

Final Technical Report

Recipient Organization: Ute Mountain Ute Tribe

Project Title: Ute Mountain Ute Tribe Community-Scale Solar Project

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Award Number: DE-IE0000095

Total Project Costs: \$2,223,165

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2. Executive Summary:

Deployment of Community-Scale solar power has been a goal of the Ute Mountain Ute Tribe (Tribe) for several years. Following the completion of a feasibility study, an unsuccessful grant proposal and constructive criticism by Department of Energy (DOE) regarding that proposal, the Tribe was able to get a DOE grant to cost share this project. Partnering with GRID Alternatives (GRID) as the project partner, a 1 MW AC photovoltaic power facility was built. The project was built to power Tribal facilities in a manner that would allow the Tribe to credit residents' electric bills and Tribal government electric bills with the dollar equivalent of the power generated. Power generator rules require distributed generation to be less than 1 MW AC, so this was sized to be 999,999 KW. Other accomplished project objectives, in addition to learning the intricacies of such an endeavor, included strengthening the relationship with the local electric cooperative and their primary power provider, analysis of the generation and operations and maintenance during a one-year test phase, workforce development and training, and using the project to plan and drive future community scale solar projects. The Tribe's vision of a net-zero electrical independence for its communities became a clearer reality with this project.

2. Project Objectives:

Task 1.0: Award and Contract Negotiations

Contracts were negotiated and awarded for the equipment procurement and construction (EPC) primary partner GRID Alternatives and the Project Manager. The EPC awarded sub-contracts for geotechnical assessment, electrical engineering and fencing.

Task 2.0: Finalize Site and Work Plans

Original site plans were modified to an adjacent similar site. Work plans were not modified significantly, although the role of the Tribe's construction company was limited by subcontracting a different company for fencing. The EPC partner and Project Manager worked to keep the project on task with the original plans and somewhat on schedule.

Task 3.0: Finalize Engineering Plans

Engineering plans for system layout, module selection, inverter selection, data collection systems, type of racking and wire were relatively streamlined with the EPC and their electrical engineers and the Project Manager after analysis of interconnection points and geotechnical analysis. The purchase of the NUCHU 1 circuit allowed for an on-location single interconnection point and the eventual delivery of power to the Tribe's casino resort enterprise.

The transformer design was very time consuming and delayed the project after initial installation of all other equipment.

Task 4.0: Analyze Renewable Energy Credit Opportunities

Renewable energy credits were not an opportunity on this project because it is entirely “behind the meter.” While this limits the financial return somewhat, having the system behind the meter offers other advantages, such as the realized bill crediting system based on the month-to-month value of the electricity.

Task 5.0: Site Preparation

Site preparation included security fencing, and modest leveling and digging where concrete was to be poured.

Task 6.0 System Installation

System installation included workforce development, racking installation, module installation, wire runs, monitoring equipment installation, master switch equipment installation, master (net) meter installation, curtailment system equipment and meter installation, and finally the transformer installation.

Task 7.0: System Commissioning

System Commissioning occurred behind the original schedule, but took place in March 2020 at 50% generation capacity. Full capacity was realized after curtailment system testing in May 2020.

Task 8.0: Complete Energy Savings Verification and Reporting

Energy generation and savings verification took place for one year from March 2020 to April 2021. Progress reporting and financial reporting occurred quarterly and energy generation and savings reporting occurred after the one year test phase.

