DEPLOYMENT OF ENERGY EFFICIENCY AND CLEAN ENERGY ON INDIANS LANDS

EASTERN BAND OF CHEROKEE INDIANS (EBCI)

2018 DOE OFFICE OF INDIAN ENERGY ANNUAL PROGRAM REVIEW

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CHRIS GREENE, PROJECT MANAGEMENT MANGER, EBCI

18th November 2019
OVERVIEW OF PRESENTATION

• About the Eastern Band of Cherokee Indians
• Goal and Objectives
• Deployment Location and Designs
• Operational Progress
• Project Summary
CHEROKEE, NC

- Qualla Boundary is comprised of ~56,000 acres in Western North Carolina
- Much of boundary is next to Great Smoky Mountain National Park (GSMNP)
- Deeded and trust parcels located in surrounding counties
  - Additional ~3,000 acres
- Nearing 16,000 enrolled members; ~6 – 8,000 live on Qualla Boundary
1) Promote Indian Tribal energy development, efficiency and use.
   - Reduction of energy consumption through the deployment of this solar PV array

2) Reduce or stabilize energy costs
   - Murphy Electric Power Board nearing capacity and reduction of EBCI needs would benefit expanding community

3) Enhance and strengthen Tribal energy and economics infrastructure related to natural resource development
   - Partnership with Siemens will provide training to EBCI enrolled members for the operation of the solar PV array, increasing skills and capacity of the Tribe

4) Bring electrical power and service to Indians lands
   - Solar array fosters renewable energy and aligns energy investment with EBCI long-term vision of energy independence

5) Support and promote EBCI participation in strategic energy initiatives
   - EBCI is embarking on energy independence and self-reliance goals that will diversify revenues resources and increase skill competencies of EBCI enrolled members by providing new job market opportunities
Cherokee River Valley Casino & Hotel
Opened in fall of 2015
This data provides annual average daily total solar resource averaged over surface cells of 0.038 degrees in both latitude and longitude, or, nominally, 4 km in size. The insolation values represent the resource available to concentrating systems, and were created using the PATMOS-X algorithms for cloud identification and properties, the NMAOC radiative transfer model for clear sky calculations, and the SASRAB model for cloudy sky calculations. The data are averaged from hourly model output over 8 years (2005-2012).

This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.

Nicholas Gilroy, April 4, 2017
Deployment of Energy Efficiency and Clean Energy on Indian Lands -
A Community Solar Project
Eastern Band of Cherokee Indians (EBCI)

Project Summary
Deploy a ground mounted solar PV array on the Murphy, NC reservation to generate 700 kilowatts of renewable energy. This community scale PV farm would supply power to four buildings totaling 155,352 sq. ft: casino (110,400 sq. ft.), hotel (23,000 sq. ft.), and two administrative buildings (10,976 sq. ft. each). All power generated would be consumed onsite. Due to the site location's topography, civil work will be required to prepare the land for the PV panel installation. The rural utility company is nearing its generation capacity, so this project will alleviate some of their electrical demand and will aid in their growth capabilities. More importantly, this green energy project will foster further economic, cultural, and social opportunities and greater energy independence for the EBCI community, which aligns with the EBCI Strategic Energy Plan.

Key Personnel/Organizations
- Chris Greene - Technical POC
- Amanda Strohm & DeMakus Straton - Grants Office POCs
- Cameron Cooper - Commerce Division POC
- Siemens Government Technologies, Inc. - Partner for design and build, and training program

Budget and Timeline
Federal funds: $1.0M  Cost-share: $1.0M  Total: $2.0M

Key Milestones & Deliverables
Year 1: Siemens to Design/Build Solar PV array, and train tribal members to install, operate and maintain system
Year 2: Savings begin to be captured and tracked, and results shared with the community and school.

Project Outcomes
This system is expected to cost $2.0M and is projected to generate 1,007,340 kWh with an annual savings of $99,122, based on a blended electrical rate of $0.0984/kWh. Assuming the $1.0M DoE grant, the tribe’s simple payback is anticipated to be 10.1 years. This project will also include a community awareness communication plan and school education program to further promote energy conservation and the use of renewable energies. Additionally, tribal members will be trained to install, operate and maintain the system, and leverage these skills for future solar projects on tribal land or within the community.

