which was financed through RUS using a standard Federal Financing Bank loan.

4. Project Development

The site was selected because of its suitability for the project, its visibility to the public and the fact that SMECO already owned the property. As a turnkey project, all components of the array (modules, inverters, racking), as well as engineering and design, were developed by Sun Edison and reviewed by Burns and McDonnell on behalf of the cooperative. Sun Edison utilized Vaughn Industries as the prime construction subcontractor. Actual yield to date is very closely aligned with initial projections.

Typical permitting and licensing issues were encountered, and SMECO was able to expedite the permitting process. One unique siting issue was that there were a number of old tobacco barns of historical significance on the property that needed to be moved; best practices were used during removal of the barns. Although the barns themselves could not be saved, they were documented, and plans were made to reuse the raw materials.

Final commissioning and acceptance testing were performed by Sun Edison, with review by Burns and McDonnell.

5. Operations and Maintenance

The cooperative has a five-year maintenance agreement contract with Sun Edison's subsidiary, NVT, which covers all operations and maintenance issues with the array, as well as SMECO employee training. At the end of the contract, SMECO will evaluate whether to continue to outsource this function or to bring it in-house.

A site inspection checklist was developed by Burns and McDonnell.

The array has an interconnection with SMECO's distribution system on a large feeder very close to a substation. Given the loading on this feeder, calculations showed that there would be no operational issues; there have been none to date. No mitigation techniques or special technologies were required prior to interconnection.

Although the site is fenced, there have been a couple of instances of vandalism using rocks.

6. Telemetry

Array output is posted to a Sun Edison Client Connect website using its proprietary programs. The website is linked to the cooperative's SMECO Solar website so members can view the array output in real time. Array monitoring is provided by Sun Edison as part of the five-year contract.

7. Administrative Impacts

The addition of the array added some work to all departments. Additional legal and accounting work was needed to develop the for-profit subsidiary, SMECO Solar, and to fulfill annual reporting and tax requirements. Because the array was not marketed to the membership, most outreach efforts consisted of maximizing the project's public relations value to the membership and the community at large. As part of this effort, a companion website for the subsidiary was developed (www.smecosolar.com). The cooperative also utilized press releases and articles in the monthly newsletter, *Cooperative Review*, to keep members informed about SMECO Solar.

Recognizing its achievement with the SMECO Solar array, SMECO was named 2014 Electric Cooperative Utility of the Year by the Solar Electric Power Association (SEPA).

In 2014, SMECO held a series of open house meetings that were well-attended by members who wanted to learn more about solar generation. The open house meetings, which were held in response to recent national solar developer marketing campaigns geared toward rooftop solar installations, have strained cooperative engineering and administrative resources. As a result, the cooperative is currently evaluating staffing and organizational changes to better address the increased workload as interest in rooftop solar continues to grow.

8. Renewable Policy Development

The cooperative has had distributed generation (DG) policies and procedures in place for quite a while. The state of Maryland has adopted a renewable portfolio standard that gradually increases over time to require the cooperative to achieve 20 percent renewable energy in its power supply portfolio by the year 2022. The cooperative is also required to achieve 2 percent of its renewable energy total using solar sited within the state. Any utility that does not achieve these minimum percentages is subject to a financial penalty payable to the state.

SMECO's board reviewed and approved both this project and Rockfish Solar, which is currently under development. As a cooperative responsible for its generation portfolio, the board has a risk oversight committee that reviews power supply risk. SMECO plans to integrate additional renewables into its future portfolio planning through long-term wind and solar power purchase agreements (PPAs) or additional solar ownership, depending on the economics at the time.

NRCO recently completed a study for SMECO that reviewed both community and rooftop solar with an eye toward implementing changes to its DG policies. SMECO offers true net metering per state requirements, compensating members who put energy back on the grid on an annual basis at the energy-only rate for their net production.

9. Member Interest in Solar

Member feedback as a result of this project has been very positive. Given SMECO's Chesapeake Bay location, there is continuing sensitivity to environmental issues, and this project has been a net plus in this regard. Currently, the cooperative has 662 members with some form of DG, primarily solar. Another 332 applications for DG are pending. SMECO foresees a high penetration of rooftop solar in its future, particularly as a couple of national rooftop solar firms are marketing actively in the area to members and nonmembers alike. The combination of saving money on energy with no money down while also going green has earned a lot of attention.

Because of the positive experience with this project and the state of Maryland's renewable portfolio standard requirements, SMECO is proceeding with the larger 10-MW Rockfish Solar project. It is structured differently than the first in that it will be owned by the developer; SMECO will purchase the entire output of the Rockfish project under a PPA with the developer.

10. Business Options

SMECO reviewed various business models and evaluated them at each decision point considering two primary concerns: meeting the RPS requirements and the impact on members' rates. Although the two solar projects are different, they share the common denominators of meeting both the RPS and the lowest cost requirements.

At the time of each RFP, SMECO selected the lowest-cost, all-rolled-in, life-of-project option. For the SMECO Solar project, that lowest-cost approach was direct ownership, primarily due to the ARRA funding. For the Rockfish Solar project, it was a PPA. Both options give SMECO rights to the full output, including energy, capacity and solar RECs. Going forward, SMECO plans to investigate community and rooftop solar options to meet member demand.

11. Lessons Learned

Overall, SMECO has had a positive experience with owning the first solar project, though in hindsight, it might have looked more closely at a third-party PPA. Letting a third party own and operate the project would have eliminated a few headaches along the way. It will have firsthand experience with both approaches once the Rockfish Solar project is operational. SMECO found that using consultants to assist in the process was extremely valuable. Also, NRCO was especially helpful. SMECO strongly recommends using an RFP process with competitive bids, as it has found that there are a lot of players out there anxious to make a proposal, with some making multiple proposals.

SMECO foresees additional DG fitting into its power portfolio, driven by both the RPS and member interest. It continues to see higher penetration of solar DG driven by rooftop solar developers, an option the cooperative is currently investigating.

Because of the recent proliferation of solar in its service territory, SMECO will be studying future rate design alternatives for both the power supply side and the DG side to cover its fixed costs. This also means SMECO must continue to learn, educate and evolve as the industry and technologies develop.

For additional information, contact:

Joe Slater
CEO, Southern Maryland Electric Cooperative
Joe.Slater@smeco.coop
Ph: 301-274-4343
Asst. Ph: 301-274-4489

Beth Kennedy
Controller, Southern Maryland Electric Cooperative
Beth.Kennedy@smeco.coop
Ph: 240-528-9716

Solar Case Study
San Miguel Power Association

A Touchstone Energy® Cooperative

1. Company Profile

San Miguel Power Association (SMPA) is an all-requirements member of Tri-State Generation and Transmission Cooperative. SMPA serves 13,500 members in the southwestern corner of Colorado. The eastern part of its service territory is ski and tourist country with mountainous terrain, while the western part is primarily broad valleys and plateaus. Membership is about 81 percent residential and 18.5 percent commercial. SMPA serves about seven members per mile of line. Some members are very "ecologically conscientious," while others are very bottom-line-driven.

As part of Tri-State, SMPA is allowed 5 percent ownership of local generation. Due to the size of the association's solar array and the addition of several smaller hydro projects, the co-op has reached this limit.

2. Renewable Profile

SMPA's solar array, located in Paradox Valley, Colo., has a nameplate capacity of 1.1 megawatt DC. In 2013, the unit maintained a 20 percent capacity factor. Siting, permitting and installation of the array took approximately one year and was completed Dec. 13, 2012. The array consists of 4,784 Hanwha Solar One modules of 235 watts each. Power conversion is accomplished with an AE Solar Energy PowerStation 1000 NX with two AE 500 NX inverters. Racking was ground-mounted on driven piles. The site covers more than 6 acres of a 9.27-acre parcel of land.

3. Financing and Rate Design

SMPA evaluated two business models for its community solar project: third-party ownership and full ownership. After a request for proposal (RFP) was issued and responses evaluated, a third-party ownership model was chosen. SMPA management recommended Clean Energy Collective (CEC) to the board based on CEC's experience with community solar. The board selected CEC to sponsor the project for the benefit of its members while limiting financial risk to the cooperative.

CEC has about 35 community solar projects across the country, 11 of which are with electric cooperatives. CEC is technically the owner of the Paradox Valley array and assumes all financial responsibility and risk. Co-op members who want to participate can purchase a panel of the array and receive a share of the output as a monetary credit on their monthly bill. Members can purchase one or several panels at a cost of between $695 and $750 per panel, depending on the application of the solar rebates in effect at the time. Monthly credits are calculated as the member's percentage of interest in the array multiplied by the metered output less 5 percent, which is escrowed for future operation and maintenance. This amount of kwh is credited at 11.615 cents per kwh and increases at 1 percent per year. Please see the example on page 17.

The gross cost of the installed array is about $5.54 per watt, including both hard and soft costs.

4. Project Development

SMPA had already been looking at the Paradox Valley site prior to the RFP process and assisted CEC by recommending the site and sharing in a small portion of the siting groundwork. All other development issues, including site development criteria, engineering, procurement and construction up to and including final commissioning, were CEC's responsibility.

SMPA wanted to build as large an array as feasible and allowable under its power supply contract. However, SMPA did not want to build a facility that would cause excess power flow back onto Tri-State's system. One MW was appropriate because its production would not exceed the native load. The size of the array was also determined using a combination of engineering, economics and siting.

CEC engaged Martifer Solar as its primary contractor and Sunsense Solar as the designer. The site is predicted to produce 1,731 megawatt hours annually, although actual production topped 2,000 MWh during the first year. The array is interconnected to a three-phase feeder on the SMPA distribution system. Internally developed engineering calculations showed that, based on feeder loading, no interconnection issues would develop on either the distribution or transmission systems, and none have. SMPA system coordination and protective schemes were studied prior to facility construction. Changes to the system scheme had to be implemented to accommodate the reverse power flow in two substations. Security fencing around the array was a requirement of NEC (National Electric Code) as well as a necessity given both the array's remote location and the fact that it sits in an open livestock range.

5. Operations and Maintenance

CEC is responsible for the array's operations and maintenance. It has a standalone LLC that operates like a trust to ensure funding for operations and maintenance over a 50-year period. This is funded by 5 percent of the sales price of the panels and the dollar value of the array's kilowatt-hour output.

The array has not experienced any major maintenance issues, although components in the inverters were replaced under warranty in year two of operation. Given the southwestern desert location, CEC is investigating the need to clean the array annually for maximum output. No operational energy issues such as islanding or reverse power flow have occurred. No mitigation techniques, technologies or special metering have been required.

Real-time production data from the array is collected by CEC's proprietary Remote Meter software and posted to CEC's public website. The cooperative website provides links to this data so that members can access information. Data that the cooperative uses to credit members' accounts for kilowatt hours produced by the array is also generated by the Remote Meter software.

6. Administrative Impacts

No additional staffing was required, though additional front-end work with ATS, the cooperative's billing provider, was required to correctly bill the accounts of those who participated in this project, which totaled approximately 70 participants at the project's inception. This was largely due to the need to credit the accounts for the production of the array by integrating a crediting file, which is created by CEC monthly and then downloaded into the ATS software. Since implementation, no major issues have arisen, although monthly monitoring by SMPA is necessary.

Member service personnel spent considerable time answering members' questions, the most common one being the economics of participation. As marketing and sales of the array panels were the responsibility of CEC, it handled most of the inquiries and sales questions. Marketing pieces were developed jointly by SMPA and CEC. A website for the array, www.smpasolar.com, was developed.

7. Renewable Policy Development

Colorado has a mandated net metering state law at 10 kw or less for residential and 25 kw or less for commercial. SMPA has had distributed generation (DG) installations in place that predate state programs. The co-op has voluntarily developed renewable incentives for local renewable resource development. These are currently at $0.75 per watt of installed capacity up to a limit of 3 kw for residential members and 10 kw for commercial members. Purchasers of the array units are eligible to receive these incentives.