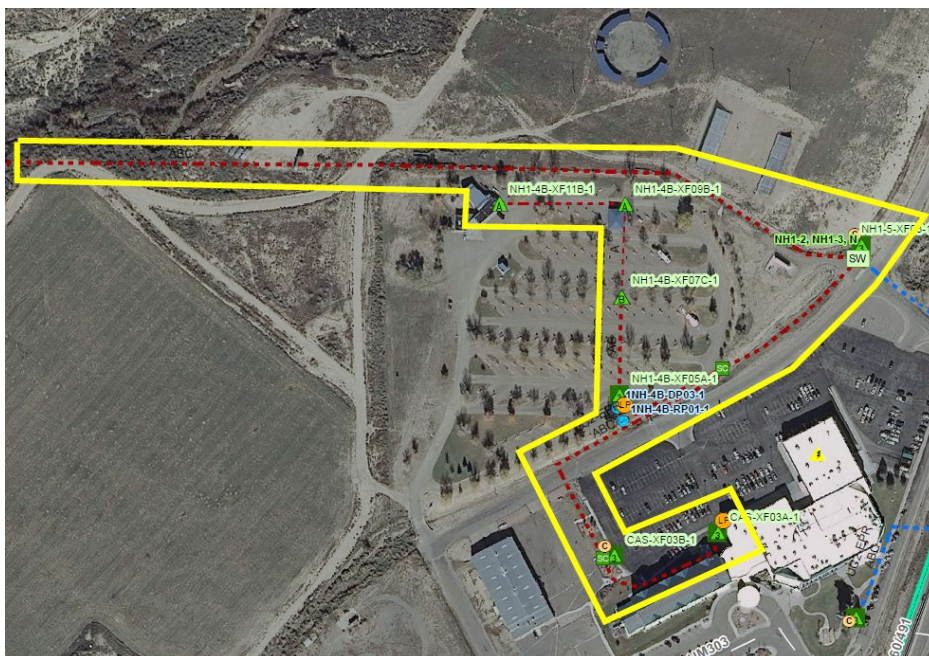
4. Description of Activities Performed:

Upon completion of the pre-award documentation and National Environmental Policy Act (NEPA) compliance checklist, the award was officially issued and a contract was negotiated with Grid as the sole-source EPC (equipment, procurement, construction) contractor. With a contract executed, points of contact were established for Grid, the Tribal Government, Weeminuche Construction Authority (Tribally-owned construction company), electrical engineering subcontractors (after request for proposals and bidding process undertaken by Grid), and Empire Electric Association (Empire). An interconnection agreement with Empire Electric Association was entered into by the Tribe and Empire Electric Association. Tri-State rules governing the distributed generation project limited the size to 1 MW, and thus entailed the addition of a curtailment system to avoid penalties for exceeding that level during high generation periods. Electricity generated by the project would be mostly consumed by the Ute Mountain Casino Hotel and Resort- casino, hotel, RV Park, outdoor performance venue and adjacent facilities. That is the largest consumer of electricity in the community (largest Empire customer in Towaoc).

With no meaningful experience in undertaking the project, a Project Manager was hired to be the Tribe's point person during design and construction and he provided an excellent point person for the Tribe over the course of more than a year. The contract proved invaluable to the Tribe in successfully implementing the project. Meetings with the Project Manager, Grid, the Tribe and any subcontractors were held at least monthly over the design and construction phases. In the latter half of 2019, most were updates on the status of the transformer specifications and order and delivery. Other subjects prior to that included the final design specifications, Nuchu 1 circuit procurement, other procurement status, subcontractor roles, on-the-ground updates from the construction foreman, personnel issues with interns (handled by the Tribe's Technical Lead, also hiring lead and Supervisor under Tribal Policies and Procedures), timing on project installation phases, and final commissioning and curtailment testing.

The change of site described above caused a revisit to the NEPA *Categorical Exclusion* issued by DOE and the new site was also deemed to be under the coverage of a Categorical Exclusion, with concurrence from the Bureau of Indian Affairs, who has land surface trust responsibility on the Reservation. Geotechnical analyses were undertaken to assess the structural stability of pile-mounted racking systems for the project. These demonstrated that piles were going to be effective for mounting the racking system.

