Cover Sheet

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Type of Award:	Deployment o	Deployment of Energy Efficient and Clean Energy on Indian Lands-2017			
Recipient Organization:	Eastern Band	Eastern Band of Cherokee Indians			
Project Title:	Deployment c A Community	Deployment of Energy Efficiency and Clean Energy on Indians Lands – A Community Solar Project			
Project Officer:	Tweedie Doe US DOE Office	Tweedie Doe - Project Officer US DOE Office of Indian Energy			
Project Monitor:	Jami Alley - Pr US DOE Office	Jami Alley - Project Monitor US DOE Officer of Indian Energy (Contractor)			
Project Period:	09/30/2017 tł	09/30/2017 through 09/29/2020			
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Executive Summary

The Eastern Band of Cherokee Indians (EBCI or Tribe) is a federally recognized Indian Tribe located on ancestral homelands in western North Carolina. The Tribe is comprised of just over 16,000 enrolled members, with an estimated 8,000 – 10,000 residing on tribal lands. The Qualla Boundary is comprised of over 56,000 acres of contiguous trust land adjacent to the Great Smoky Mountain National Park. The EBCI also possess an assortment of scattered parcels of varying sizes across western North Carolina, some in trust status and others in deeded or fee simple. This project was implemented on a trust parcel in Cherokee County, NC.

The Tribe was awarded the maximum amount of \$1,000,000 for the installation of a 705.6 kilowatt (kW) solar PV array to supplement the power consumed and reduce annual utility costs at the Harrah's Cherokee Valley River (HCVR) casino and hotel in Murphy, NC. The casino is a tribal entity of the Tribe. The total cost of the project was \$2.364 million. The system was officially commissioned on April 12, 2019. For the purpose of calculating the amount of power produced and reduction in utility costs, the time frame assessed is May 2019 through April 2020. All power generated was consumed onsite.

	May 2019 – April 2020	May 2018 – April 2019	Difference
Total kWh Consumed	11,214,918	12,281,840	1,003,922 kWh (8.68%)**
Total Utility Bill	\$ 1,010,776.56	\$ 1,102,994.29	\$ 92,217.73 (8.36%)**
Total kWh Produced	979,344.33	91,608.28*	
Total Value of kWh Produced (\$0.091/kWh)	\$ 89,120.33	\$ 8,336.35*	

Figure 1. Power Reduction and Cost Savings

*The 705.6kW solar PV array became operational in March 2019 and was commissioned on April 12th, 2019. ** The casino opened an additional 40,000 s.f. of entertainment space in June 2018. This was an unanticipated addition to the originally planned space of 155,352 s.f.

Based on the first full year of data, the project achieved the estimated 8.3% reduction in utility costs. A total of six casino and tribal staff were trained and received a North American Board of Certified Energy Practitioners (NABCEP) certification, giving our staff the resources and skills to manage and operate the solar PV array. Based on the Tribal match of \$ 1,377,797 and estimated net annual benefit of \$89,000, the estimated return on investment (ROI) is 15.48 years.

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Project Overview

The EBCI operates two casinos properties on two separate trust parcels in Western North Carolina. This project targeted the HCVR casino, hotel, and multitaiment center located in Murphy, NC. The casino opened in 2015 and was comprised of four buildings, the casino





(110,400 s.f.), the hotel (23,000 s.f.), and two administrative buildings (10,976 s.f. each), totaling 155,352 s.f. In the summer of 2018, the property added and opened another multi-tainment venue with over 40,000 s.f. of space. The project did not account for the additional electricity demand, but nonetheless, the solar PV array met the objectives of reducing energy costs and producing renewable energy for the benefit of the Tribe.