SMPA sees a greater penetration of DG in its future as equipment prices fall and reliability and access to DG increases. Further utility use of smart grid technology will allow DG to expand to greater utilization. SMPA works toward a rate-neutral strategy for DG development so that, in general, the costs of DG do not place upward pressure on the rate base. In one case the co-op has reduced wholesale power costs by obtaining an “offset” contract under Tri-State policies.

8. Member Interest in Solar

As a point of reference, SMPA currently has 178 members with net-metered DG systems, 170 of which are solar. When SMPA embarked on this project, it was largely based on the results of a member survey that made it clear they wanted options for local renewable energy. The decision to consider community solar as a means of supporting member interest was driven by the board of directors. Currently, SMPA has sold out the array with 214 members participating. Two large purchases account for about 50 percent of the array. The town of Telluride purchased panels for all of its low-income housing units (about 95 kw), and the Telluride school district purchased panels to offset the energy usage of a large addition to an existing building (about 500 kw). Member feedback has been very positive, even with members who are not participating. Some members want solar, but their property is not conducive to panels. Others want solar but do not want to be burdened with installation or maintenance issues. Members are pleased that nonsubscribers are not subsidizing subscribers and that the program is not affecting the cost of electricity for nonsubscribers. SMPA is currently experiencing pent-up demand for another community project. Recently, two municipalities enacted Renewable Energy Mitigation Programs (REMP) that apply to new construction, additions and remodels, which in part is driving this demand. SMPA is also exploring a community hydro project and a low-income community solar project sponsored by the cooperative to benefit low-income members.

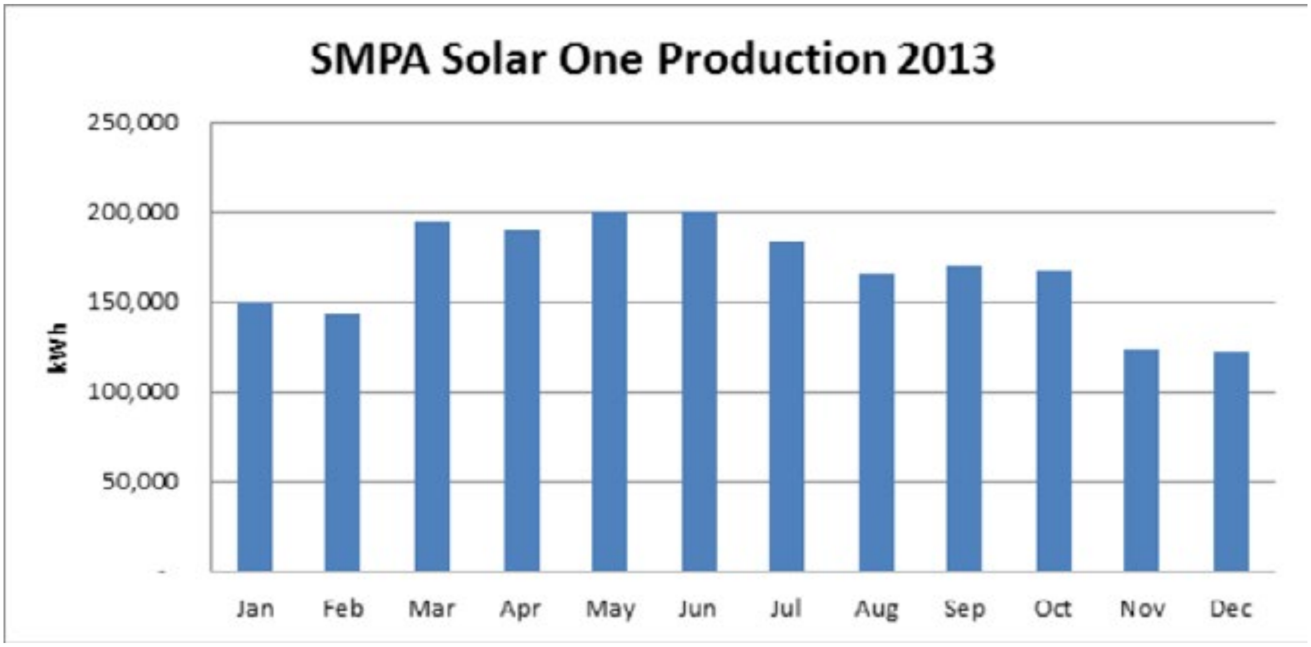
9. Lessons Learned

Loss of control was the first lesson learned. The agreement with CEC called for branding the project as the San Miguel Solar Garden. As CEC grew and staff turned over, SMPA ran into some issues with being left out of marketing and branding activities and ads. Closer monitoring and communication with CEC in the marketing activities would have been appropriate. At times, confusion existed among the membership regarding this third party selling electricity and marketing to members. This was important to SMPA, as it wanted it to be clear that no other entities would be selling electricity to its membership without its agreement. Better monitoring and communication with CEC in this regard would have helped. SMPA may have chosen to have better control over the sales, marketing and branding of its community solar array. Going forward, SMPA will analyze all business options available to it as market conditions, the state of technology and societal attitudes toward solar evolve.

SMPA chose to build the larger array anticipating more member demand and participation. There was not much response to pre sales notices, although the region is highly supportive of local renewable resources. The array did sell out in the projected three-year period, primarily achieved through large purchases. Another option, given the rapid decline in solar photovoltaic module costs, would have been to build the array in stages, which might have ultimately resulted in lower panel prices for the members. In the future, SMPA will evaluate this option as well.

What would SMPA tell a cooperative starting from scratch? Perform the upfront work to understand the demand for the product, why you are offering it and how it will benefit the membership and the cooperative at large. It should be a win-win for all. Otherwise, it might not be a good fit for your co-op.

Calculation of a Monthly Credit



Sally Smith buys 10 panels. Her portion of the total 4,784-panel array is .0020903.

September's total output from the array was 163,245 kwh. Sally's portion of this (163,245 x.002093) is 341 kwh, less the 5 percent escrow for operation and maintenance, leaving 324 kwh to credit.

Thus, the credit applied for September is 324 x .11615 = $37.63

For additional information, contact:

Brad Zamborski
Manager of Member Services, San Miguel Power Association
brad@smpa.com
Ph: 970-765-5554

Solar Case Study

Okanogan County Electric Cooperative

NRECA

A Touchstone Energy® Cooperative

1. Company Profile

Headquartered in Winthrop, Wash., Okanogan County Electric Cooperative (OCEC) serves approximately 3,100 meters. It is located on the eastern side of the northern Cascade range in Washington state, about 40 miles south of the Canadian border. An all-requirements member of the Bonneville Power Administration, Okanogan County Electric is allowed to have additional distributed generation resources. Through Bonneville, approximately 88 percent of the co-op's power requirements are generated by hydro and 10 percent by nuclear. About 41 percent of its members are residential, 43 percent seasonal, 5 percent irrigation loads and less than 10 percent commercial. The terrain is mountainous with a large snowpack in wintertime. The service territory is a remote, resort-type area with many second homes. The co-op's large number of seasonal accounts is a factor in the relatively high, fixed monthly fee of between $35 and $40 a month for most members. The co-op averages about 6.4 members per mile of line. OCEC is winter-peaking, and solar adds little, if any, capacity to the system.

2. Renewable Profile

The cooperative has developed two community solar projects that use Silicone Energy solar modules and inverters. Made in Washington state, the Silicone Energy equipment makes the co-op eligible for additional incentives from the state. The first project, commissioned in September 2010, is the Okanogan County Electric Cooperative Community Solar Project (OCEC CSP). It consists of 104 195-watt modules totaling 20.28 kw, that are connected to four 4,200-watt inverters. The second, the Winthrop Community Solar Project (Winthrop CSP), was commissioned in July 2011 and consists of 120 190-watt modules totaling 22.8 kilowatts that are connected to five 4,200-watt inverters.

Energy Solutions, the engineering, procurement and construction (EPC) contractor, designed, engineered, procured and managed the construction of both projects. It subcontracted with Norwil Electric, Bart and Company and Doug Hayes Excavating for installation of the systems. It used Cascade Concrete for the concrete ecology blocks, and North Valley Lumber supplied the steel pipe for the racking system. Both the EPC firm and subcontractors were local companies. Project implementation took approximately six months.

OCEC developed the community solar arrays because of the ecological inclination of the members and because of the addition of the community solar section of the Washington State Renewable Energy System cost recovery program. Energy Solutions, the local solar provider, made a presentation to the cooperative's board of directors.

3. Financing and Rate Design

The projects were self-funded. Funds for all costs of the array were raised from co-op members in advance. A mailing was sent to all members inviting them to participate. Component spec sheets and warranties were reviewed by Energy Solutions and OCEC. Installing contractors were licensed and bonded. The OCEC attorney developed a contract for participating members and funders. Sizable incentives from the state of Washington were the primary driver of the projects. The letter describing the program and the participation agreement can be found on pages 22-23.

Members can fund the array at various levels, but most committed to the $6,000 level. The funders are paid back in two ways. First, the funders receive a production credit, based on the amount of energy produced by the array and multiplied by the average cost of wholesale power for the year. Based on the percentage of the member's funding of the total investment, the member gets that percentage of the production credit value in a check. In 2011, a typical year, the credit was $30.45 for a funder at the $6,000 level.

Second, the funders receive a State of Washington Incentive payment for Renewable System Cost Recovery, which is funneled back through OCEC via its excise tax. Based on production in a typical year, this amount works out to about $1.08 per kwh produced. The funders at the $6,000 level receive $750 in a typical year.

This arrangement continues until 2020, at which time both payment programs end. The array and its output are then the property of OCEC. Based on both payment programs, the simple payback is less than seven years.

4. Project Development

A location at the OCEC headquarters site was selected for the first array. It has a southern-facing exposure and great visibility to the membership. The town of Winthrop agreed to host the Winthrop CSP at its water treatment plant, which also had excellent southern exposure. Energy Solutions was the turnkey provider for both projects and performed the yield projections, which turned out to be accurate. State and local governments required electrical permits for both projects. An environmental impact checklist and building permits also were required. Energy Solutions subcontracted some work to local contractors, but it provided final commissioning and acceptance testing. Array output is recorded through OCEC's advanced metering infrastructure (AMI) system. Both projects are interconnected to Okanogan's distribution system at a primary voltage of 12.47 kv.

5. Operations and Maintenance

No formal operations and maintenance procedures have been developed. Array outputs are monitored every 30 minutes by computer, and any errors or false readings automatically generate an email to designated OCEC individuals, as the cooperative performs any operations and maintenance in-house. The design and tilt of the arrays allow snow to slide off and clean the arrays during the winter months. Unscheduled maintenance issues developed as some of the solar modules and inverters were the first ones manufactured at Silicone Energy's plant in Washington. Two inverters developed irregular output and were replaced under warranty. After three years, some of the solar modules showed moisture penetration at the edge of the glass, although this did not affect the energy output. Those modules showing the defect were replaced under warranty.

Initial calculations showed that no operational issues would be anticipated, and none have been observed. No changes to the distribution system, mitigation techniques or additional technologies were required.

6. Telemetry

The cooperative operates Aclara's two-way automated communications system (TWACS) and advanced meter reading (AMR) system. A standard TWACS meter was installed at each array and reports the output for monitoring and energy production to the OCEC's website, which members can view.

7. Administrative Impacts

No additional staffing or personnel were required, but some additional member services work was required. The board approved the community solar projects with the understanding that no construction or management costs would be paid by OCEC, except in instances of additional insurance costs or necessary legal costs to implement the project. The board was also involved in reviewing the project announcement and funding solicitations mailed to the members.

8. Renewable Policy Development

Washington state law requires Okanogan to provide net metering to its members. Further, OCEC is required to offer net metering to at least 0.5 percent of its load, based on its 1996 peak demand. OCEC has met the minimum and plans to continue to make net metering available. Because of OCEC's relatively high monthly charge of between $35 and $40 for most members, solar is not economical in many instances without incentives.