Project design also considered the cost-benefit of the Tribe purchasing part of the distribution system from Empire so that the Tribe would own the infrastructure to deliver the electricity from the project to the casino resort and not have wheeling implications behind the meter. The Nuchu 1 circuit was then purchased for this purpose. From the solar array net meter to the casino resort the Tribe created a mini micro-grid for the project. Empire still has an on call, as needed maintenance agreement for the system. This mimics another system- the distribution line to the main Farm and Ranch Enterprise- another mini micro grid a couple miles away going west from Towaoc. Cost for the Nuchu 1 circuit was \$60,417.14.



Nuchu 1 circuit



Geotechnical analysis

As a component of the goal to look towards the future for this project's outcome and future projects, a work-force development component was built into the project. In spring of 2019, Grid conducted a week long workshop for potential employees on the project. Students learned about basic photovoltaic solar technology, installation, testing, and various system components. Occupational Safety and Health Administration (OSHA) construction safety was also taught. After the training, job advertisements were posted locally for interns for the project. The original budget had provided funding for two interns for six months. Grid informed the Tribe that construction was more likely on the order of three months, so we changed it to four interns for three months. Interest was overwhelming. Twenty-one Tribal Members applied. After reaching out to other programs here, funding from a higher education program and the temporary worker program allowed us to employ up to eleven interns for project construction. After hiring interns and starting the racking installation, a volunteer work day was hosted with participation from Towaoc residents and other locals who were interested in the project.



Hands-On Training for Solar Technicians



Groundbreaking ceremony 2019



Interns, Grid Employees and Volunteers during construction

After racking was installed and panels were mounted, a pause in the next phase of construction caused a temporary lay-off of interns. Most returned after the two-month delay. DC wire was run from the panels to inverters and AC wire was run from inverters to the main shut-off switch and transformer location. Design of the transformer proved to be a significant delay, with an approximate eight month time-frame to order, custom build and deliver the final piece of equipment for the project. This was completed in February 2020, and installed in early March. The system came online at 50% capacity in mid-March and a commissioning ceremony was held to acknowledge the milestone for the Tribe in a significant start in the community clean energy goals- the end goal being a “net zero” one in which the Tribe produces as much electrical energy as it consumes. One megawatt in Towaoc represents a large chunk of that electrical demand.



Tribal Council and Tribal Chairman discuss the solar milestone for the Tribe in front of the long-awaited transformer

Within days of the commissioning ceremony, the world entered the coronavirus pandemic. The final detail for the project was to test the curtailment system- the defense against penalties for exceeding the 1MW maximum for distributed generation per Tri-State policy. As the Tribe and Empire literally closed their doors, blocked off inroads, and implemented policies to protect public health, the curtailment system testing was delayed. On May 19, 2020 the curtailment system was tested successfully and the array went to 100% generation capacity. As expected, this nearly doubled the generation from April to May 2020, also owing to the longer days as the summer solstice approached.

Operations and Maintenance (funded by the Tribe) were originally envisioned to be under contract during at least the first year of generation. Two companies had expressed interest, and one had a more competitive bid. After months of non-responsiveness from the company regarding contracting, we were almost half way through the test phase. At that point, after addressing one inverter issue, we saved the money and have been conducting inspections and limited O&M internally. It is likely that the Tribe will enter into an on call contract with an electrical engineering company to address O&M issues in future years, but the first year was relatively smooth and without incident.

The primary goal of the project- to offset electrical costs for residents in Towaoc and the Tribal government began during the first few months of generation. In order to get generated electricity from the project turned into dollars saved (credited) on electric bills, the following matrix was implemented:

- A finite time was allotted for residents to sign up for the program- this was planned to end in December of 2019, but was extended due to delays in the system commissioning. Initially, one hundred ten residents signed up. The 2021 sign up period increased that to one hundred sixty-six residents. A list of prioritized government accounts was created to allocate the remainder of bill credits. The government accounts prioritized the Public Works Department bills that provide direct community services to residents. The purpose on this was also to offset costs to Public Works accounts because they are the department that is providing meter reading, operations

and maintenance service for the project for the long term. The bill credits would, theoretically, offset the costs for their employees' work.