This project was preceded by several years of planning and smaller solar PV construction projects. In 2007, the EBCI Tribal Council passed Resolution 636, establishing the following energy goals:

- To protect, preserve, and ensure the wise utilization of the limited natural resources located on Tribal lands for the Cherokee people in the most efficient manner and in an effective way that the natural beauty of Tribal lands and natural resources, which are the basis of its culture and well-being, are preserved and protected;
- To identify opportunities for economic and community development for the Tribe that promote sustainable development; and
- To identify energy cost savings opportunities for the Tribe.

The Tribe was awarded a Department of Energy (DOE), Tribal Energy Program grant (DE-FG36-07GO17084) for the creation of a Strategic Energy Plan (SEP) that was completed in January 2009 and revised in July 2011. The plan crafted the following energy objectives:

- Establish the Tribe's current energy usage;
- Identify renewable energy and energy efficiency alternatives available on Tribal lands
- Assess the benefit and costs of each alternative; and
- Create a strategic plan for the development and implementation of the selected alternatives.

In carrying out recommendations of the SEP, in 2012 the Tribe installed over 100 k on six solar PV arrays between two welcome centers that have produced 139 MWh since being commissioned.

In the winter of 2016, the Tribe solicited a Request for Proposals for qualified firms to respond to the DOE, Office of Indian Energy Policy and Programs, Deployment of Energy Efficiency and Clean Energy on Indians Lands – 2017 grant. Three firms responded, with one demonstrating the greatest benefit to the Tribe. Siemens Government Technologies, Inc. (Siemens) was selected to contract with to support and assist the Tribe in granting writing, data collections, system design and planning, and construction of community scale solar PV project for the DOE-FOA-0001660, Area 2 – Deploy Clean Energy Systems on a Community Scale.

Photo 2. Project site location

Water Tower Ground Mount Option: A1. 700 kW fixed solar array, steel pile footings, steel rack design, string inverters located on racking. Metering will be located at this location. C2 C1 -75 B2 Cabling will be 7200 volts. B1 Proposed Cabling direct burial B3 B2 Proposed cable <u>B4</u> Proposed cable route using directional boring for connecting array into site power system. Directional boring will terminate at transformer B2 B3. Represents a cable pull vault to be located in the hashed off parking area. No parking spaces will be affected. C1. Pad mounted 750 kVA transformer to be located in grassy area. Conduit will be run from transformer pad along the outside of the building into the electrical C2. Electrical tie in w be in electrical room. Ti would be in the 480 volt system. Proposed Bore Hole Location

At the time of the initial assessment of the HCVR utility data, the project targeted four buildings for the deployment of a 700-kilowatt solar PV array to offset utility costs and produce a sustainable energy source. The location was targeted based on the more subtle topography in valley area in Cherokee County as compared with Tribal property in the Qualla Boundary that is nestled in the mountains with higher peaks that causes more shadowing.

The approach for competitively selecting a contractor for this project is novel and worth consideration for other Tribes. The Siemens bid through the Tribal RFP was selected from competitive process in which the awarded contractor would write for the DOE grant on behalf of the Tribe. Any resulting grant award would result in a contract for the project. Once the Tribe received notification from the DOE for being awarded the grant, discussions resumed on the final project

location. Contract negotiations were executed smoothly between attorneys with Tribe, Siemens, and Harrah's.

The project contract began on 02/28/2018 and was scheduled to be completed by 02/28/2019. The site first needed to have the trees dropped prior to the April 15th moratorium on cutting trees per Section 7 of the Endangered Species Act that directs all Federal agencies to work to conserve endangered and threatened species, such as the Indiana bat in our case. By July, the site had been scrubbed of brush and in August, civil work began for leveling the site. There was moderate delay in completing the site preparation due to the frequency of precipitation events.

By the end of September, the site was prepped and the racking system was beginning to be installed. The PV modules were being installed in tandem with the racking system through the month of October and November. The project was on scheduled to be substantially complete by December 15th, 2018.