9. Member Interest in Solar

Given the area, OCEC knew its members were interested in renewable energy, solar in particular. Of the 3,100 meters in its system, the cooperative has about 30 net metering accounts as of 2014, mostly solar. Due to high member interest in solar, OCEC quickly sold out both arrays prior to construction. OCEC first mailed a letter to each member describing the first array, its costs and the Washington state cost recovery program. It is worth noting that the first project was funded in 14 days with a waiting list. Eight months later, those members were accommodated in the second array. Through the use of the local news media, the second array was quickly fully funded, again prior to construction.

10. Business Options

Because of the Washington renewable energy cost recovery program, the cooperative did not investigate other methods of ownership of the array or other models. Due to state program constraints, OCEC is maxed out for participating in the state program.

11. Lessons Learned

OCEC believes that the projects have been valuable from a public relations perspective, in part by helping OCEC to engage its members. The model it chose both limited the risk to OCEC and maximized the value to participating members. Not only was this a good deal for the members from an environmental perspective, but because of state incentives, it also did not shift costs to members who did not participate. Evaluating the project in retrospect, OCEC does not believe that it would have done anything differently.

For additional information, contact:

Dave Gottula
CEO, Okanogan County Electric Cooperative
dgottula@ocec.coop
Ph: 509-996-2228

Program Details and Participation Agreement

August 13, 2012

Potential OCEC Community Solar Funders,

We have received 16 inquiries from members who are interested in purchasing the available shares in the OCEC Community Solar Project. As stated previously, we will enter all of the names in the drawing for $8,050.63 investment, unless requested not to. There will be one winner of the drawing. The remainder of the names will be put into the drawing for the $4,830.36 investment. One winner will be drawn for that investor option.

The original share amounts were $6,000.00 and $10,000.00. Each of the funders has been paid back amounts reducing the investment levels to the $4,830.36 and $8,050.63 respectively. The percent ownership of the solar system remains at the original share level.

How the program works.

The solar array came on line in September of 2010. The solar project was funded by OCEC members at $200,000.00. There are 31 member-funders at different investment levels;

1. $5,000.00 1- funder
2. $6,000.00 25 – funders
3. $7,000.00 1 – funder
4. $9,000.00 2 – funders
5. $10,000.00 2 – funders

The funders are paid back in two ways. The first is calculated from the amount of energy generated times the average cost of wholesale electricity purchased by OCEC for the calendar year. In 2011, the average cost of this electricity was .03395 cents per kwh. After the end of a calendar year when this annual average is determined, the funder will receive a check for this amount times the share of the kWh produced by the project based on the percent of the funder's contribution to the total project cost. The kWh production for 2011 was 29,900 kWh. The total amount $1,015.11. (29900 kwh x .03395 cents/kwh = $1,015.11) was divided up as follows:

1. Funder level 1 - $25.38
2. Funder level 2 - $30.45
3. Funder level 3 - $35.53
4. Funder level 4 - $45.68
5. Funder level 5 - $50.76

P. O. BOX 69 • WINTHROP, WASHINGTON 98862 • TEL (509) 996-2228 • FAX (509) 996-2241

The other way funders are repaid is through the State of Washington Renewable energy system cost recovery program. The State of Washington foregoes excise taxes that OCEC would ordinarily pay in the amount due to the funders under the program. These funds are instead used to make the cost recovery payments. The Washington Department of Revenue incentive payments may not exceed $25,000.00 annually for community solar projects owned by an electric utility company. Under the program the OCEC pays funders twice a year at $1.08 per kWh for the percent of the cost of the community solar system funded. For the 2011 program year (July 1, 2011 through June 30, 2012) the member-funders received as follows:

1. Funder level 1 - $625.01
2. Funder level 2 - $750.00
3. Funder level 3 - $875.00
4. Funder level 4 - $1,125.00
5. Funder level 5 - $1,250.00

As stated in the contact this program will end June 30, 2020. At that date there will be no further payments and OCEC will retain full ownership.

We have attached a contract for your review. More information is available on the Washington State website, access wa.gov and search WAC 458-20-273 for the Renewable energy system cost recovery.

Please confirm your interest by filling out the enclosed drawing application.

Thank you again for your interest.

Please contact me if you have any questions.

David Gottula
General Manager

Solar Case Study
Green Power EMC

NRECA
A Touchstone Energy® Cooperative

1. Company Profile

Created in 2001, Green Power EMC (GPEMC) is owned by 38 of the 41 electric cooperatives in the state of Georgia, to whom GPEMC currently provides 32 megawatts of renewable electricity. These 38 cooperatives are also members of Oglethorpe Power Corporation (OPC), their generation cooperative; the remaining three cooperatives in the state have their power supply needs provided for by the Tennessee Valley Authority (TVA). GPEMC's generation portfolio consists mostly of wood-fueled biomass, landfill gas and hydropower, with about 465 kilowatts of solar. Peak load for the OPC Georgia cooperatives is about 9,000 MW.

Though cooperatives in Georgia do not have any mandates or renewable portfolio standards to meet, members of GPEMC may choose, on a subscription basis, to buy into various proposed projects. GPEMC recently announced agreements to purchase the full output of three planned projects: a 20-MW solar project and a 52-MW solar project located near Hazlehurst, Ga., both owned and operated by the Silicon Ranch Corporation, and a 131-MW solar project owned and operated by Southern Power near Butler, Ga. The outputs of these are scheduled to come online in late 2015 to late 2016, with purchase power agreements from 25 to 30 years.

2. Renewable Profile

GPEMC's most visible project to date is its Sun Power for Schools program, where it has provided 37 solar demonstration systems to schools in its members' service areas across the state. As each site averages about 1.2 kw, this program is primarily educational. To simplify installation, each system is a standard kit developed by GPEMC and its contractor, and is mounted behind the meter at each participating school. Each system comprises of four to eight photovoltaic panels, from a variety of panel and inverter manufactures, including Sharp, Suniva, Canadian Solar, SMA, Kaco and Fronius, as well as other appropriate electrical disconnects. The solar array is pole-mounted to a Power Fab pole mount, which also houses the wiring. Each kit also contains a weather station and data acquisition capabilities provided by Locus Energy. Installation and routine maintenance is performed by a solar contractor. The average installed cost of each system is about $14,000.

GPEMC currently has three producing solar purchase power agreements in place for 465 kw. It has worked with Cobb EMC in implementing the 7.5-MW Azalea Solar project power purchase agreement. Green Power EMC and its member EMCs recently announced agreements with Silicon Ranch and Southern Power for projects totaling 203 MW. In addition, GPEMC is evaluating the development and construction of several small utility-scale solar projects of approximately 1 MW each. The following is a list of GPEMC Solar PPAs:

1. 115-kw Rooker Rooftop Project (14 EMC participants)
2. 150-kw Clean Controls ground-mount project (14 EMC participants)
3. 200-kw ChemNut rooftop project (18 EMC participants)
4. 7.5-MW Azalea Solar Project (Cobb EMC contracted asset)
5. 20-MW SR Hazelhurst fixed ground-mount project (27 EMC participants)
6. 131-MW Taylor County (Warner Robbins) single-axis tracker ground-mount project (three EMC participants)
7. 52-MW South Loving (Hazelhurst) single-axis tracker ground-mount project (nine EMC participants)

3. Financing and Rate Design

The 38 members of GPEMC are eligible to participate in any power project on a subscription basis and at any level they deem appropriate, including not participating at all. As GPEMC is a cooperative, the output of any power project is sold to members at cost. Member cooperatives generally roll the cost per kwh of each project into their overall power portfolio cost. Recent research indicates the bus bar cost for utility-scale solar in Georgia is approaching 6.5 cents per kwh or less, after tax incentives.

4. Project Development

Since its inception in 2005, the objective of the Sun Power for Schools project has been education and member relations. Power production has been minimal. As such, the location of the school and the visibility of the project were of prime importance, and it was left to each participating cooperative member to determine the right location for the package system. Member cooperatives do the legwork at the local level by contacting and recruiting appropriate host schools, while GPEMC provides the equipment and arranges for installation and system monitoring. There have been no permitting or licensing issues. Working with a recognized educational resource, the University of West Georgia, GPEMC developed an off-the-shelf curriculum for middle and high schools. The curriculum uses real-time and historic data from solar power generated from school installations. The program also supports teaching requirements for science, technology, engineering and mathematics. Course offerings in the areas of physical science, physics, chemistry and mathematics have been developed and put into use at partnering schools. By providing a current technology in a real-world setting in their communities, this program has won the cooperative praise from parents, students, teachers and school boards.

For purchased power projects, GPEMC focused on matching members' renewable energy needs with availability of solar production at a competitive price. The recent purchase power agreements with Silicon Ranch Corporation meet those needs. As such, Silicon Ranch is responsible for the entire engineering, procurement and construction process, as well as ongoing operations and maintenance. The only requirement set forth by GPEMC was that the facility needed to be located in the state of Georgia.

In addition, small utility-scale solar projects (250 kw to 2 MW) will likely be developed with member cooperative ownership in mind. These projects will be located in participating EMCs' respective service areas to provide maximum visual exposure to end-use customers. The EMCs will determine a suitable location for the project and will work closely with GPEMC to finance, construct and operate the facilities.

5. Operations and Maintenance

With the Sun Power for Schools project, a third party provides maintenance on a contractual basis; with the exception of maintaining the data acquisition components, very little maintenance has been required.

Under the power purchase contracts with third parties for the larger solar installations currently under development, GPEMC has no responsibility for operations, maintenance or interconnection issues.

Plans for the smaller utility-scale projects (1-MW each) include a collaborative operation and maintenance plan to be conducted by Green Power EMC and the staff of participating EMCs.

6. Telemetry

The Sun Power for Schools program uses the Locus Energy solar monitoring system. This data acquisition system transmits data to a central server from each school's solar installation using the school's local Internet service.

Green Power EMC is evaluating Locus Energy as well as other data acquisition and monitoring systems for use in the new utility-scale systems currently under development.

7. Administrative Impacts

GPEMC has a management services contract with OPC that provides management and administrative support on a fee basis. During the development of the Sun Power for Schools program, and more recently with the negotiations of the purchase power agreements, OPC provided the equivalent of about two full-time employees. When legislative needs arise, GPEMC works with OPC, Georgia EMC and local cooperatives to help address issues regarding renewable energy. For example, a recent Georgia law allows third-party solar energy sales. This state legislative effort was a combined effort of multiple stakeholders, including the EMC organizations listed above, as well as the investor-owned utility, municipal utilities and interested parties from the solar industry.

GPEMC has developed a statewide cooperative training program for renewable energy for the benefit of the entire state.

8. Renewable Policy Development

Although cooperatives in Georgia are not regulated by the Public Service Commission and are not required to meet a renewable portfolio standard, they believe it prudent to voluntarily increase the amount of renewable generation—solar in particular—in their power portfolio mix. To that end, they develop or purchase renewable generation. They are increasing the local presence and visibility of renewables to educate their members, and are exploring ways to give those members options to engage directly in renewables, through either a virtual rooftop option or participation in a community solar array.

9. Lessons Learned

Frequent and effective communication with cooperatives and their staffs is the main lesson learned. EMC staff awareness of renewable energy issues is critical to helping a cooperative maintain its mission as the energy leader in its service territory. As the price of renewables, especially solar, continues to fall and those of traditional generation resources continue to rise, member interest in renewables will increase. Green Power EMC has been successful in keeping the cooperatives of Georgia working together and leveraging their collective strengths to meet the challenges and opportunities of renewable energy. GPEMC is working on instituting a four-part strategy with its members to prepare them for the future:

1. Offer retail rates—Better current volumetric-based retail rate structures with the fixed-cost nature of the utility business.
2. Build and/or buy solar—Participate, get hands-on experience and show leadership and credibility with an emerging energy technology.
3. Become your community's local solar expert by educating yourself, your staff and your membership—Become the go-to solar experts that your members think of first when considering solar technology.
4. Offer opportunities for the cooperative membership to engage and participate in EMC/cooperative-sponsored solar energy projects and service.