- On a monthly basis, the net (master) meter of total project generation was read
- A gross-up of cost for electricity delivered to the casino from the project is generated and billed to the casino, this is based on the commercial customer peak demand price for the power. From the March 2020 start-up to the end of May 2021, this was \$88,958.67.
- The Casino pays the gross-up amount to the Tribe for the energy
- The Tribe then pays the same amount to Empire
- The Tribe works with Empire to credit the bills identified (residential and governmental) at the rates prescribed by the Tribe, less an administrative fee for Empire's staff time
- Residents and governmental bills show the amount credited monthly
 - Residential and government bill credits equal \$87,872.54 from 3/2020 to 5/2021

See additional report on generation and cost savings verification

5. Conclusions and Recommendations:

The main goals of the project described above have been met, with a lot of challenges and modifications along the way. Deployment of a one megawatt photovoltaic solar power generation system to provide net-metered cost savings to the Tribe was accomplished. This represents roughly 40% of the peak electrical demand for the community, based on the Parametrics analysis completed in 2014.

Partnerships with Empire and Tri-State have been enhanced by the project. When approached by the Tribe in the 2011-2015 era, Empire was not interested in a power purchase agreement for solar power for a variety of reasons, including system costs at the time, and energy storage limitations. The net-metered project has fostered a new relationship with Empire, and they have been supportive of other future endeavors in Towaoc. It is likely that the next phases of community energy generation, storage and delivery in and around Towaoc will build on that relationship and continue to solidify the Tribe's energy sovereignty in reaching its net zero goal.



As documented in the associated generation and cost savings verification for the project, system functionality, delivery of electricity to the targeted entity and return electrical cost savings have met the intended goal. During the 12 month test phase, **2,119,200 KWh** of electricity were generated and delivered to the Ute Mountain Casino Resort Enterprise. During the March 2020- April 2021 period, the value of the electricity generated was **\$87,872.54**. Residential customers were credited \$51,534.64, governmental bills were credited \$36,337.90, and \$1,118.13 went for administrative fees for Empire to process the credits. Original projections for the generation from the project by Grid were on the order of 1,640,000 KWh, so actual generation was 29% higher than projected, despite the 2 month delay at 50% generation caused by the curtailment system test delay. Carbon offset was approximately 960.2 metric tons of carbon offset, at 0.4532 kg CO2 equivalent per KWh.

Evaluation of the project after the first year of generation, has resulted in multiple future decisions for the Tribe and its energy sovereignty and net zero goal. With the imposition of the Tri-State policy limiting the distributed generation at 1MW, add-ons to the project need to be creative. One alternative is to add generation capacity with battery or other storage, such as a 4MWh or 8MWh storage system. If implemented this could accomplish two things- if PV-generated energy beyond 1MW is directly stored on a battery system, a control system could direct the power plant to deliver that stored electricity after dark without violating the 1 MW limit. This also has an added bonus of “peak shadowing,” pushing the peak demand of directly purchased utility generated power later into the night when it would be less expensive because the commercial rate is based on the peak demand cost of power- generally when people get home from work and turn on appliances and adjust HVAC systems for comfort.

The Tribe is poised to work with a company that assists in the energy sovereignty arena for this project and others on the Reservation. In the meantime, the Tribe has successfully applied for two grants- one for each community – White Mesa, UT and Towaoc, CO for facility scale photovoltaic systems. These are “low hanging fruit,” and will have a significant impact in reaching the net zero goal. Phases two and three are getting underway.

6. Lessons Learned:

The workforce development component of this project showed the Technical and Business Contacts for the Tribe that there is a lot of interest in learning about and being employed in solar installation jobs. Future community projects have plans for continuing those training and employment programs through internships on a little smaller scale than the 1 MW project. This also bodes well for future jobs in the industry as commercial scale projects are planned, and holds to the concept of this project being a stepping stone to commercial solar development on Tribal Lands. Compliance with the Tribal Employment Rights Ordinance here is envisioned to be job creation instead of fees in lieu of jobs.

