Tribal Renewable Energy – Final Technical Report

Cover Sheet

October 5th, 2018

Recipient Organization:	Tonto Apache Tribe
Project Title:	Tonto Apache Solar, Phase II
Project Period:	June 1 2015 through February 28th 2018
Reporting Period:	Q7, January 1st, 2017 through February 28th 2018
Award Number:	DE-EE0006946
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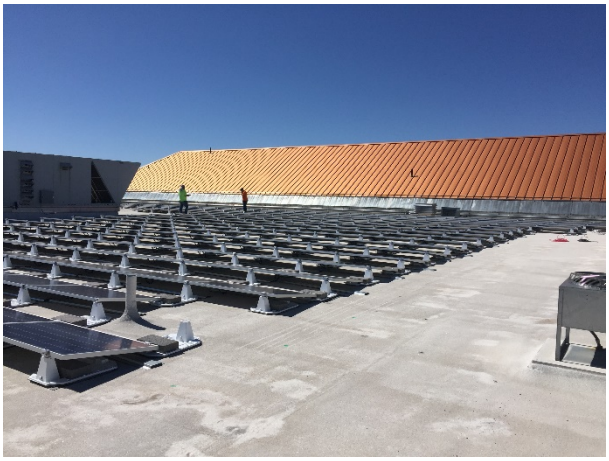
Executive Summary

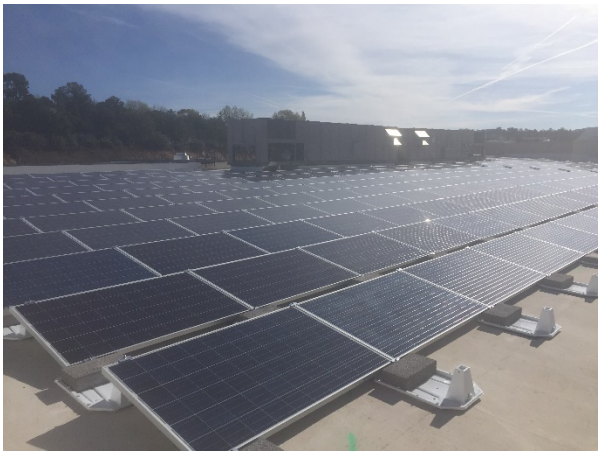
The Tonto Apache Tribe decided to apply for a second Grant opportunity within the Department of Energy's "Tribal Energy Program" for the "Community Scale Clean Energy Projects" in Indian Country in 2015. The plan was to create a solar energy project with Photovoltaics that would offset the energy footprint of the tribal hotel on the reservation.

The system applied for consists of roof mounted solar PV on top of the hotel and casino, interconnecting to two meters; the Hotel, and the Old Casino/bingo meter. The solar system was designated to reduce the electricity costs of those two meters by 33.4% as well as associated cost savings. The system installed meets those objectives.

The total system size installed increased to 270kW, when original project objectives was 250kW. The additional kW installed was from a cost decrease in which we applied the difference in the total project cost to add to the system and offset more kWh's for the Tribe. Solar PV has proven the most effective technology for the Tribe and the previous system installed is working well and producing as expected.

A final picture of the rooftop installation for this project:





Project Overview

Key objective of the 2nd project (Grant II): Integrate solar into the largest energy using meters on the reservation, continue to lead by example to other tribe's in its commitment to being self-sustainable, job creation/support, and reduce their carbon foot print in the process.

Scope: The original Tribal Hotel PV system would be connected to a single interconnection point (Meter) with the Utility Company. By using proven solar PV technology in the Arizona climate, this system is projected to provide approximately 33% offset of total building annual energy usage.

Project scope changes: The Mazatzal Hotel and Casino complex is made up of several independent buildings that are all one complex/structure. An error was discovered during construction and that set-in motion required changes to the buildings that are serviced by the solar grant. The solution was to split the original PV system (249kW) into two PV systems and therefore offset two utility meters, now totaling 270kW; keeping 143kW interconnected to the Hotel meter and 127kW to the Old Casino meter. This was due to a change in the Utility program requirements to net metering. The Utility (APS) changed their system sizing program requirements to limit system sizes to 125% of peak kW load during the previous 12 months. Due to the fact of the grant time and construction timeline, the facility had reduced their loads to initiate splitting up the system from one interconnection point, to two. This would also provide for the best value of net metering solar energy with the utility company on the two meters of the hotel and old casino respectively.

Hotel System: 573 (250w each) of the solar panels that are installed on the roof interconnected to the meter as they were originally intended to. This system was re-designed by our electrical engineer and was 143.25kWDC in size. See attached stamped engineering.

Old Casino System: 508 (250w each) of the other half of the solar panels installed on the roof are interconnected to a second meter with the building complex and ended up being 127kWDC in size. See attached stamped engineering.

Both systems were re-engineered to meet the utility company's interconnection requirements and all building codes where adhered to with the changes. We also re-submitted to the DOE the Facilities Energy offset calculations to ensure compliance within the Grant II requirements.

The tribe was successful in achieving the 2nd community scale grant award from the Department of Energy (DOE) in 2016 and executed on that plan to bring the Hotel complex solar energy while meeting the requirements of all programs associated.

Key Objectives met:

-Integrate solar on the largest energy using meters/area of the reservation: This objective was met of installing another large solar (PV) system on the roof of the Hotel Complex which interconnected to two large electrical meters with the support of the tribal energy grant from the DOE. The system is a ballasted racking method of mounting solar panels on a flat roof and covers a vast area of roof space while being all discretely mounted behind the roofs parapet walls and offering no roof penetrations as well.

