DEPLOYMENT OF ENERGY EFFICIENCY AND CLEAN ENERGY ON INDIANS LANDS

EASTERN BAND OF CHEROKEE INDIANS (EBCI)

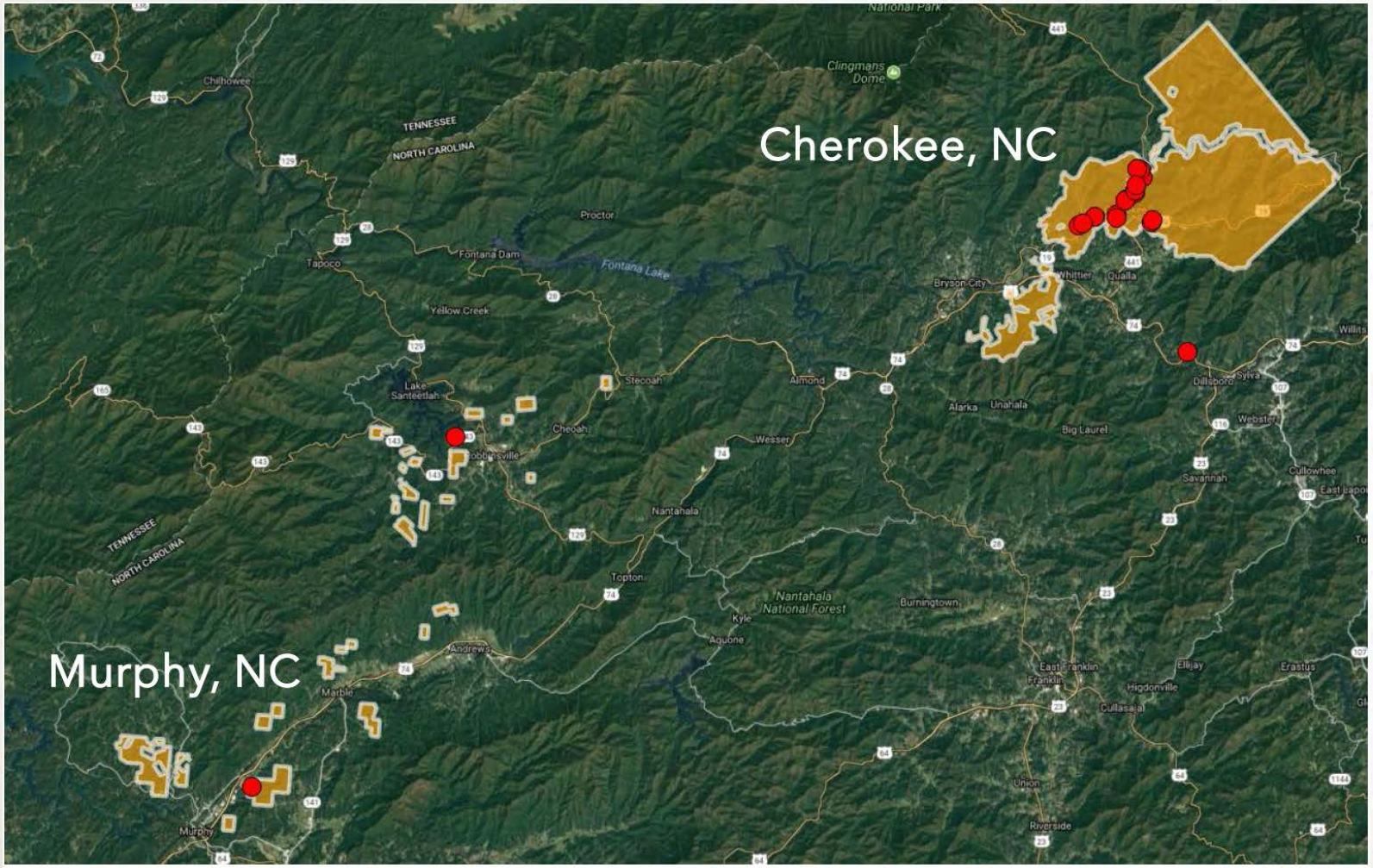
2018 DOE OFFICE OF INDIAN ENERGY ANNUAL PROGRAM REVIEW

JOEY OWLE, SECRETARY OF AGRICULTURE AND NATURAL RESOURCES, EBCI
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