For additional information, contact:

Jeff Pratt
President, Green Power EMC
jeff.pratt@opc.com
Ph: 770-270-7900

Solar Case Study
Cherryland Electric Cooperative

NRECA
A Touchstone Energy® Cooperative

1. Company Profile

Cherryland Electric Cooperative serves approximately 33,000 members in six counties in northwestern Michigan around the Traverse City area, about a four-hour drive north from Detroit. Cherryland is an all-requirements member of Wolverine Power Supply Cooperative (Wolverine), its G&T. As such, its power supply is about 57 percent coal, 13 percent natural gas, 23 percent nuclear and 5.6 percent renewables, with the remainder coming from other sources.

Its membership makeup is about 95 percent residential and 5 percent commercial and industrial (C&I). The system density is about 11 members per mile, and the system is summer-peaking. The terrain is hilly and heavily treed, with ample water resources for farming and recreation. Given its location and proximity to Lake Michigan, the system is subject to heavy winter snowfalls. Recreational and summer homes abound; Cherryland's largest single member is the Crystal Mountain ski resort.

2. Renewable Profile

Michigan has a renewable portfolio standard (RPS) of 10 percent renewable generation by 2015. Wolverine is capacity-short at present and has a new natural gas-fired peaking power plant under development. Wolverine has created a subsidiary, Spartan Renewable Energy (Spartan), to develop renewable energy projects on behalf of its members. Spartan is the owner of a 52-kilowatt DC Cherryland array called the SUN Alliance, which is short for Solar Up North. The SUN Alliance array consists of 224 235-watt DC Sonali-branded solar panels. The panels, mounted on AETR 24 and AETR 36 ground-mount racks, use 14 RENOVO inverters. Although some components were imported, final assembly of the modules was completed in Michigan. The racks and inverters were also engineered and developed in Michigan. The array encompasses an area of about 240 feet by 240 feet (approximately one acre), and is located at the Cherryland's headquarters in Grawn, Mich. Project development started in October 2012, construction started in December 2012 and the project entered service on April 21, 2013. Given its northern location, the disparity in power production between high and low months is revealing. The power produced in August, its highest production month, was worth about $2.75 per panel, based on the current retail rate. In January, its lowest month, the power was worth about 27 cents! Examples of monthly production for August and January are on page 32.

The array fits into Wolverine's overall power supply portfolio because of the RPS mentioned above. Another consideration leading to development of the community solar array was the significant presence of green energy advocates in Cherryland's territory.

3. Finance and Rate Design

Because of its wholesale power supply contract and working relationship with Wolverine, Cherryland developed the project through Wolverine's for-profit subsidiary, Spartan, to utilize available tax credits and lower the overall net cost. No other models were considered. Spartan owns the array and leases it back to Cherryland. At the end of a six-year period, Cherryland has the right to purchase the project at a set residual amount, similar to a tax equity flip structure.

In addition to the lease payment, Cherryland is responsible for all costs associated with the array—operation, maintenance, taxes, insurance, etc. Members can participate by purchasing a share of the array at $470 per share, which amounts to about 223 watts AC. Because of a Michigan energy conservation mandate, Cherryland is required to spend the amount necessary in energy conservation measures or rebates to reduce consumption by 1 percent of last year's sales. Solar qualifies, so members who purchase a panel also received a $75 rebate, lowering the net cost per panel to $395. Members do not own a specific panel, but rather a 1/224 interest in the output of the array. Members receive a credit on their bill based on their percentage of array output ownership in a particular month on a per-kilowatt-hour basis. The kilowatt hours to be credited are valued based on the wholesale cost of power (currently 8.3 cents per kilowatt hour) to the cooperative for that particular year. This arrangement continues for 25 years. In a somewhat unique arrangement, based on Cherryland's long working history with its local municipal utility, Traverse City Light and Power (TCLP), customers of the municipal utility may also participate in the array on the same basis as members of the cooperative. This is accomplished by crediting the municipal utility for the kilowatt hours of its participating customers. TCLP then issues a credit to each of its participating customers on their municipal electric bill. Any value of renewable energy credits stays with the cooperative to offset future costs associated with the array. Consumers who move out of co-op or municipal utility territory can transfer their ownership to any other member or customer serviced by the two utilities. The solar garden investment agreement between Cherryland and individual participating members is on page 33.

Cherryland felt that because this was a community solar array, and the first in Michigan, it wanted the larger community to be able to participate. This also provided a larger market for the panels and reduced risk. The array sold out in less than 12 months, leading Cherryland to consider plans for a second array. The second array will likely be located on TCLP lines.

4. Project Development

A primary concern was to keep the project as simple as possible. It was quickly determined that Cherryland's headquarters could accommodate an array of this size. Three qualified contractors in the area were invited to respond to a request for proposals. A local vendor with a history of solar expertise, Contractors Building Supply, was selected to engineer, procure and construct the project. This vendor was selected not only because of its bid, but because of its expertise with solar. It was also a co-op member. The vendor was responsible for the turnkey operation, including commissioning, interconnection and acceptance testing.

There were no issues with the required local electrical inspection. Fencing was not required. The only zoning issue encountered was related to the size and location of signage at the array.

5. Operations and Maintenance

No special operations and maintenance procedures have been developed other than the schedule for weekly monitoring of the array's output. Inverters and panels are covered by a 25-year warranty, and few operational issues or failures have been encountered. Given that snow sometimes blankets the area, consideration was given to sweeping snow off the array to obtain maximum output. This was researched, and based on informal calculations, it was determined that the cost of removing snow from the array would not justify the increase in output.

For simplicity, the array was connected to Cherryland's office building, effectively netting a portion of the building's consumption. Given the load size of the office building, initial calculations showed no operational issues were anticipated, and none have been observed. No mitigation techniques or added technologies were required of the electric distribution system to accommodate the interconnection.

Cherryland donated two panels to the local high school robotics class to develop a method for removing snow from solar panels using robotic techniques.

6. Telemetry

No advanced technology is used to monitor or manage the array. Its output is collected weekly and posted in real time on the co-op's website. The RENOVO inverters were chosen with this in mind.

7. Administrative Impacts

No additional personnel were required; however, some extra effort was needed for marketing. One employee was designated as the go-to person for member contacts. Some effort and money were spent on legal services to develop the necessary agreements. No changes in staffing are anticipated as a result of the array. The biggest administrative task was to develop the necessary agreements and to train member contact personnel in the signup process.

8. Renewable Policy Development

In 2011, the Cherryland board voted to remove the cooperative from regulation by the Michigan Public Utilities Commission (Commission). However, Cherryland closely follows public policy set forth by the Commission. Cherryland and Wolverine are following state mandates and expect to have 23 percent of their load generated from renewable sources by 2018.

9. Member Interest in Solar

The cooperative had anecdotal evidence of member interest in solar. Management decided, with board support, to develop what they called a brick-and-mortar survey to determine member interest. If it sold out, that would be an indicator, and if it failed to sell, that would be another. In addition to the solar array, the cooperative presently has 40 net metering systems interconnected, with the majority of those being solar. Currently, 120 members and 80 TCPL customers are participating in the array, which is 100 percent sold out. Member feedback has been overwhelmingly positive.

10. Business Options

Cherryland approached the project with three principles in mind: Keep it simple, maintain control and ownership, and build visibility for the project. Third-party ownership with major national entities was rejected as too complex. Its partnership with Spartan and TCLP fit the project well from the start.

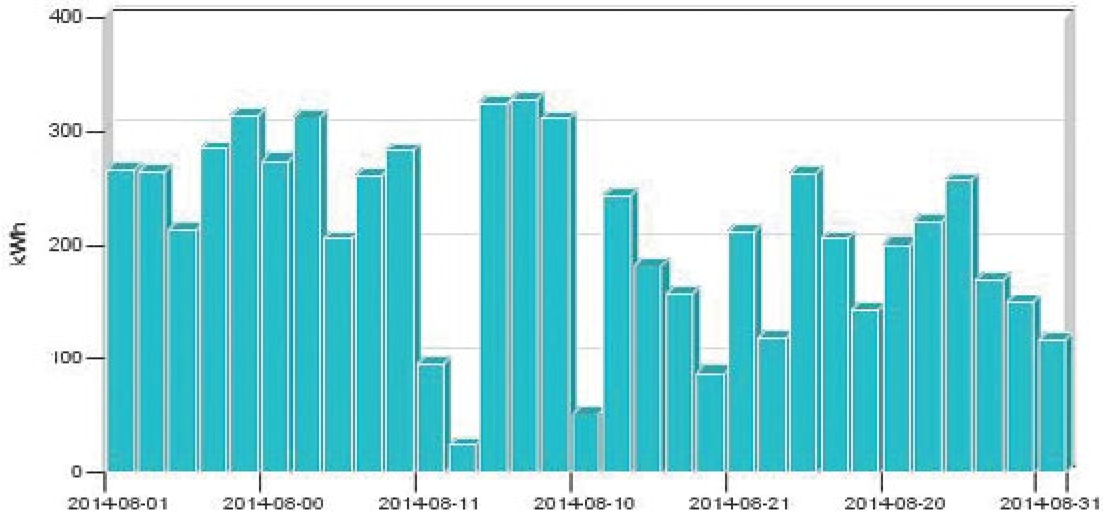
A formal cost-benefit analysis was not undertaken prior to the start of the project. An overriding goal was to keep the total cost of the project low enough that a member could buy a share for under $500 and mitigate risk. That goal was met with the $470 share price thanks to favorable financing and utilization of the tax credits available through Spartan. Lowering risk was accomplished through right-sizing the project and including the 11,000 TCPL customers as potential buyers.

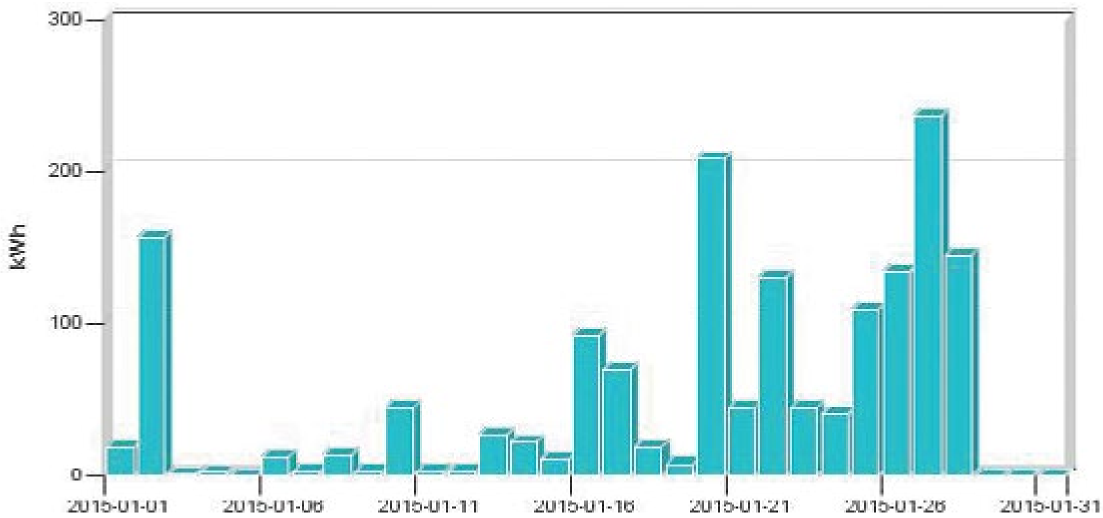
11. Lessons Learned

This project was an overwhelmingly positive experience for Cherryland. It was able to not only provide a low-cost solar resource to its members, but also successfully position itself as environmentally progressive and not just the “coal guys.” The availability of the array has provided opportunities that otherwise may not have been available to a segment of the membership that wants greener and cleaner energy. It provides the link from the energy resources of today to the resources of tomorrow, and those who want it pay for it without cross-subsidization.