Photo 4. October 29, racking and module install

The array was substantially complete by the above mentioned deadline. Commissioning of the system began on January 2nd, 2019. On January 11, there was incident in which the main breaker in the casino's main electrical room was tripped. This resulted in some casino equipment being damaged. Through careful examination of incident, it was revealed that the trip settings on the main casino breaker was set to the lowest (most sensitive) or factory setting. The original coordination study showed that the settings at the time were not set per recommendations of the engineering company who completed the study. However, this could not be conclusively determined to be the cause of incident. A stop work order was issued through the month of February in order to thoroughly examine all equipment and procedures. A recovery plan was created by the solar installer and was scheduled for implementation on March 11th. The system was fully commissioned on April 12th.



Photo 5. Aerial of PV array

Objectives

The objectives for this project were aligned with the goals outlined in the Department of Energy, Office of Indian Energy, Strategic Roadmap 2025:

1) Promote Indian tribal energy development, efficiency, and use.

- This objective was achieved by providing a grant funding match to construct a 705.6 kW solar PV array at the HCVR casino. HCVR is a critical revenue resource for the Tribe and the completion of this project developed a sustainable power source to reduce the annual utility costs thereby increasing revenue to the Tribe for community member services. The Tribe has demonstrated its commitment to achieving the energy goals stated in the 2007 resolution from EBCI Tribal Council.

2) Reduce or stabilize energy costs

- The Murphy Electric Power Board (MEPB), utility provider for HCVR, is tracking towards the upper threshold of its electrical generation capacity. The construction of the solar PV array for the HCVR reduces the facility's electricity demand, allowing the utility to better serve the expanding community and buffer the Tribe from increased utility costs on other tribal project developments in the service area. With an estimated ROI of about fifteen years, the Tribe will realize another ten years of substantial energy production, based on a twenty-five-year PV module useful life expectancy.

3) <u>Enhance and strengthen Indian tribal energy and economics infrastructure related to natural resource</u> <u>development and electrification</u>.

- Through this project and in collaboration with the project contractor, Siemens, select casino and tribal staff went through training led by a Siemen's subcontractor for a NABCEP PV Commissioning and Maintenance Specialist certification. The certification program provides a pathway for experts at operating, commissioning, and maintaining PV systems. Four casino staff and two tribal staff completed the certification training. While we do maintain an operations and maintenance contract for bi-annual cleanings and an annual inspection with a local area solar company, having staff knowledgeable about the system and capable of addressing minor to moderate issues has already proven of benefit on several occasions.

- This project was also the first of its size for EBCI Project Management staff to navigate. Gaining the invaluable experience of oversight for the construction of this project has enhanced the Tribe's ability to seek funding and carryout future substantial energy producing projects on other Tribal government, commercial, and residential assets.

4) Bring electrical power and service to Indian land and homes of tribal members

- This project accomplished the goal of fostering renewable energy production on tribal trust land for a vital economic entity and revenue source for the EBCI. It was important to target HCVR given the need to reduce power consumption from an increasingly stressed utility source. As the Tribe develops more commercial and residential properties in the area that the MEPB services for enrolled members and Tribal interests, this project allows for more stable energy costs for those future Tribal developments.

5) <u>Support and promote meaningful tribal participation in critical national and global tribal energy</u> initiatives and crosscuts, including water-energy nexus, grid modernization and microgrids.

- The application of the 705.6 kW solar PV array at HCVR is the Tribe's first large scale engagement with renewable energy deployment. Through all of the previous planning efforts and small-scale solar projects, the funding from this grant enabled the Tribe to offset a meaningful percentage of electricity consumption from a substantial energy consuming facility that is vital to Tribal prosperity and well-being. This project has garnered interests on the Tribe's future energy ambitions from local, state, and federal entities and partners.