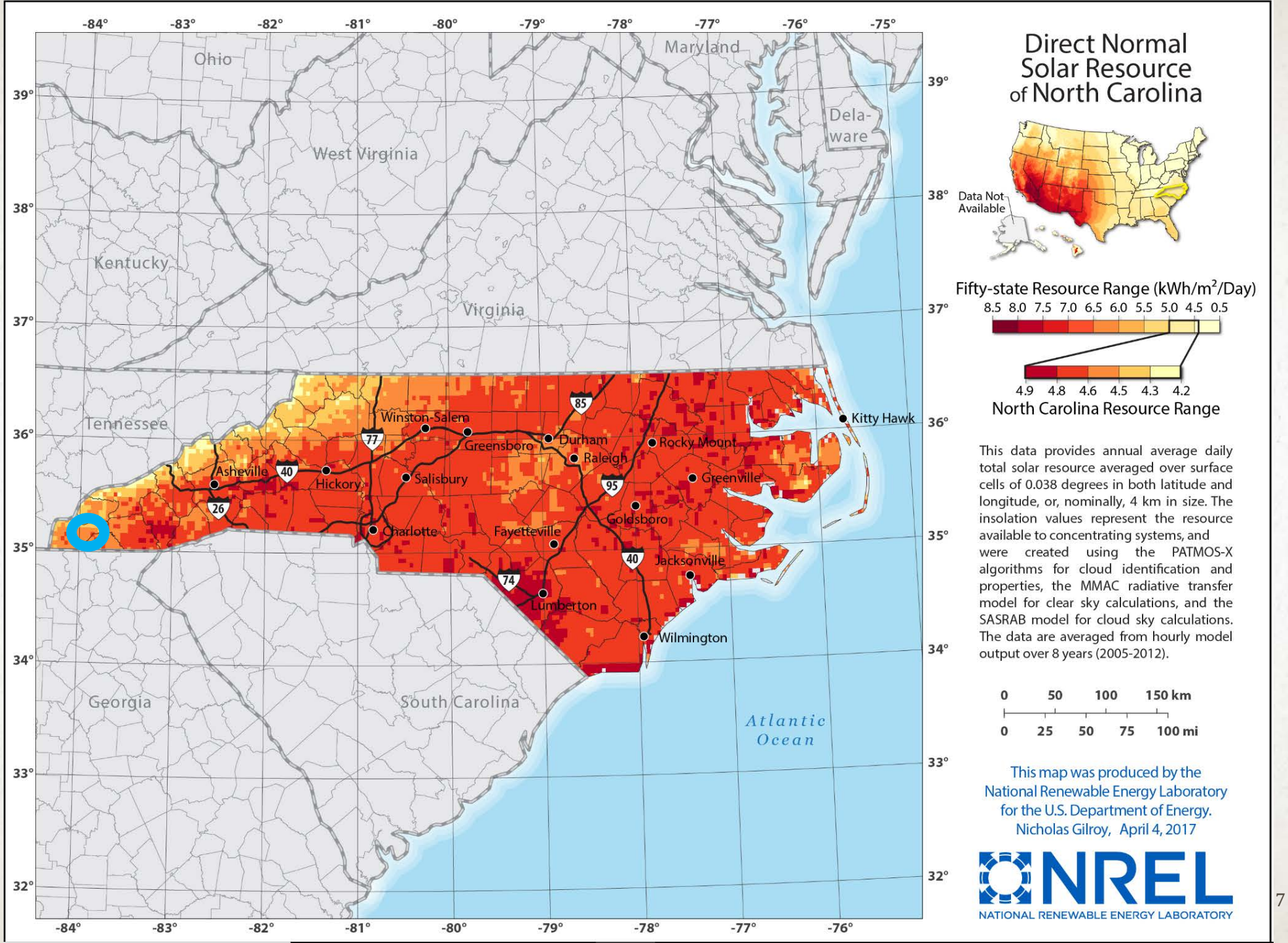
- QUALLA BOUNDARY IS COMPRISED OF ~ 56,000 ACRES IN WESTERN NORTH CAROLINA
- MUCH OF BOUNDARY IS NEXT TO GREAT SMOKY MOUNTAIN NATIONAL PARK (GSMNP)
- DEEDED AND TRUST PARCELS LOCATED IN SURROUNDING COUNTIES
  - Additional ~3,000 acres
- NEARING 16,000 ENROLLED MEMBERS; ~ 6 – 8,000 LIVE ON QUALLA BOUNDARY