The cooperative’s advice to those who are contemplating a community solar would be the Nike motto—Just Do It! There were some skeptics on Cherryland’s board, but a careful explanation of the facts brought them around.

Examples of Monthly Production—August and January





SOLAR GARDEN INVESTMENT AGREEMENT
CHERRYLAND ELECTRIC COOPERATIVE

This Solar Garden Investment Agreement ("Agreement") is made and entered into this ___ day of ____________, 2013 by and between Cherryland Electric Cooperative ("Cherryland"), with its principal place of business at 5930 US 31 South, Grawn, Michigan 49637 and the Cherryland Member ("Member") identified as follows:

Member: ________________________________
Service Address: ________________________________
City/Twp: ________________________________
State: ________________________________
Telephone: ________________________________
Member No.: ________________________________

1. **Overview**.

1.1 Cherryland has developed the Solar Up North Alliance (also known as the "SUN Alliance") Community Solar Garden ("Solar Garden") located at 5930 US 31 South, Grawn, Michigan 49637, which is comprised of, among other things, photovoltaic solar panels (each a "Solar Panel").

1.2 Qualifying Cherryland members may purchase investment shares in the Solar Garden and receive future billing credits by paying a one-time upfront charge.

1.3 This Agreement sets forth the terms and conditions of Member's purchase of investment shares in the Solar Garden.

2. **Purchase of Solar Garden Investment Shares**.

2.1 Subject to the terms and conditions set forth in this Agreement, Cherryland hereby grants to Member credit for savings incurred by Cherryland's headquarters related to net metering the energy output from the Solar Garden in the amount set forth in the Approval Form ("Solar Garden Credit"), attached hereto as Exhibit 1 during the term of this Agreement.

2.2 Member will receive the Solar Garden Credit as a credit on the Member's monthly billing statements for service provided by Cherryland at the customer service address set forth in the Approval Form ("Service Address") in the manner provided in Section 6 below.

2.3 Member acknowledges and understands that Cherryland will retain sole ownership, possession and control of the Solar Garden and each Solar Panel and will have the exclusive right to maintain and operate such Solar Panels and the Solar Garden.

2.4 Member acknowledges and understands that Member is not purchasing electricity from the Solar Garden, and that its sole involvement is as an investor in the Solar Garden to encourage and support Cherryland's use of renewable energy at Cherryland's headquarters. Cherryland will interconnect the Solar Garden to its facility located at 5930 US 31 South, Grawn, Michigan 49637 and treat the Solar Garden as a net metering project and all energy produced by the Solar Garden will be isolated and metered at the facility in compliance with Cherryland's net metering tariffs.

3. **Consideration**. Member will pay Cherryland the amount set forth in the Approval Form as consideration for the Solar Garden Credit granted, and to be granted, to Member pursuant to this Agreement.

4. **Effective Date**. The Effective Date of this Agreement shall be the first day of the Member's billing cycle which follows the later of: (i) the interconnection date of the Solar Garden (the date the Solar Garden starts delivering energy to the Cherryland headquarters facility) or (ii) Cherryland's execution of this Agreement.

5. **Term**. This Agreement shall run from the Effective Date for a period of twenty-five (25) years or, if earlier, until the death of the Member (the "Term"), subject to early termination as provided in this Agreement.

6. **Solar Garden Credit**. The Member will receive a credit on the Member's monthly billing statement equal to the Member's proportional share of the total Solar Garden net metering savings in kilowatt hours multiplied by the existing rate applicable to the Cherryland headquarters facility.

7. **Change in Member Location**.

7.1 Member shall notify Cherryland in writing within fourteen (14) days prior to any change in Member's utility service location during the Term.

7.2 If Member moves to a new location within the service territory of Cherryland, then the account associated with the Member's new service location shall be substituted for its original account in effect when this Agreement was executed.

7.3 If Member moves to a new location outside of the service territory of Cherryland and fails to effectuate a transfer of the Solar Garden Credit to another qualifying member of Cherryland pursuant to Section 8 below, the investment shares shall revert to Cherryland and Member shall have no claim to the investment shares or future credits, and shall have no claim to a refund of the investment share price.

8. **Transfer or Assignment of Solar Garden Credit**.

8.1 Member, or Member's duly authorized representative or agent, may seek to transfer the Solar Garden Credit to another qualifying Member of Cherryland by submitting a Transfer Application. Cherryland has sole discretion as to whether to approve the Transfer Application.

8.2 If Cherryland approves the Transfer Application, the transfer shall not be completed until the Member receiving the Solar Garden Credit (transferee) executes a new Solar Garden Investment Agreement and any other necessary documents related to the transfer.

9. **Additional Acknowledgments**.

9.1 Member acknowledges that, except as expressly provided in section 8 of this Agreement, Member may not assign, gift, bequeath or otherwise transfer any Solar Garden Credit to any other individual or entity.

9.2 Member acknowledges that Member has no right, title or claim to the electric energy produced by the Solar Garden.

10. **Reporting and Marketing**. Member authorizes Cherryland to use Member's name, the amount of purchased shares and Solar Garden Credit information ("Member Information") for reporting and marketing purposes. Cherryland may use the Member Information only for official reporting to governmental authorities, public utility commissions, and similar organizations, and in marketing materials generated and distributed by Cherryland or its agent. Except as required by law and as otherwise provided in this Agreement, Cherryland will not release or otherwise publish any information collected from Member other than the Member Information. Notwithstanding this section, Cherryland will not use or disclose Member's name if Member provides written notice strictly prohibiting such use.

11. **Notice**. All notices, requests, consents, and other communications under this Agreement shall be in writing to the mailing address for each party stated above.

12. **Governing Law/Jurisdiction/Venue**. This Agreement shall be deemed to have been made in, and shall be constructed under, the laws of the State of Michigan. The parties acknowledge and agree that a court of competent jurisdiction located in Grand Traverse County, Michigan shall have exclusive jurisdiction in any action or proceeding arising under or relating to this Agreement.

13. **Entire Agreement**. This Agreement, including the Exhibit(s) attached hereto, constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all previous proposals, both oral and written, negotiations, representations, commitments, writings and all other communications between the

parties. This Agreement may not be released, discharged, or modified except by an instrument in writing signed by a duly authorized representative of each of the parties.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first written above.

MEMBER	CHERRYLAND ELECTRIC COOPERATIVE
____________________________ Member Name (please print)	____________________________ Signature
____________________________ Member Signature	____________________________ Printed Name
____________________________ Date	____________________________ Title
	____________________________ Date

For additional information, contact:

Tony Anderson
CEO, Cherryland Electric Cooperative
tanderson@cecelec.com
Ph: 231-486-9200

Solar Case Study

Kit Carson Electric Cooperative

NRECA

A Touchstone Energy® Cooperative

1. Company Profile

Kit Carson Electric Cooperative (Kit Carson) serves approximately 29,000 meters in three counties in north-central New Mexico near the town of Taos, in the Sangre de Christo Mountains. The cooperative is an all-requirements member of Tri-State Generation and Transmission Cooperative. Kit Carson averages 11 members per mile of line. The terrain is on a high plateau with elevation starting around 6,900 feet, and the climate is semi-arid. Solar resources are in the 5-to 6-kilowatt hour/m^2 range per day on an annual average, according to National Renewable Energy Laboratory maps. The territory receives about 300 sunny days per year. Under a power supply contract with Tri-State, Kit Carson can self-provide up to 5 percent of its energy and 10 percent of peak demand in locally owned renewables. The makeup of Kit Carson's load is about 75 percent residential, 20 percent small commercial and 5 percent large commercial. The cooperative's largest single account is Chevron Mining, followed by a ski resort. Tourism, recreation and service industries make up a large part of the local economy. Special considerations are required in working with two Native American tribes, the U.S. Forest Service and the Bureau of Land Management.

Kit Carson has a telecom subsidiary, KC Telcom, which serves 1,996 members, as well as a propane subsidiary, KC Energy, which serves 2,816 members.

2. Renewable Profile

Since 2009, Kit Carson has undertaken 10 solar projects: four owned by the cooperative, three commercially owned, two owned by the school district with power purchase agreements (PPAs) with the cooperative and one community solar array. These projects currently total just over 6,000 kilowatts AC of solar capacity. They range in size from 45 kw to 1,550 kw. Kit Carson was not committed to any set model, design or components. Rather, it has used a number of different models to provide its community's solar needs. In fact, three entities own the three commercially owned arrays. For the community solar array located at the Taos Charter School, Kit Carson partnered with Clean Energy Collective (CEC).

The cooperative's membership is interested in solar, and Kit Carson is responding to its membership. Kit Carson anticipates developing additional solar projects and is currently in discussions with Tri-State to increase its self-provide limit in their supply contract. The four projects owed by Kit Carson are UNM Taos-435 kw, KCEC canopy-82 kw, KTAOS canopy-45 kw and Eco Park Canopy-60 kw.

Kit Carson estimates the solar production peak matches its system peak demand about 75 percent of the time.

On January 15, 2015, Kit Carson announced expansion of its community solar program with CEC to provide an additional 1.5 megawatts AC of solar to be located in four different areas within its service area. These projects will essentially follow the same ownership model used with CEC at the current community solar array.

3. Financing and Rate Design

Kit Carson used several models to incorporate solar onto its system. The cooperative received funding of $5 million as part of the Clean Renewable Energy Bond program, which funded the four projects it owns.

For the Taos Charter School community solar project, members were able to purchase a 235-watt panel for an investment of $845. Members who did so received tax credits and net metering of the output as if the panels were installed on their own roof—essentially a virtual net metering. All 420 panels available for sale sold out in a short period. This project was structured through CEC, where it owns, operates and maintains the array. At the start of the project, there was a PPA between Kit Carson and CEC whereby Kit Carson purchased all of the array output at a negotiated price. As each panel was sold, the PPA amount decreased by that amount and the purchasing member was credited as described below.

CEC has about 35 community solar projects across the country, 11 of which are operated in partnership with electric cooperatives. CEC is technically the owner of the Taos Charter School array, with all of the financial responsibility and risk. Kit Carson members who wished to participate purchased one or more panels at $845 per panel, less any solar rebates available at the time. Monthly credits are calculated at the members' pro-rata share of the metered output of the array that month, less 5 percent times the current retail rate. Kit Carson and CEC have a standalone LLC that operates like a trust to ensure funding for the operations and maintenance of the array over the next 50 years, funded by the value of the 5 percent of the output produced monthly.

All remaining project costs were blended into the overall power cost of the cooperative. Kit Carson feels that all of the PPAs should stabilize prices and make them more predictable, due to the fixed price nature of the PPAs. Traditionally sourced power costs are increasing with unknown or unpredictable increases.

4. Project Development

Kit Carson's projects used different designs and specifications based on the best available at the time. The four projects owned by Kit Carson were standardized. As some projects were only for purchased power, the cooperative had less influence, but it did attempt to keep as much of the work with local firms as practical, and specified so in each project contract. Sol Luna Solar and PPC Solar are two local contractors that were used. Each project was developed on a turnkey basis with the developer responsible for engineering, procurement and construction.

The UNM Taos array consists of 2,640 Canadian Solar panels of varying sizes (180, 190 and 200 watts) that use a 500-kw Satcon PowerGate inverter. The KCEC Canopy has 528 156-watt Yingli Panels and a 100-kw Satcon PowerGate inverter. The KTAOS Canopy has 242 180-watt Trina panels and a 50-kw Satcon PowerGate inverter. The EcoPark Canopy uses 308 230-watt Yingli panels and two 35-watt Advanced Energy inverters. The UNM Taos array has single-axis tracking racks manufactured by Array Technologies; the other three canopy arrays use fixed racks.

5. Operations and Maintenance

Kit Carson has contracted with a local installer to perform semiannual inspections of the arrays it owns. Procedures and checklists are still under development; at this point, only a visual inspection has been necessary. No failures or maintenance issues have developed. A third party is under contract to perform required maintenance. A copy of the inspection form is on pages 42-43.