We cannot underestimate the value of a project manager for us on this project. As was pointed out by DOE in our unsuccessful grant application, we did not have any experience in this arena prior to the project. Hiring someone who did have that experience, and recently with

a local tribe proved invaluable. Routine weekly or (at a minimum) monthly meetings with the Project Manager and EPC kept the Tribe well informed and able to keep DOE well informed. We probably would have had a rocky implementation without the Project Manager. He earned every dime of his income.

Cost overruns totaled \$52,769.00. For a \$2.2 million project that is not exorbitant, and the Tribe was able to cover it. Closer tracking of EPC costs may have limited that, but overall the performance of the EPC was very good. Tracking costs internally will be handled slightly different on future similar projects. Project delays were caused by some scheduling conflicts with the EPC and resulted in some less practical timing for the interns, but most of them were able to stay on through the duration. The final design, build-out and delivery for the transformer proved to be very time-consuming and delayed the project several months. It was very carefully planned, to the credit of the EPC and their engineers, to be accurate on a decision without option for error.

The biggest lesson learned was that the Ute Mountain Ute Tribe *can* work with partners to fund, build and operate community-scale solar projects to benefit of its membership and be a leader in clean energy and climate action.



Sunset on Towaoc Community Solar Array, Left Toe Sleeping Ute Mountains Backdrop

Generation and Cost Savings Verification								
Towaco Community Solar Initiative: DOE Grant Cost-Share DE-IE-0000095								
Project Energized on 3/5/2020; approximate 50% of capacity due to need for Curtailment system verification test needed								
Meter Reading Date	Total Generation (KWh)	Monthly Net Generation	Billed to Casino	Resident Bill Credits	Governemnt Meter Bill Credits	Empire Electric Administrative Fee	Unallocated Balance	Notes
4/1/2020	57,100.27	57,100.27		\$ -	\$ -			credits deferred and accumulated to future payment
5/1/2020	160,800	103,699.73		\$ -	\$ -			Curtailment system tested May 19, successfully; system ramped up to 100%; credits deferred and accumulated to future payment
6/1/2020	278,400	117,600.00		\$ -	\$ -			credits deferred and accumulated to future payment
7/1/2020	513,600	235,200.00	\$ 21,567.13	\$ -	\$ -			Casino Bill Gross up cumulative to August 1 ; credits deferred and accumulated to future payment
8/1/2020	676,800	163,200.00	none	\$ 10,698.64	\$ 10,747.96	\$ 220.53	\$ 100.00	First Bill Credit Implemented 8-10-20!
9/1/2020	751,200	74,400.00	\$ 9,981.71	\$ -	\$ -	\$ -	\$ -	Anomaly? Inverter 1 down; Troubleshoot
10/1/2020	969,600	218,400.00		\$ 2,625.00	\$ 7,065.07	\$ 198.64	\$ -	Second Round Bill Credit implemented 10-28-20
11/1/2020	MSSING DATA		\$ 9,181.54					
12/1/2020	1,384,800							
1/1/2021	1,598,400	213,600.00	\$ 8,273.47	\$ 6,489.00	\$ 2,514.73	\$ 177.81	\$ -	
2/1/2021	1,792,800	194,400.00	\$ 18,060.39	\$ 6,180.00	\$ 2,029.56	\$ 88.91	\$ -	Casino Bill cumulative for 2 months
3/1/2021	1,939,200	146,400.00	\$ 8,172.58	\$ 11,270.00	\$ 6,591.75	\$ 198.64	\$ -	Applied Credit 3-10-21
4/1/2021	2,119,200	180,000.00		\$ 6,400.00	\$ 1,655.78	\$ 116.80	\$ -	
5/1/2021		#VALUE!		\$ 7,872.00	\$ 5,733.05	\$ 116.80		added to correct
Totals				\$ 51,534.64	\$ 36,337.90	\$ 1,118.13		
			Total credits	\$ 87,872.54				