PROJECT OBJECTIVES

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


Direct Normal Solar Resource of North Carolina
Data Not Available
Fifty-state Resource Range (kWh/m²/Day)
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 0.5
4.9 4.8 4.6 4.5 4.3 4.2
North Carolina Resource Range
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 MMAC radiative transfer model for clear sky calculations, and the SASRAB model for cloud sky calculations. The data are averaged from hourly model output over 8 years (2005-2012).
0 50 100 150 km
0 25 50 75 100 mi
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Nicholas Gilroy, April 4, 2017
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
Ohio
Maryland
Dela-ware
West Virginia
Kentucky
Virginia
Tennessee
Georgia
South Carolina
Atlantic Ocean
Winston-Salem
Greensboro
Durham
Raleigh
Rocky Mount
Kitty Hawk
Asheville
Hickory
Salisbury
Greenville
Charlotte
Fayetteville
Goldsboro
Jacksonville
Lumberton
Wilmington
-84° -83° -82° -81° -80° -79° -78° -77° -76° -75°
39° 38° 37° 36° 35° 34° 33° 32°

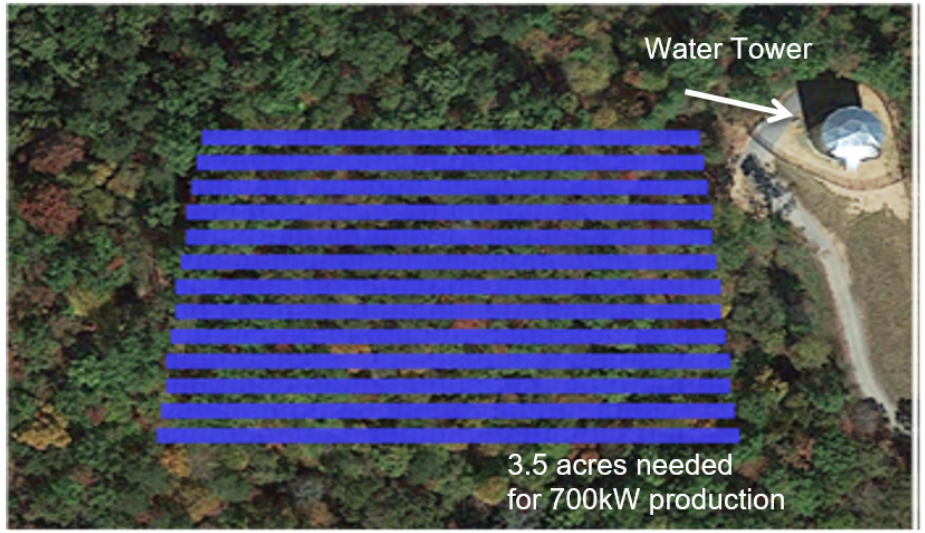
Deployment of Energy Efficiency and Clean Energy on Indian Lands- A Community Solar Project

Eastern Band of Cherokee Indians (EBCI)

Control Number: 1660-1525

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 1,007,340kWh 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

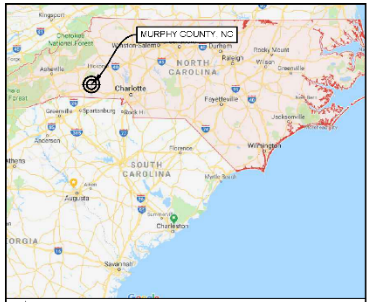
Usage Period	kWh Usage
Oct 01-31 2015	957,445
Nov 01-30 2015	861,914
Dec 01-31 2015	955,588
Jan 01-31 2016	872,910
Feb 01-29 2016	789,726
Mar 01-31 2016	843,732
Apr 01-30 2016	848,472
May 01-31 2016	953,865
Jun 01-30 2016	1,070,636
Jul 01-31 2016	1,167,548
Aug 01-31 2016	1,174,789
Sep 01-30, 2016	1,000,456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

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

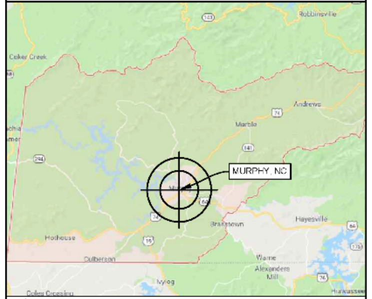
	Baseline Energy (kWh/yr)	Electricity Savings (kWh/yr)	Electricity Savings Yr 1 ($/Yr)	Percentage Savings (%)
Solar Photovoltaic System	11,497,081*	1,019,870**	$100,355	8.9