No operational issues have been encountered. Mitigation studies were performed prior to installation by Los Alamos National Labs. Kit Carson developed an internal policy that any array in excess of 50 kw would have voltage regulation installed or upgraded in conjunction with the interconnection at the site. This seems to have precluded any voltage problems.

Kit Carson is not aware of any warranty or operations and maintenance issues encountered by the six arrays owned by other parties and connected to its system.

6. Telemetry

Kit Carson operates both a Cannon power line carrier and Next Grid mesh network smart metering systems to monitor output from the arrays. In addition, those units in excess of 1 MW are also monitored by Tri-State as part of its network. The community solar array at Taos Charter School has its output posted on the CEC website and linked to the Kit Carson website. The other arrays do not have production data available for public viewing at this time.

7. Administrative Impacts

No additional personnel were required as a result of participating in the solar projects. However, staff time was directed toward communicating with members about the cooperative's participation in these projects. Press releases, including photos, were developed for each of the projects. In addition, the cooperative has a special section located on the Kit Carson website (www.kitcarson.com/content/go-green) pertaining to solar that includes fact sheets about its involvement. The community solar array is also linked to the CEC website dedicated to Kit Carson (www.kcecsolar.com), and the FAQs are attached.

8. Renewable Policy Development

Kit Carson's solar projects are a response to feedback provided in member meetings over several years. Kit Carson participates in a net metering program, as required by the New Mexico Public Utility Commission, and currently has 189 net metering solar members. The cooperative has developed an advisory solar committee of its membership, with subcommittees focusing on the areas of finance, education, technical and workforce development. A copy of the subcommittee's mission statements is attached. Early on, the committee of 22 members met quarterly, or more often as necessary. However, the committee is not active at this time.

9. Member Interest in Solar

Starting with a series of meetings in 2005, Kit Carson first became aware of member interest in solar. Since then, member interest and support have steadily grown. A large segment of the membership is environmentally conscientious, and the public response to Kit Carson's solar initiatives has been overwhelmingly positive; for example, the community solar array at Taos Charter School quickly sold out. Given the sunniness of the cooperative's territory, solar is a natural fit. Member preference is for local, independent control of the power supply, which solar partially provides. The cooperative positioned itself for change according to its members' wishes. Kit Carson has received positive local press for its solar initiatives, and it was named Solar Utility of the Year by the Solar Electric Power Association (SEPA) in 2013, recognizing its achievement in developing solar.

10. Business Options

In short, Kit Carson took an all-of-the-above approach to solar. Members can subscribe to the community solar program for direct ownership. If they choose, they can install their own rooftop solar array. All members receive a portion of solar as part of the standard generating mix under the cooperative's ownership of solar arrays and through power purchase agreements.

11. Lessons Learned

Kit Carson plans to review its pricing and rate structure, given that solar is becoming a larger part of its overall portfolio. The cooperative found several good sources of information, including local contractors, a University of New Mexico branch college and SEPA. Its advice to cooperatives starting from scratch would be to begin by educating board members, soliciting member input, listening to different opinions and educating the membership about what is feasible.

For additional information, contact:

Luis Reyes
CEO, Kit Carson Electric Cooperative
lreyes@kitcarson.com
Ph: 575-741-0213

Inspection Form

PPC SOLAR

Semi-Annual Site Visit Checklist for KCEC Solar Electric Systems

Sites: Klauer Campus, KCEC HQ, KTAO, Eco-Park

Technician(s):
Date:

Site Inspection

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection for erosion control	
	Visual and physical inspection of all fencing	
	Visual and physical inspection of landscaping	
	Visual and physical inspection of service road	

Photovoltaic Modules

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection for plant growth or any obstructions causing shading	
	Visual and physical inspection for corrosion on all terminals, cables and enclosures	
	System testing (operating current of each string)	

Tracking System (Klauer Only)

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection of module clamp fasteners, bushing housing, gear box brackets, and torque tube fasteners.	Semi – Annual
	Visual and physical inspection of gear drives and drive-shaft assemblies for proper gear-tooth alignment, limit switch integrity, and overall structural integrity	Semi – Annual
	Test wind stow function	Semi – Annual
	Visual and physical inspection of Slew Rings, torque markings are aligned (Gear Drives)	Semi – Annual
	Visual and physical inspection of top cap and torque tube welds	Semi – Annual
	Inspect drive-shaft assemblies and column housings for misalignment due to grnd settling	Annual
	Inspect Bearings for excessive wear and check torque marks on column	Annual
	Inspect seals on electronic enclosures	Annual
	Grease Slew Rings (aka: gear drives), center zerk 80cc, outer zerks 40cc each	Every other yr.
	Inspect all hardware on one row per motor block, if loose expand inspection	Every other yr.

Inverter

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection of appearance/cleanliness of the cabinet, ventilation system and all exposed surfaces, clean as necessary.	
	Visual and physical inspection of air filter elements, clean/replace as necessary	
	Visual and physical inspection for corrosion on all terminals, cables and enclosure	
	Visual and physical inspections of all fuses and fuse holders	
	Visual and physical inspection of the internally mounted equipment including sub-assemblies, wiring harness, contactors, power supplies and all major components	
	Visual and physical inspection of the condition of all the AC and DC surge suppressors	
	Torque terminals and all fasteners in electrical power connections	
	Check the operation of all safety devices (E-Stop, door switches)	
	Record all operating voltages and current readings via the front display panel	

PV Array Combiner Boxes

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection for corrosion on all terminals, cables and enclosure	
	Visual and physical inspections of all fuses and fuse holders	

Square D Ventilated Dry Type Transformer (Klauer Only)

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection for corrosion on all terminals, cables and enclosure	

Square D 800 Amp 480 VAC 3 Phase Heavy Duty Safety Switch

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection for corrosion on all terminals, cables and enclosure	
	Check the operation of all safety devices	

Fat Spaniel Monitoring System

Initials	Inspection	Notes – Status, Failures, Remedies, Repairs
	Visual and physical inspection for corrosion on all terminals, cables and enclosure	
	Visual and physical inspection of weather station	

Kit Carson Electric Cooperative Inc.

FAQ: Solar Projects

575-758-2258 * 800-688-6780* www.kitcarson.com

KCEC Solar Questions & Answers

We've heard Kit Carson Electric Coop is a national leader in solar energy production. What does that mean? The Solar Electric Power Association (SEPA) ranks utility companies according to the amount of solar power they utilize in their system. In 2012 KCEC was ranked third in solar watts produced per consumer and fourth in overall solar watts produced. SEPA also nominated KCEC as the UTILITY OF THE YEAR for 2011. KCEC CEO Luis Reyes was on of the two finalists in a nation-wide competition between all utilities for CEO of the Year in 2012.

We've been hearing a lot of talk about Community Solar. What is it? KCEC is the first New Mexico electric company to utilize Community Solar. The Clean Energy Collective sells individual and multiple panels from the solar array at Taos Charter School to KCEC members. The electricity produced by the purchased panels is then credited to the member's bill. This allows members who can't install solar panels at the home or business to still take advantage of the power of the sun. For instance, if a member rents their home or business, lives in a location that does not get full sunlight, has neighborhood restrictions or just doesn't want to bother with a home system, KCEC Community Soar is a great alternative. The panels are real property, so the energy can continue to be applied to the member's bill if he or she happens to move within the KCEC service territory. The panels are affordable and can be purchased on a low interest payment plan. KCEC Community Solar is our way of making renewable energy available and affordable to all KCEC members.

It's been said the northern part of KCEC's territory is solar powered. What does that mean? On a sunny day, every home and business from Questa north is powered by the sun. The solar array outside Amalia, which was energized in June 2012, produces 1.25MW AC power. The Chevron Mining concentrated solar array produces 1MW. The two arrays produce enough power to provide all the electric needs for every home, retail business, school, village government and medical facility in Questa, Cerro, Sunshine Valley, Costilla, Amalia and everything in between.

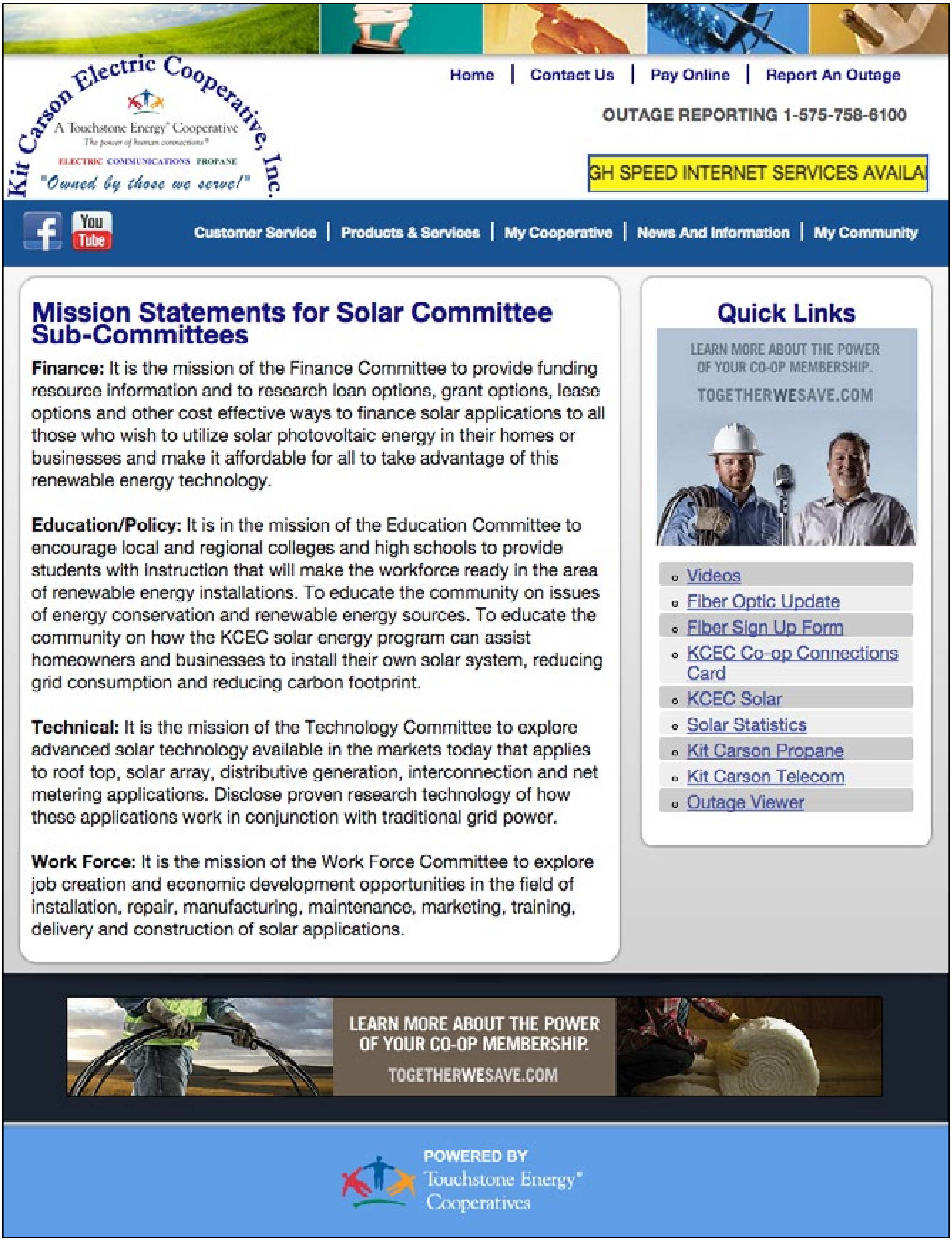
Does KCEC actually own all these solar arrays? KCEC owns the UNM-Taos, KTAO, Taos High School and our headquarters parking lot arrays. The rest of the solar arrays in our service territory were built by other parties. We have Power Purchase Agreements with them.