Description of Activities Performed

To achieve the objectives of the project, the following tasks were completed by the end September 2019:

Task 1. Design and Permitting

- M1.1 Final Approved System Plan Set
 - Contractor has provided a complete system plant set that satisfies the design and format requirements. Plan sets must have all necessary professional engineering stamps and be in a final form at such time as necessary to enable work to proceed in accordance with the Project Schedule, and prior to substantial completion.
- M1.2 Professional Engineering Approvals
 - Contractor is responsible to have plan sets stamped by licensed professional engineers for structural, electrical, and civil design as required by system application. Any engineering reports completed to support the design must all be provided to the Project Manager for review.
- M1.3 Permitting
 - Contractor provides a copy of all approved permits that satisfy any and all jurisdictional requirements to permit the construction of the system. Conditional circumstances may not exist that would prevent final permitting approval to proceed with system build.
- M1.4 Interconnection Application
 - Contractor will submit necessary documentation to advance through the utility interconnection validation process.

Task 2. Interim Completion

- M2.1 Mechanical Completion
 - The system is electrically and mechanically complete, construction of such system has been completed in accordance with the specifications (other than the Punchlist items), and the system is free from defects.
- M2.2 Drawings
 - Contractor delivers preliminary, but accurate, As-Built drawings
- M2.3 Final Permits
 - Proof of final approval of the electrical and structural permit has been delivered to the Project Manager.
- M2.4 DC Commissioning Report
 - All equipment with respect to DC wiring and equipment has been commissioned in accordance with manufacturers' specifications and requirements. DC Insulation Resistance Testing and DC String Level Open Circuit Testing results are delivered to client on prescribed forms.

Task 3. Substantial Completion

- M3.1 Permits
 - All government permits have been received.
- M3.2 Commissioning

- All equipment is commissioned by 3rd party contractor in accordance with manufacturers' specifications and requirements. Inverters have been commissioned with manufacturers' representatives or trained technicians onsite. The monitoring system has been commissioned in accordance with manufacturer specifications and is fully operational and able to log data pyranometers and temperature sensors connected to such monitoring system used to monitor insolation, module temperature, and air temperature have been calibrated.
- M3.3 Interconnection
 - The System has been interconnected and synchronized in accordance with the applicable interconnection agreement, and local utility requirements have been fulfilled with respect to the System.
- M3.4 Performance Test
 - The System has achieved the Performance Ratio as determined pursuant to construction agreement.
- M3.5 Warranties
 - Contractor has assigned all Subcontractor warranties for the System to EBCI.
- M3.6 Punchlist
 - Contractor delivers a list of all Punchlist Items, and the reasonably anticipated cost of completing such items is less than 5% of the Contract Price.
- M3.7 Spare Parts
 - Contractor delivers to Project Manager any spare parts required in accordance with the Scope of Work.
- M3.8 Utility Permission to Operate Letter
 - Contractor obtains the permission to operate letter from the utility.

Task 4. Final Completion

- M4.1 Punchlist
 - Completion of all Punchlist Items.
- M4.2 As Built Drawings
 - Contractor delivers final, stamped As-Built drawings.

Task 5. Reporting / Performance

- M5.1 Submit Quarterly Reports
- M5.2 Present at Annual DOE Indian Energy Program Review
- M5.3 Complete 12 Month Monitoring

The quarterly reports were submitted by each deadline for the duration of the project. The Tribal Technical and Coordinator contacts presented at the Indian Energy Program review in 2017, 2018, and 2019. The 12-month monitoring period observed for performance, May 2019 through April 2020, resulted in 979,344.33 kWh of electricity generation at a value of \$ 89,120.33.

Conclusions and Recommendations

The project resulted in the achievement of a renewable power source that is meaningfully offsetting the electricity consumption of a Tribal entity on tribal lands and is resulting in reduced energy costs for HCVR. With an estimated ROI of about fifteen years, the Tribe will realize about ten years of costs savings, likely more with proper maintenance of the system. The project was completed within budget and within a suitable timeframe.

There were some anticipated challenges with the project based on the topography of the location and underlying geology. By July 30th, 2018, the subcontractor tasked with boring for the conduit experienced the anticipated challenge of hitting a rock vein beneath the casino parking lot. The approach was to conduct several test drills at varying depths and angles until an adequate route was determined.