* Baseline of FY16 Utility Usage

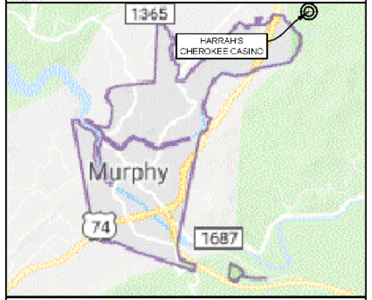
** Yearly production of solar array degrades at a 0.7% rate annually after year 1



STATE of NORTH CAROLINA



COUNTY of MURPHY



CITY of MURPHY

1
PV-###
SITE PLAN
SCALE: 1/64" = 1' - 0"

SOLAR PV SYSTEM OVERVIEW

System Size (DC):	700.4 kW
System Size (AC):	550.0 kW
Array Tilt Angle:	20° Fixed
Array Azimuth (N=0°):	≈ 173°
Module Name:	SILFAB SLG-M340 (340W)
(#) of Modules:	2060
(#) Modules in Series:	(30) Strings of 18, (80) Strings of 19
(#) of Strings per Inverter:	(3) Inverters w/ Strings of 18, (8) Inverters w/ Strings of 19
(#) of Strings Total:	110
Inverter Name:	ABB TRIO-50-TL-OUTD-US-480
(#) of Inverters:	11

SIEMENS

HANNAH SOLAR GOVERNMENT SERVICES
1090 Jack Primus Rd
Charleston, SC 29492

CEO/PRESIDENT:
COL (RET) Dave McNeil
NABCEP Certified
PV Installer - 100414-003117

LEAD ENGINEER:
Jack Brandon
NABCEP Certified
PV Installer - 102415-012142

DESIGNER:
Andrew Slaw
Solar PV Designer

DRAFTER:
Gary Spruill
Solar PV Drafter

DRAWING STATE:
PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

REV	DATE	BY	REVISION DESCRIPTION	APRV'D
0	02/19/2018	G.SPRUILL	INITIAL DRAWING CREATION AND RELEASE	A.SLAW

SIEMENS GOVT. TECH
EBCI-Harrah's Cherokee Casino
777 Casino Parkway
Murphy, NC 29806
700kWDC Ground Mount Array
550kWAC Solar PV Generator
SHADE ANALYSIS

PROJECT NO: TBD

DRAWING NO: SK-20180219-1

SHEET NO:

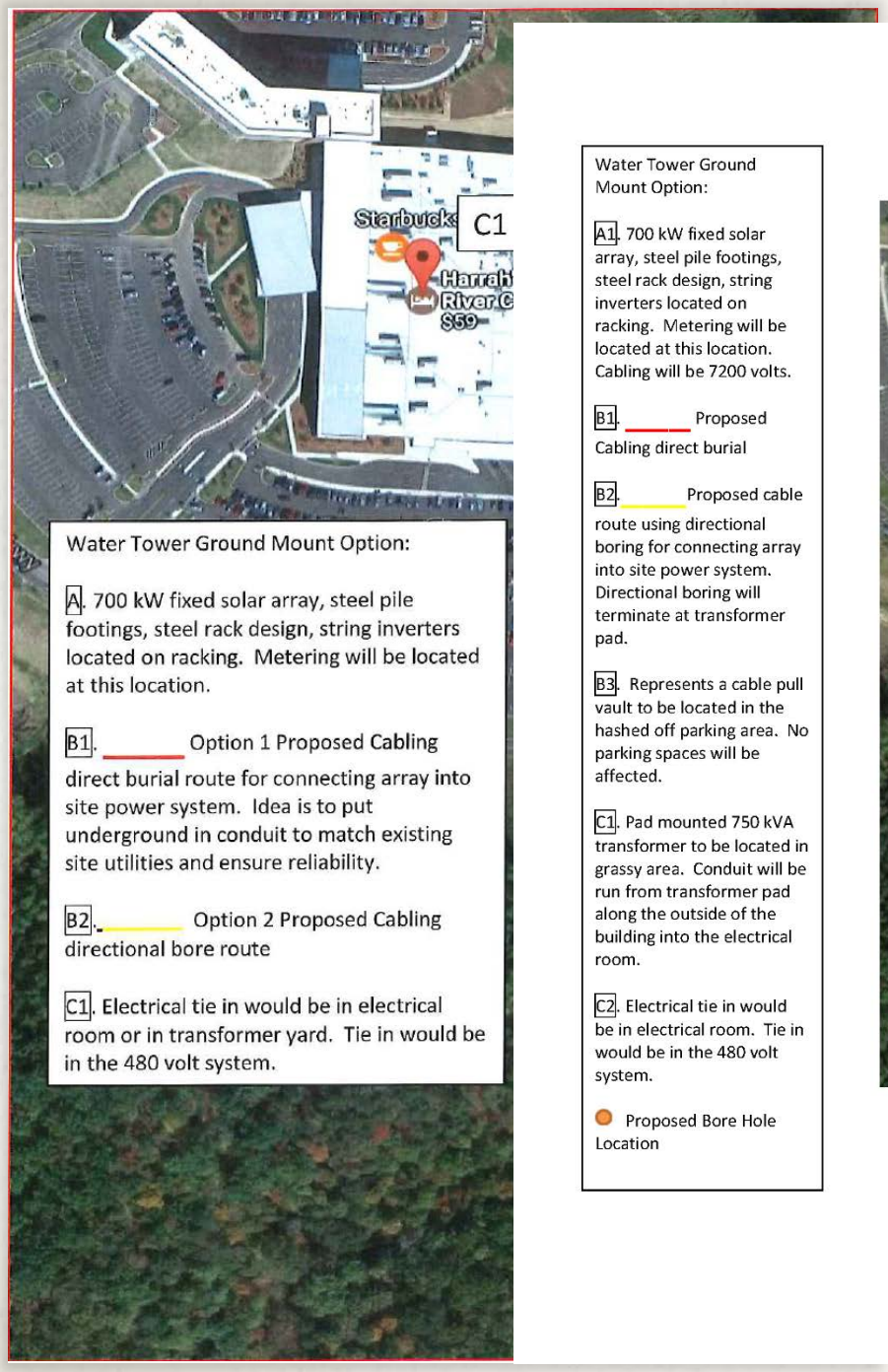
SHEET SIZE: ANSI-D / 22x34

FILE NAME: SKTCH-Site Plan.dwg

SCALE: AS NOTED

REVISION: 0

REVISION DATE: 02/19/2018



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. Cabling will be 7200 volts.

B1. _____ Proposed Cabling direct burial

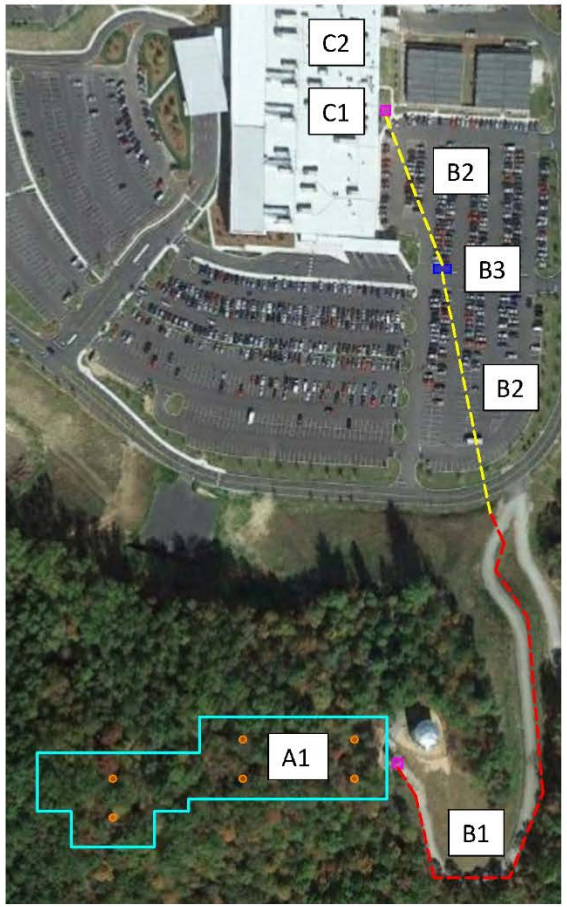
B2. _____ Proposed cable route using directional boring for connecting array into site power system. Directional boring will terminate at transformer pad.

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 room.

C2. Electrical tie in would be in electrical room. Tie in would be in the 480 volt system.