What is a Power Purchase Agreement? When an investor plans to build an array a power purchase agreement can be put in place. This means KCEC agrees to purchase the power produced by the array at a certain price. The electricity produced is metered before it is fed into the electric grid. KCEC pays for the power that is produced. At this time we are limited to 5% of our total electric needs coming from these agreements.

Can KCEC add more solar arrays to their portfolio? At this time, due to the 5% limit, we are at the maximum for solar production. We are working with our power provider, Tri-State Generation and Transmission, to increase the percentage of power we receive for our abundant sunshine.

Kit Carson Electric Cooperative, Inc.
A Touchstone Energy® Cooperative
ELECTRIC TELECOM INTERNET
"Owned by those we serve!"

Mailing Address: P.O. Box 578, Taos, NM 87571
Street Address: 118 Cruz Alta Road, Taos, NM 87571
Business Hours: 8:00 a.m. – 4:30 p.m. Monday through Friday



Kit Carson Electric Cooperative, Inc.
A Touchstone Energy® Cooperative
The power of human connections®
ELECTRIC COMMUNICATIONS PROPANE
"Owned by those we serve!"

Home | Contact Us | Pay Online | Report An Outage

OUTAGE REPORTING 1-575-758-6100

GH SPEED INTERNET SERVICES AVAILA

Customer Service | Products & Services | My Cooperative | News And Information | My Community

Mission Statements for Solar Committee Sub-Committees

Finance: It is the mission of the Finance Committee to provide funding resource information and to research loan options, grant options, lease options and other cost effective ways to finance solar applications to all those who wish to utilize solar photovoltaic energy in their homes or businesses and make it affordable for all to take advantage of this renewable energy technology.

Education/Policy: It is in the mission of the Education Committee to encourage local and regional colleges and high schools to provide students with instruction that will make the workforce ready in the area of renewable energy installations. To educate the community on issues of energy conservation and renewable energy sources. To educate the community on how the KCEC solar energy program can assist homeowners and businesses to install their own solar system, reducing grid consumption and reducing carbon footprint.

Technical: It is the mission of the Technology Committee to explore advanced solar technology available in the markets today that applies to roof top, solar array, distributive generation, interconnection and net metering applications. Disclose proven research technology of how these applications work in conjunction with traditional grid power.

Work Force: It is the mission of the Work Force Committee to explore job creation and economic development opportunities in the field of installation, repair, manufacturing, maintenance, marketing, training, delivery and construction of solar applications.

Quick Links

LEARN MORE ABOUT THE POWER OF YOUR CO-OP MEMBERSHIP.
TOGETHERWESAVE.COM

- Videos
- Fiber Optic Update
- Fiber Sign Up Form
- KCEC Co-op Connections Card
- KCEC Solar
- Solar Statistics
- Kit Carson Propane
- Kit Carson Telecom
- Outage Viewer

LEARN MORE ABOUT THE POWER OF YOUR CO-OP MEMBERSHIP.
TOGETHERWESAVE.COM

POWERED BY Touchstone Energy® Cooperatives

Solar Case Study

Great River Energy

NRECA

A Touchstone Energy® Cooperative

1. Company Profile

Great River Energy (GRE) is a generation and transmission cooperative that comprises 28 distribution cooperatives in Minnesota and Wisconsin. GRE serves about 660,000 accounts or about 1.7 million people. About 57 percent of GRE's end-use members are residential consumers, and 43 percent are commercial and industrial. It has a variety of generation resources totaling more than 2,800 megawatts, the largest of which is the Coal Creek Station with 1,140 MW of coal-based generation. GRE has sufficient capacity resources through 2027, but it will need to add renewable resources by 2024 to meet the Minnesota renewable mandate of 25 percent by 2025. As part of its resource planning and as a learning experience, GRE has deployed a 272-kilowatt solar array at its campus in Maple Grove, Minnesota. The site had an existing 72-kw rooftop array and a 250-kw wind turbine. This array was sized to not exceed the average building load.

GRE has committed to installing about 20 smaller, 20-kw arrays at its member distribution cooperatives' locations.

2. Renewable Profile

The Maple Grove solar array consists of three sections, each with a different manufacturer and configuration:

1. Sharp (180 panels of 300 watts, totaling 54 kw) supported by Creotecc racking and Cantsink helical pile foundations.
2. tenKsolar (297 panels of 410 watts, totaling 121.7 kw) supported by tenKsolar rails and Chance helical pile foundations.
3. Suniva (360 panels of 265 watts totaling 95.4 kw) supported by Carport Structures parking canopies.

The total nameplate rating is 272 kw. An Advanced Energy 100-kw AC central inverter was paired with the Suniva modules. A Solectria 50-kw AC central inverter was paired with the Sharp modules, and tenKsolar 500-watt micro inverters in 6-kw inverter buses were paired with tenKsolar panels. The annual capacity factor is estimated at 15 percent.

Construction started in January 2014 and the project entered service at the end of May 2014. The array was added as part of the GRE energy renewable generation resource mix and will serve as an overall learning experience for GRE as it deploys up to 20 planned 20-kw solar projects at each distribution co-op member's location through 2015. GRE members have the option to install additional solar modules to the array for community solar on an incremental cost basis. Two of the five installations completed in 2014 have committed to doing so, one sized at 57.4 kw and the other at 45.9 kw. Three of the 14 planned installations in 2015 have committed to adding community solar and another four are still considering it. All co-op members are allowed to supply up to 5 percent of their own needs under the current all-requirements power supply contract.

The 20-kw membership initiative was started for three primary reasons:

1. To create visibility across the membership and to showcase how the GRE portfolio is evolving by providing an opportunity for each member to have an array on its distribution system.
2. To provide a real-world, hands-on experience with small-scale solar design and installation.
3. To provide an opportunity for members to start a community solar program at a favorably priced increment.

The 20-kw-size project was chosen because it is manageable from an installation and budget standpoint. There is no limitation on the size of incremental solar that a member can add.

3. Financing and Rate Design

GRE explored a number of options for financing but chose to execute a lease structure with CoBank. It provided the best value for GRE compared to alternatives and was a relatively straightforward transaction that could be executed under GRE's existing lease agreement. The lease has a 10-year term and a buyout at the end, which allowed GRE to minimize upfront expenditures by deferring any capital requirements for 10 years.

In addition to executing a lease for GRE's solar assets, GRE also offered to execute and hold a lease for any distribution member that installs incremental solar for its own needs. GRE and the member will execute a development agreement covering the development of the solar asset and the financial obligation requirements of the lease.

Here's how it works: GRE will build and finance the project through a lease with CoBank and the co-op will simply have the obligation to pay GRE for its lease costs and for the buyout at the end of 10 years. GRE encourages its member co-ops to explore all financing and development options to determine which makes the most sense.

4. Project Development

The main requirement was to locate the solar installation within GRE's Maple Grove campus so it would be visible to the public. The only calculation for yield projection was a site shade analysis. Engineering for the project was largely completed in-house for conceptual design and component selection. Dunham Associates, the original engineer for the GRE building, performed the interconnection. Components were selected based on the country and state of origin, equipment type, availability and cost, with the goal of using as many U.S.- and Minnesota-sourced components as possible, partially to take advantage of the state tax credit.

McGough Construction was the general contractor. Standard Minnesota electrical inspection and building permits were required because this project was behind the co-op meter that serves Wright-Hennepin. The only issue encountered during the electrical inspection was the need to either fence in the array or enclose all low-voltage cables in conduit. However, fencing would detract from the look of the project and add costs, so GRE proposed a compromise in which cables were routed away from any location where someone could walk up and access them, thereby keeping conduit to a minimum.

GRE, Hunt Electric (electrical construction contractor) and Wright-Hennepin Electric Cooperative (the building power supplier) commissioned the project. An anti-islanding test was important because the interconnection was behind Wright-Hennepin's meter to the building. This requirement was easily met with the equipment used because almost all inverters today have that functionality built in. Each co-op has different metering requirements for distributed generation in terms of equipment needed and communications available to the meter. GRE has been flexible in its design to meet those needs and to use different telecommunications options to communicate with meters.

5. Operations and Maintenance

Procedures, tools, checklists and a maintenance plan are still under development. The only unscheduled maintenance issue was one panel of broken glass, the cause of which is unknown. The panel was sent to the manufacturer for analysis and replaced under warranty. No operational issues such as islanding, voltage regulation or reverse flows have been noted. As this facility serves the headquarters, the only building changes required to accommodate the solar array were additional electrical panels and 480-volt switchgear. No smart grid technology is being used; however, the building already had a rather sophisticated energy management system that is also used for monitoring the array. GRE has revenue-grade meters for each of the panel/inverter combinations that it accesses through the building management system and a separate data historian. Through the data historian, GRE has access to data in one-second increments. Small voltage fluctuations in array output, based on cloud cover, were noted, but they haven't affected operations. Real-time information on the output of the tenK-solar portion of the array is made public on GRE's website using eGauge systems equipment and web portal, and a sample graph is on page 52.

6. Administrative Impacts

The Maple Grove campus project did not require adding staff members. However, successful implementation of the 20-kw membership projects required additional internal coordination between generation, business development, land rights, billing, member services and legal departments. GRE is working on programs to help its members understand the subscription costs and to market community solar. A team effort between GRE and distribution member staff ensures that solar installation meets both parties' objectives. The four GRE staffers came from the generation engineering, member services and business development departments. Also included is one person representing the installation contractor and two or three people from the distribution cooperative. Items typically discussed included interconnection, metering and communications, size of community solar, zoning and permitting, ground preparation and soil conditions and shading structures. Other items include ground finish under the array, fencing needs, construction lay-down areas, delivery/check-in of materials, site signage, and marketing and pricing of the community portion.

The need for additional skill sets at the GRE or distribution member level is evolving and will depend on how the members decide to participate in DG. GRE is still determining what the ultimate level of involvement will be as the knowledge base increases and as the pilot program ramps up.

7. Renewable Policy Development

GRE is subject to a state renewable energy standard that currently stands at 12 percent, increasing to 17 percent on Dec. 31, 2016, and to 25 percent by 2025. GRE has sufficient resources until at least 2027 with its current resource portfolio from an overall load perspective, but it plans to add additional renewables by 2024 to comply with the increased renewables mandate.

Although GRE's board of directors sets the strategic direction for renewable initiatives, the board and the membership must approve any resource additions. The board understood the need for GRE and its membership to become involved in solar development and championed this effort, passing resolutions to enable the project's development. A press release and a fact sheet are on pages 53-55.

GRE is not rate-regulated. It is, however, required to file an Integrated Resource Plan (IRP) with state regulators every other year. The IRP contains GRE's preferred plan and alternatives during a 15-year horizon while maintaining compliance with renewable energy standards and other policies.

GRE added an amendment to its most recent power supply contract with its all-requirements members allowing 5 percent self-supply, specifically to address the addition of resources such as community solar gardens. With the exception of a couple of utility-scale wind turbines, few of its members have opted for this self-supply. For many, the ability to add community solar through the GRE program will be the first generation resource that qualifies under the 5 percent option.

GRE works actively with the Minnesota Rural Electric Association in an effort to guide state energy policy. GRE has developed a DG policy and supports a consumer's choice to supply electric needs on site as long as it does not degrade safety or reliability or create a cost burden for other consumer-members. Minnesota cooperatives are currently exempt from the state's newly enacted 1.5 percent solar energy standard. GRE members are required to offer net metering for systems less than 40 kw. Minnesota has developed a state standard interconnection and contract agreement to cover DG systems up to 10 MW, and cooperative staffs were instrumental in developing the standards.

8. The Role of the G&T

GRE foresees greater penetration of DG going forward, driven by improving technology, consumer awareness and economic incentives. It is becoming another generation resource that utilities have to account for in their long-term planning and evaluate against other generation resources. GRE believes that G&Ts should lead efforts in piloting various technologies, identifying and evaluating viable business models and providing financing solutions for its members. It should further serve as a resource to members to prevent the duplication of efforts and to provide the opportunity to mitigate risks.