A 700 kW solar PV project to foster economic, cultural and energy independence for the EBCI Tribe.
Baseline Energy

Siemens anticipates that no energy produced by the solar array will be consumed outside the campus. The energy baseline for the site is defined below in Table 2 and is based on the yearly electrical consumption of Harrah's Cherokee River Valley Casino Campus. The Casino’s monthly demand averages 2,530 kW and has a daily average consumption of 31,391 kWh.

Table 2: Energy Baseline FY 2016

<table>
<thead>
<tr>
<th>Usage Period</th>
<th>kWh Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 01-31 2015</td>
<td>957,445</td>
</tr>
<tr>
<td>Nov 01-30 2015</td>
<td>861,914</td>
</tr>
<tr>
<td>Dec 01-31 2015</td>
<td>955,588</td>
</tr>
<tr>
<td>Jan 01-31 2016</td>
<td>872,910</td>
</tr>
<tr>
<td>Feb 01-29 2016</td>
<td>789,726</td>
</tr>
<tr>
<td>Mar 01-31 2016</td>
<td>843,732</td>
</tr>
<tr>
<td>Apr 01-30 2016</td>
<td>848,472</td>
</tr>
<tr>
<td>May 01-31 2016</td>
<td>953,865</td>
</tr>
<tr>
<td>Jun 01-30 2016</td>
<td>1,070,636</td>
</tr>
<tr>
<td>Jul 01-31 2016</td>
<td>1,167,548</td>
</tr>
<tr>
<td>Aug 01-31 2016</td>
<td>1,174,789</td>
</tr>
<tr>
<td>Sep 01-30, 2016</td>
<td>1,000,456</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,497,081</strong></td>
</tr>
</tbody>
</table>

Table 3: Summary of Baseline system size of 700 kW DC

<table>
<thead>
<tr>
<th></th>
<th>Baseline Energy (kWh/yr)</th>
<th>Electricity Savings (kWh/yr)</th>
<th>Electricity Savings Yr 1 ($/Yr)</th>
<th>Percentage Savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Photovoltaic System</td>
<td>11,497,081*</td>
<td>1,019,870**</td>
<td>$100,355</td>
<td>8.9</td>
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</tbody>
</table>

* Baseline of FY16 Utility Usage
** Yearly production of solar array degrades at a 0.7% rate annually after year 1
**PROPOSED CABBING ROUTES TO SUBSTATION**

- Did experience some issue with boring due to geological make up of subsurface
- Slight variance near site due shift in array location
- Issue was that the original location footprint crossed property boundary
  - Would have required additional surveying and 2nd round of TCGE approval
April 4th 2018– Clearing trees on site
Groundbreaking held for solar farm at Valley River

May 29th

July 11th
July 30th
July 30th
September 25th
October 29th – Racking installation
October 29th
October 29th – Shading issue
December 7\textsuperscript{th} – Problem solved
December 7th
APRIL 12TH – SOLAR PV ARRAY COMMISSIONED
Output Dashboard as of November 18th 2019

Environmental Benefits

Environmental Equivalents
Achieved by use of renewable energy

- The energy to operate a TV for 226,984 days
- The pollution an average passenger car emits over 236.87 years
- The energy to power 6,029.47 computers for 1 year

Greenhouse Gases
Greenhouse gases avoided by use of renewable energy

<table>
<thead>
<tr>
<th>Gas</th>
<th>Amount</th>
</tr>
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<tbody>
<tr>
<td>CO₂</td>
<td>2,368,696.70 lb</td>
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<tr>
<td>NOx</td>
<td>428.80 lb</td>
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<tr>
<td>SO₂</td>
<td>843.60 lb</td>
</tr>
</tbody>
</table>

Carbon Offset
1,074.42 metric tons

You have offset the equivalent of:
229.10 ac

Typically one acre of pine forest will offset the equivalent of 4.89 metric tons of CO₂
### Y.o.Y. Comparison of Energy Consumption and Utility Bill at HVRC