Proposed Bore Hole Location



PROPOSED CABLING 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


April 4th

May 29th

Groundbreaking held for solar farm at Valley River

GROUNDBREAKING: Tribal officials and project officials break ground on the new solar farm at Harrah's Cherokee Valley River Casino on Tuesday, May 29. Shown (left-right) are – Tribal Council Chairman Adam Wachacha, Painttown Rep. Tommye Saunooke, Painttown Rep. Lisa Taylor, Vice Chief Alan B. Ensley, Siemens Government Technologies Vice President for Automation and Service Sam Lewis, Harrah's Cherokee Valley River General Manager Lumpy Lambert, Principal Chief Richard G. Sneed, Wolftown Rep. Jeremy Wilson, Cherokee County – Snowbird Rep. Bucky Brown, Birdtown Rep. Boyd Owle, and EBCI Secretary of Agriculture and Natural Resources Joey Owle. (Photo courtesy of Office of the Principal Chief)

July 11th

July 11th


July 11th


July 30th


July 30th

July 30th

August 17th

September 25th

September 25th

October 29th – Racking installation

October 29th

October 29th

October 29th – Shading issue

December 7th – Problem solved

December 7th

December 7th

APRIL 12TH – SOLAR PV ARRAY COMMISSIONED

Output Dashboard as of November 18th 2019

Harrah's CHEROKEE VALLEY RIVER CASINO & HOTEL

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

CARBON DIOXIDE

CO_2 **2,368,696.70 lb**

NITROGEN OXIDE

NO_x **428.80 lb**

SULFUR DIOXIDE

SO_2 **843.60 lb**

Carbon Offset

1,074.42 metric tons

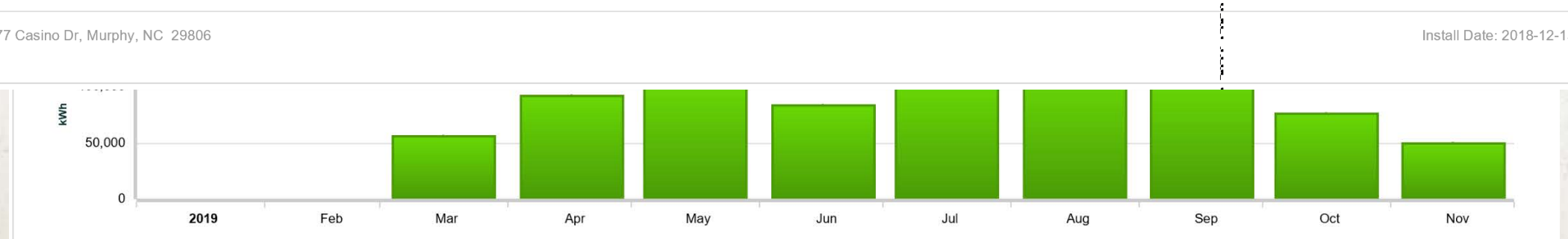
You have offset the equivalent of:

229.10 ac

Typically one acre of pine forest will offset the equivalent of 4.69 metric tons of C02

777 Casino Dr, Murphy, NC 29806

Install Date: 2018-12-13



Y.o.Y. Comparison of Energy Consumption and Utiliy Bill at HVRC

Service Month	Number of Days	KWH	Avg KWH per day	Peak	Max	Reactive Demand	Customer Charge	Facility Rental	Total Bill
FY 2018-2019									
Oct 2018	31	988,477	31,886	39,359.23	34,753.00	130.26	1,850.00	10,010.00	**$86,102.49**
Nov 2018	30	875,028	29,168	34,520.59	34,753.00	0.00	1,850.00	10,010.00	**$81,133.59**
Dec 2018	31	901,683	29,087	39,422.06	34,753.00	0.00	1,850.00	10,010.00	**$86,035.06**
Jan 2019	31	951,429	30,691	43,556.48	34,753.00	0.00	1,850.00	10,010.00	**$90,169.48**
Feb 2019	28	876,415	31,301	37,309.26	34,753.00	2.77	1,850.00	10,010.00	**$83,925.03**
Mar 2019	31	879,435	28,369	35,861.84	34,753.00		1,850.00	10,010.00	**$82,474.84**
Apr 2019	30	875,839	29,195	33,975.89	34,753.00	38.11	1,850.00	10,010.00	**$80,627.00**
May 2019	31	1,067,807	34,445	40,393.68	34,753.00	170.06	1,850.00	10,010.00	**$87,176.74**
Jun 2019	30	1,118,362	37,279	45,984.30	36,984.00	139.93	1,850.00	10,010.00	**$94,968.23**
Jul 2019	31	1,182,095	38,132	48,975.33	36,984.00	184.05	1,850.00	10,010.00	**$98,003.38**
Aug 2019	31	1,162,801	37,510	47,795.77	36,984.00	246.42	1,850.00	10,010.00	**$96,886.19**
Sep 2019	30	1,080,055	36,002	43,255.60	36,984.00	201.39	1,850.00	10,010.00	**$92,300.99**
Totals		*11,959,426*		*490,410.03*	*425,960.00*				