To support the 20-kw membership projects, GRE developed two contracts. A standard site lease agreement allowed GRE to place an array on each member site. A solar development agreement engages members wishing to develop incremental solar that could be used as a community solar resource. The additional cost for incremental solar is at the incremental cost, which allows members to realize a very competitive price on a small-scale solar project. GRE projects that the installed cost for the base 20-kw array will be about $4.40 to $5 per watt. The member's cost for the additional member kw increments will be about $2.50 to $3 per watt.

9. Consumer-Member Interest in Solar

GRE has worked closely with its member distribution cooperatives to implement its solar initiative, installing the 20-kw solar arrays at all member sites in 2015. Member feedback is very positive. GRE's 272-kw array installation initiative has been based on

1. Developing internal skills and knowledge toward DG development on member sites.
2. Creating regional visibility.
3. Assessing the technology.

GRE made a conscious effort to use U.S.-made and Minnesota-sourced panels. The G&T conducted a cost-benefit analysis, but knowledge and visibility were more important factors than economics. GRE has a special section on its website to inform the public of the solar initiatives and to show the production of the array. Future plans include establishing a member portal on GRE's Web page to view production data from the local arrays and assembling a report to capture lessons learned and establish further guidelines for future solar installations.

10. Lessons Learned

At this point, maintenance requirements will likely be relatively site-specific. GRE observed that in the solar industry, the design and technology curve is similar to laptop PCs. There is risk from supplier turnover, supplier changes in component sourcing and technical changes. Since the project started, a panel supplier changed sourcing and a rack provider stopped making the preferred rack system. Also, the marketplace is driving down the cost of panels. All of these factors can have a significant effect on the project's economics.

Managing costs and applying the appropriate development process is critical to ensuring acceptable economics on small-scale solar installations. This kind of oversight requires a slightly different skill set than we are used to across the utility industry, which has historically relied on comparatively stable suppliers and technologies.

11. Advice to G&Ts Contemplating the Move Into DG

1. Work together as a membership and develop a comprehensive approach that takes into account the needs of the G&T and its distribution members.

2. Take a measured approach, limiting the financial and implementation risks.

3. Have a clear objective for the project.

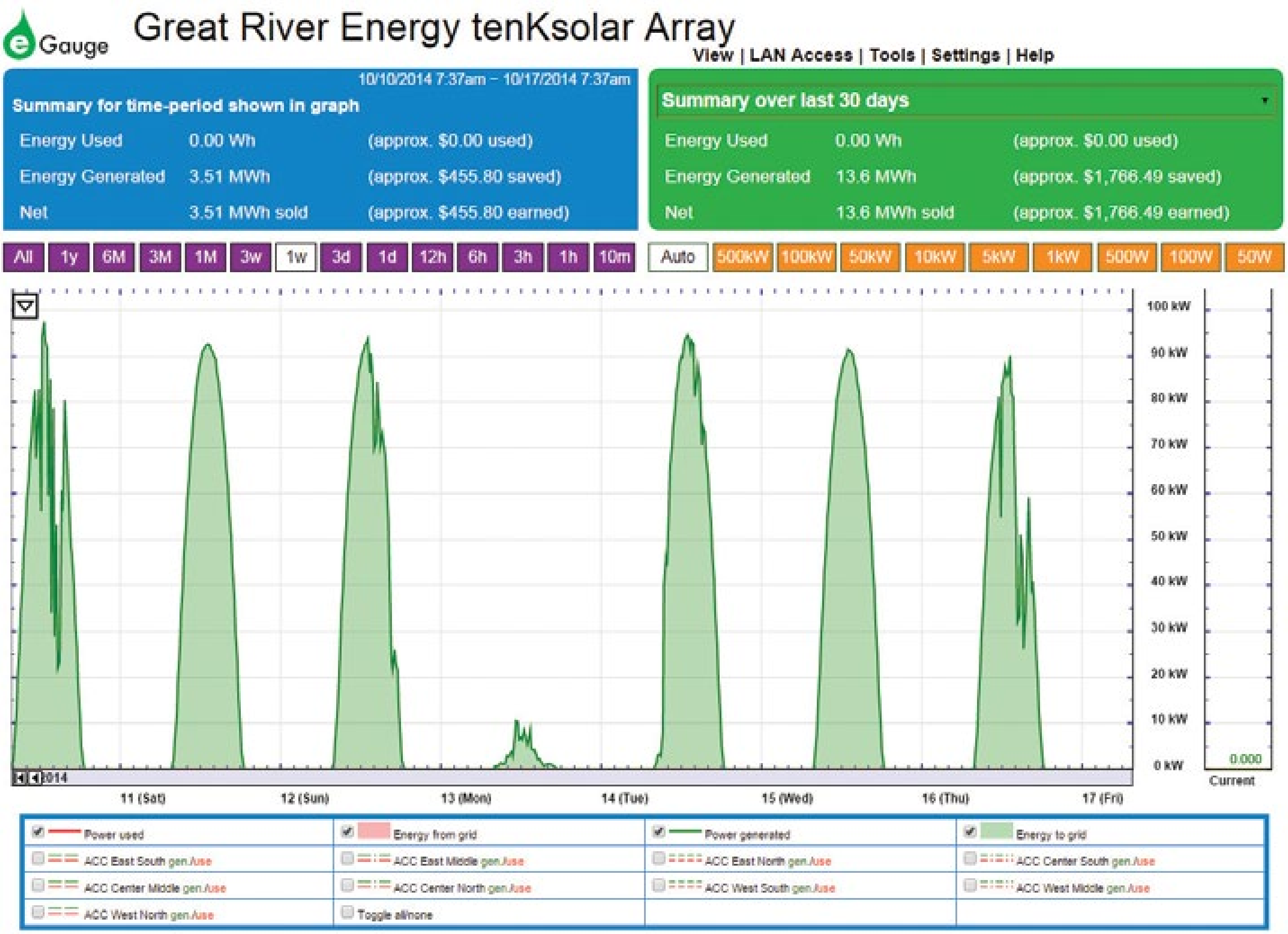
4. Coordinating this activity through the G&T allows for economies of scale and socialization of costs. Most important, it allows for all of the valuable information to be shared widely throughout the membership.

For additional information, contact:

Andy Bergrud, PE
Senior Engineer PM, Great River Electric
abergrud@grenergy.com
Ph: 763-445-5809

Robert Sandberg
Manager Corporate and Business Development, Great River Electric
bsandberg@grenergy.com
Ph: 763-445-5305

tenKsolar Array Sample Graph



Press Release

GREAT RIVER ENERGY

Home | The Cooperative Way | Making Electricity | Delivering Electricity | Saving Electricity | Learn About | About Us

Press Room

Who We Are
Financial
Our LEED Buildings
Social Responsibility
Environmental
Community
Other Services
Careers

Press Room
Working With Us

Great River Energy and Dakota Electric install local solar project

Dakota Electric Association's board of directors visited the new solar installation at the corner of Highway 50 and Denmark Ave. in Farmington, Minn.

Dakota Electric, along with its wholesale power supplier Great River Energy, has installed a 20-kW solar array in Farmington, Minn. Construction on the project, located at the southeast corner of Highway 50 and Denmark Avenue, is scheduled to be completed this month.

"We are happy to have this solar project installed in our service territory," CEO Greg Miller said. "Our members will benefit from the solar output as we, along with Great River Energy, learn about the performance of solar with this local project."

In addition to the Farmington solar site, Great River Energy is working with 17 other member cooperatives throughout the state to construct similar solar arrays.

In total, more than 600 kW of new solar energy installations are expected to be in service by the fall of 2015.

"These projects are teaching us and our member-cooperatives a lot about how solar performs and what it takes to plan, finance and execute a solar project," said Great River Energy senior engineering project manager Andy Bergrud. "We are learning a lot about the industry in general with this effort."

At its headquarters building in Maple Grove, Great River Energy recently completed construction on a 250-kW solar array. The project will measure the performance of different panel technologies, assess the benefits of a variety of inverters and document lessons learned while designing, permitting and installing the solar array.

"Our industry continues to evolve," said Rick Lancaster, vice president of generation at Great River Energy. "As an organization, we need to understand how these technologies may affect our business now and in the future, as well as research the impacts to our distribution system and evaluate the overall costs to integrate both large- and small-scale solar installations."

In the future, Dakota Electric will place a display on the company's webpage that will show the solar panel's actual output.

Careers | Press Room | Contact Us

12300 Elm Creek Boulevard, Maple Grove, MN 55369-4718 P: 763-445-5000 F: 763-445-5050

Privacy | Terms | Site Map

Cooperative solar projects span state

Great River Energy building distributed solar network throughout Minnesota

The electric cooperatives of Minnesota are working together to convert the sun's rays into electricity throughout every corner of the state.

In 2014 and 2015, solar arrays will be installed at sites owned by electric cooperatives. The projects are being led by Great River Energy, a wholesale electricity provider to electric cooperatives.

The local solar installations are part of a series of 18 projects, each with an electricity generating capacity of 20 kilowatts (kW). The solar projects will help Great River Energy and its member cooperatives evaluate the impact of solar energy while providing up to 500,000 kilowatt-hours (kWh) of renewable energy annually.

Although the installations will be designed, built and owned by Great River Energy, the company will work with each participating member cooperative to identify the ideal location. Additionally, Great River Energy will assist the member cooperatives with interconnection efforts and collect key information about energy production and system interaction.

Most of the solar arrays will use a packaged system design from tenKsolar. One will install panels made by Silicon Energy. Both manufacturers are Minnesota companies.

Some of the participating cooperatives are exploring plans to install additional solar arrays at sites in their service area.

Research and development

The first and largest in the series of solar installations was completed at Great River Energy's Maple Grove, Minn., headquarters site in June 2014. The 250-kW project has a research and development component that will test the performance of a variety of technologies and configurations.

The cooperative solar installations will employ solar technology from Minnesota companies tenKsolar and Silicon Energy. Energy Concepts installs and commissions the projects.

The project will enable Great River Energy and its member cooperatives to research how solar energy can work best when connected to cooperative electric systems in Minnesota and provide valuable information for future utility-scale solar projects.

Additionally, Great River Energy is working with the National Rural Electric Cooperative Association (NRECA) and Department of Energy (DOE) to analyze various business cases for distributed generation and solar installations.

That work, which is funded by a joint DOE/NRECA grant and part of DOE's SunShot Initiative, will provide valuable information for cooperatives across the country.

Using a variety of solar panels and different types of electrical systems to collect and convert electricity, Great River Energy will analyze the solar energy facilities for: energy production, power quality, efficiency, durability, ideal installation conditions, reliability and finance structure.

Great River Energy's headquarters site will test a variety of solar technologies and configurations. The new 250-kW installation expands upon 72 kW of solar panels that were installed in 2008. The array includes panels made by Sharp (two rows pictured at bottom), tenKsolar (three square-shaped clusters) and Suniva (three rows closest to the building).

Great River Energy – Powering what's possible

Agralite Electric Cooperative • Arrowhead Cooperative, Inc. • BENCO Electric Cooperative • Brown County Rural Electrical Association • Connexus Energy • Cooperative Light & Power • Crow Wing Power • Dakota Electric Association • East Central Energy • Federated Rural Electric Association • Goodhue County Cooperative Electric Association • Itasca-Mantrap Cooperative Electrical Association • Kandiyohi Power Cooperative • Lake Country Power • Lake Region Electric Cooperative • McLeod Cooperative Power Association • Meeker Cooperative • Mille Lacs Energy Cooperative • Minnesota Valley Electric Cooperative • Nobles Cooperative Electric • North Itasca Electric Cooperative, Inc. • Redwood Electric Cooperative • Runestone Electric Association • South Central Electric Association • Stearns Electric Association • Steele-Waseca Cooperative Electric • Todd-Wadena Electric Cooperative • Wright-Hennepin Cooperative Electric Association.

greatriverenergy.com/solar

GREAT RIVER ENERGY®
A Touchstone Energy® Cooperative

7-30-2014

12300 Elm Creek Blvd., Maple Grove, MN 55369