Photo 6. July 30th, 2018; Directional boring routes for proposed cabling

Due to the topography of the project location and annual precipitation patterns, the site has experienced and continues to experience issues with erosion. The contractor worked with the subcontractor who completed the site prep on several occasions to address the issues through reseeding, armoring drainage ditches, and installing groundcover BMPs. The site is considered stable but will continue to be closely monitored for action items.



Photo 7 & 8. Southwest corner of project site. The drainage ditch to the retention pond was armored and matting installed in early spring 2020.

We also noticed erosion occurring underneath each row of the system, which was the result of runoff from the upper modules between the lower modules. As ground cover becomes more established, we anticipate this issue remedying itself. However, it would be our recommendation to install some kind of mulch to reduce water impact and prevent gullying from occurring underneath the system.

Overall, if a deployment project is constructed in mountainous terrain, it is our recommendation to work with the contractor ensure the permitting documents, such as EPA Construction General Permit, Stormwater Pollution Prevention Plan, and erosion BMPs, are developed to meet and exceed the calculated precipitation measurements to prevent substantial erosion events. While our project did meet that qualification, we

Photo 9. Erosion underneath modules

emphasize the importance of potentially planning for greater resources to be directed toward erosion prevention goals.

In conclusion, the unique approach for selecting a contractor to assist with the grant development and application resulted in a professionally planned and designed solar PV array that has been generating economic benefit for the Tribe for over a year, with more than twenty years of useful life expectancy remaining in the modules.

Lessons Learned

When the project commenced, the Tribe was in the process of hiring on a Renewable Energy Specialist who would have taken over the Coordinator role from the Secretary of Agriculture and Natural Resources. It was anticipated that the hired position would come with substantial knowledge and experienced in working with renewable energy planning and implementation, specifically solar PV applications. However, due to unforeseen budget restrictions experienced in FY2018 the position was scrapped, and no hires have been made. It would benefit the Tribe pursue this position again in order to centralize project development and administration.

The Tribe government has a Project Management team that performs the administration and oversight of most large-scale projects for all Tribal divisions, departments, and programs. The Project Management Manager was the lead technical contact and the Secretary of Agriculture and Natural Resources was the coordinator for this project. This arrangement was sufficient for carrying out and completing the project. However, there were minor challenges posed on information sharing for reporting, given the technical contact received and maintained all status reports, permit, drawings, and invoices. The problem was ultimately overshadowed by a ransomware attack that crippled the Tribe's IT network on December 6th, 2019 through April 2020. Fortunately, much of the project documentation was saved and secured in a cloud network. Having a Renewable Energy Specialist hired on would have better streamlined information consolidation.

Project development in mountainous terrain requires diligent oversight and action for ensuring proper erosion controls are implemented and maintained. It is imperative to stabilize a project site to prevent erosion from occurring underneath and around the foundation of the racking system and other essential components. This simple action will guarantee the system will fulfill a twenty-five-year useful system expectancy and beyond.

Targeting a Tribal entity that would consume all power onsite alleviated the need to negotiate interconnection application with the utility. Through previous years of attending the Indian Energy Program Review, we had heard of the challenges posed by the utility companies and state laws that Tribes had to work with and through to complete their projects. For our project, the Contractor performed due diligence in reaching out to the utility provider about the project but did not receive any objections or constraints to implementing the project.

This project has created a foundation for renewable energy development of which the Tribe can grow upon. Before the conclusion of this project, Tribal Council passed Resolution 74 (2019), brought by a youth leadership group, to install solar panels on all Tribal buildings by December 31, 2020. Due to economic impact from COVID-19, the intent of the resolution will be challenging to fulfill. Planning efforts are underway for targeting newly constructed, or recently constructed tribal buildings, to have solar PV systems installed or retrofitted through future DOE grant opportunities.

We are grateful for the grant award and DOE staff support on this project.