Service Month	Number of Days	KWH	Avg KWH per day	Peak	Max	Reactive Demand	Customer Charge	Facility Rental	Total Bill
FY 2017-2018									
Oct-17	31	915,238	29,524	40,123.40	33,948.00	118.17	1,850.00	10,010.00	**$86,049.57**
Nov-17	30	792,640	26,421	34,345.80	33,948.00	79.07	1,850.00	10,010.00	**$80,232.87**
Dec-17	31	770,418	24,852	34,700.69	33,948.00		1,850.00	10,010.00	**$80,508.69**
Jan-18	31	772,748	24,927	35,861.10	33,948.00		1,850.00	10,010.00	**$81,669.10**
Feb-18	28	738,679	26,381	35,880.48	33,948.00	67.42	1,850.00	10,010.00	**$81,755.90**
Mar-18	31	770,094	24,842	35,531.04	33,948.00	65.00	1,850.00	10,010.00	**$81,404.04**
Apr-18	30	814,553	27,152	35,832.15	33,948.00	1,418.39	1,850.00	10,010.00	**$83,058.54**
May-18	31	1,029,034	33,195	44,815.16	33,948.00	179.87	1,850.00	10,010.00	**$90,803.03**
Jun-18	30	1,136,580	37,886	54,885.24	36,110.00	197.86	1,850.00	10,010.00	**$103,053.10**
Jul-18	31	1,288,053	41,550	60,097.67	36,110.00	186.47	1,850.00	10,010.00	**$108,254.14**
Aug-18	31	1,231,606	39,729	59,087.28	36,110.00	217.16	1,850.00	10,010.00	**$107,274.44**
Sep-18	30	1,248,261	41,609	54,971.13	36,110.00	200.96	1,850.00	10,010.00	**$103,142.09**
Totals		*11,507,904*		*526,131.14*	*416,024.00*				

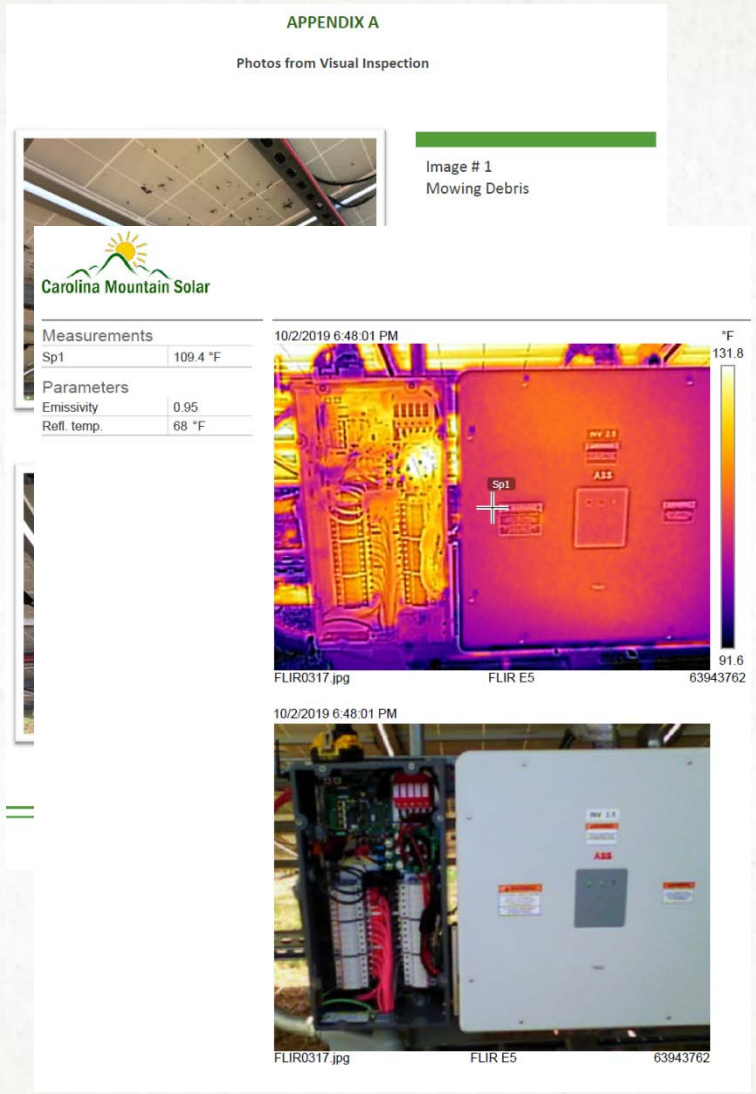
	2019	%	2018	%	2016	Diff. '19 – '16 %
June	1,118,362	(1.60)	1,136,580	6.16	1,070,636	4.46
July	1,182,095	(8.22)	1,288,053	10.32	1,167,548	1.24
August	1,162,801	(5.59)	1,231,606	4.84	1,174,789	(1.02)
September	1,080,055	(13.48)	1,248,261	24.77	1,000,456	7.96