<table>
<thead>
<tr>
<th>Service Month</th>
<th>Number of Days</th>
<th>KWH</th>
<th>Avg KWH per day</th>
<th>Peak</th>
<th>Max</th>
<th>Reactive Demand</th>
<th>Customer Charge</th>
<th>Facility Rental</th>
<th>Total Bill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2018</td>
<td>31</td>
<td>988,477</td>
<td>31,886</td>
<td>39,359.23</td>
<td>34,753.00</td>
<td>130.26</td>
<td>1,850.00</td>
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<td>Nov 2018</td>
<td>30</td>
<td>875,028</td>
<td>29,168</td>
<td>34,520.59</td>
<td>34,753.00</td>
<td>0.00</td>
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<tr>
<td>Dec 2018</td>
<td>31</td>
<td>901,683</td>
<td>29,087</td>
<td>39,422.06</td>
<td>34,753.00</td>
<td>0.00</td>
<td>1,850.00</td>
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<tr>
<td>Jan 2019</td>
<td>31</td>
<td>953,429</td>
<td>30,691</td>
<td>43,556.48</td>
<td>34,753.00</td>
<td>0.00</td>
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<td>Feb 2019</td>
<td>28</td>
<td>876,415</td>
<td>31,301</td>
<td>37,309.26</td>
<td>34,753.00</td>
<td>2.77</td>
<td>1,850.00</td>
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<td>$83,925.03</td>
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<td>Mar 2019</td>
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<td>34,753.00</td>
<td>38.11</td>
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<td>31</td>
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<td>139.93</td>
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<table>
<thead>
<tr>
<th>Service Month</th>
<th>Number of Days</th>
<th>KWH</th>
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<th>Total Bill</th>
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<td>915,238</td>
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<td>35,961.20</td>
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<td>1,850.00</td>
<td>10,010.00</td>
<td>$81,669.10</td>
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<td>24,842</td>
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<td>41,609</td>
<td>54,971.13</td>
<td>36,110.00</td>
<td>200.96</td>
<td>1,850.00</td>
<td>10,010.00</td>
<td>$103,142.09</td>
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Totals: 21,959,426 | 490,410.03 | 425,960.00 | 11,507,904 | 526,131.14 | 416,024.00

<table>
<thead>
<tr>
<th>Year</th>
<th>2019</th>
<th>%</th>
<th>2018</th>
<th>%</th>
<th>2016</th>
<th>%</th>
<th>Diff. ‘19 – ’16 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>1,118,362</td>
<td>(1.60)</td>
<td>1,136,580</td>
<td>6.16</td>
<td>1,070,636</td>
<td>4.46</td>
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<tr>
<td>July</td>
<td>1,182,095</td>
<td>(8.22)</td>
<td>1,288,053</td>
<td>10.32</td>
<td>1,167,548</td>
<td>1.24</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>1,162,801</td>
<td>(5.59)</td>
<td>1,231,606</td>
<td>4.84</td>
<td>1,174,789</td>
<td>(1.02)</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>1,080,055</td>
<td>(13.48)</td>
<td>1,248,261</td>
<td>24.77</td>
<td>1,000,456</td>
<td>7.96</td>
<td></td>
</tr>
</tbody>
</table>
UNANTICIPATED ADDITION TO PROPERTY AT HVRC

- June 2018: 40,000 + SF multi-tainment center opened
  - 16 bowling lanes
  - 2,220 SF arcade
  - Full service bar
  - Private entertainment rooms
O&M SERVICES: CAROLINA MOUNTAIN SOLAR

- O&M contract for semi-annual and annual inspection
  - Semi-Annual
    - Soiling, inverter, wiring, racking, panel, label
    - Testing: bolt torque, inverter filter
    - Wash all 2,016 panels
  - Annual
    - Infrared Module-Level Integrity Scan
    - Infrared Electrical System Integrity Scan
    - IV Curve Trace Testing
ADDITIONAL POWER MONITORING EQUIPMENT

• Trane Tracer SC+, irradiance meter, and Power Meter Kit

• Equipment tied in directly to breaker

• Incorporated into existing Trane Building Automation System (BAS)

• Enables “third-party” system output validation
  • Aurora Vision portal shows generic output metrics
  • Power meter kit measures power output per invertor into breaker
AREAS TO BE ADDRESSED

• Erosion
  • Due to two back to back years of wetter than average weather, achieving a stabilized site has been challenging
  • Weather did contribute to delays in project during civil work and construction
  • Current status of site need site remediation
• **Challenges and Successes**
  - Back to back years of higher than average precipitation
  - Invertor issue (warranty)
  - Communication, Professionalism
  - Data demonstrates savings!

• **Next steps**
  - Address erosion issues, re-seed site
  - Maintain annual O&M contract
  - Continue energy and economic impact analysis
ACKNOWLEDGEMENTS

- Cherokee Enterprises
- Alford Engineering
- All other contractors
Thank you! Questions?