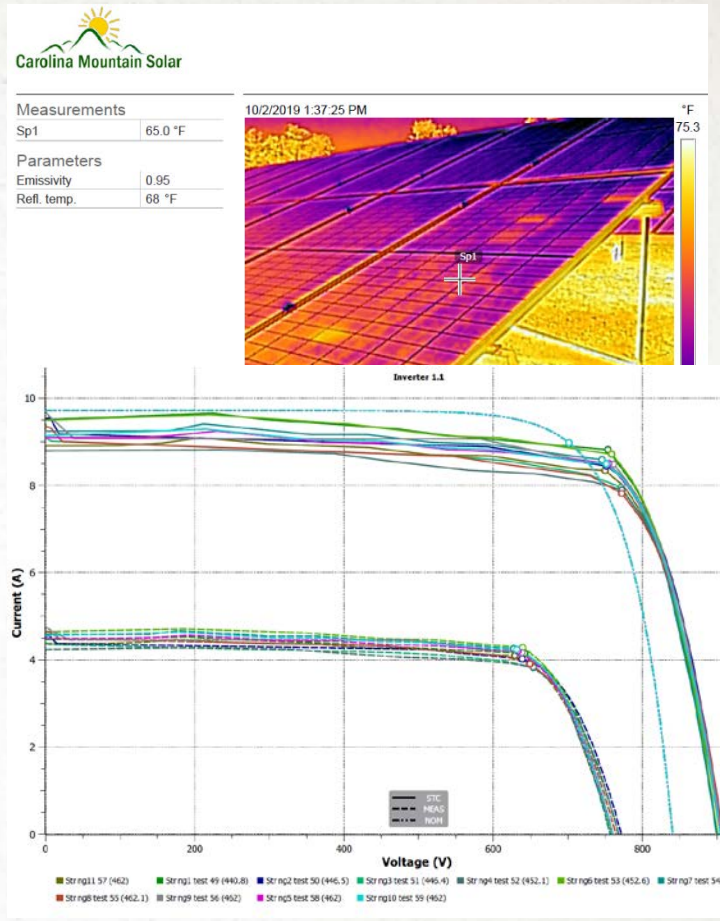
UNANTICIPATED ADDITION TO PROPERTY AT HVRC

- 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

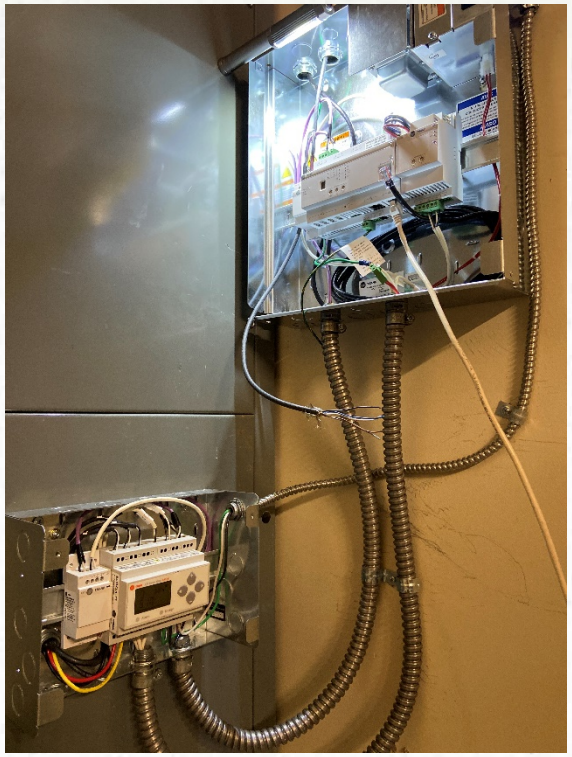
- O&M contract for semi-annual and annual inspection
  - Semi-Annual
    - Soiling, inverter, wiring, racking, panel, label
    - Testing: bolt torque, inverter filter
    - Wash all 2,016 panels
  - Annual
    - Infrared Module-Level Integrity Scan
    - Infrared Electrical System Integrity Scan
  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

PROJECT SUMMARY

- **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?