-The tribe continues to lead by example with not just Grant supported projects but, entire community lighting retrofits as well.

-This project provided (4) installer positions within the tribe and 1 full time construction management position for 1 year.

-By developing these types of projects and with a continued commitment to reduce the tribe's carbon foot print they have proven to be a leader for other tribes to follow and a prime example for facilities operators with the state of Arizona and the country as well.

Final Construction schedule graph details:

Task Schedule

Task Number Per Statement of Work	Title or Brief Task Description	Task Completion Date				Progress Notes
		Original Planned	Revised Planned	Actual	Percent Complete	
1	NTP to Engineering Electrical & Structural Design on Hotel	12/31/15	1/29/16	1/29/16	100%	Completed
2	Major Equipment Procurement	2/1/16	2/15/16	2/15/16	100%	Completed
3	Utility Interconnection Paperwork & Design submitted	2/1/16	3/14/16	3/14/16	100%	Completed
4	Mobilization	2/15/16	2/15/16	2/15/16	100%	Completed
5	Construction	8/31/16	2/13/17	2/13/17	100%	Installation of the equipment
6	Final Walk Through with the tribe	8/31/16	2/15/17	2/15/18	100%	System described and approval
8	Commissioning	9/1/16	2/15/17	2/15/18	100%	Utility Inspection and grid tie in
9	Demobilization	9/15/16	2/28/17	2/28/17	100%	Punch List and clean up complete
10	Savings Verification	1/31/17	7/31/18	7/31/18	100%	DOE Project Guidelines met

Description of Activities performed

Planning:

We put together the specifications of the project designed to meet the DOE criteria of Grant II which called for specific and detailed information on facility energy usage, system design and specs, and financial models/cost savings in the response.

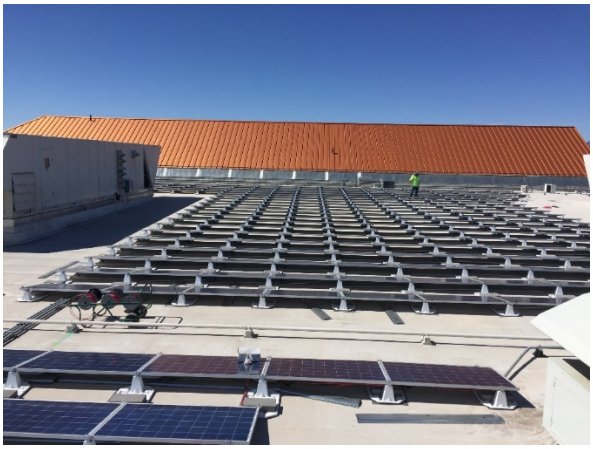
Based on the proven track record of execution the tribe used SunRenu Solar as its technical partner with its previous success of Grant I in 2013 and supporting the tribe's other energy savings measures of a period. Together the response was formed and submitted to the DOE by the tribes Grants program director Joe Bresette.

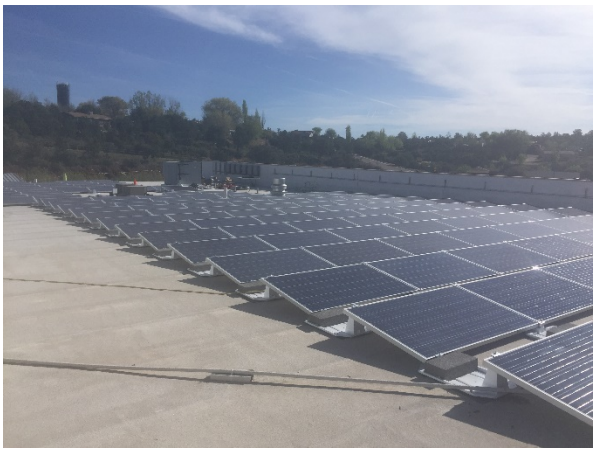
The other factor was the actual installation of the solar project (when awarded) and the facility impact to the clients, roofs, security, and parking areas which were addressed by the facilities

manager and plan was put in place by their team and fully executed on with no issues throughout the project installation period

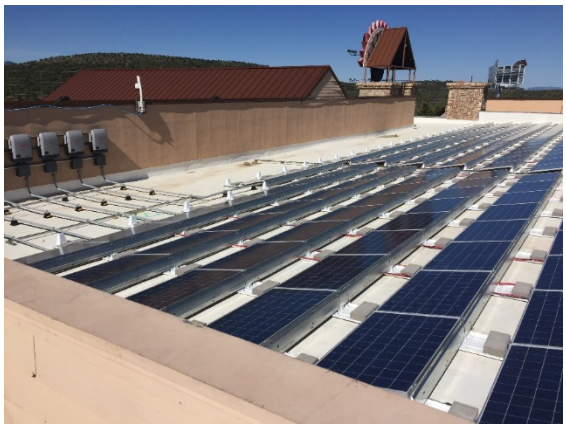
Implementation:

Although considered a turn-key construction project with the previous contractor from Grant I internal reviews where required and all project layouts, schedule, budget, where all done through the Tribal Council.





Detailed site, electrical, and structural plans where designed and approved before construction. Once the approval process was met the contractor was able to order equipment and to start accepting orders for delivery and the installation process of the project. We concurrently worked with the utility company to ensure interconnection and approval of the project by the utility company and meter departments.



Coordinating:

This was an on-going effort between the contractor, the tribe, and the utility company. The schedule was followed by the contractor and major milestones of the project reported to and approved by the tribe throughout the project.

Reporting:

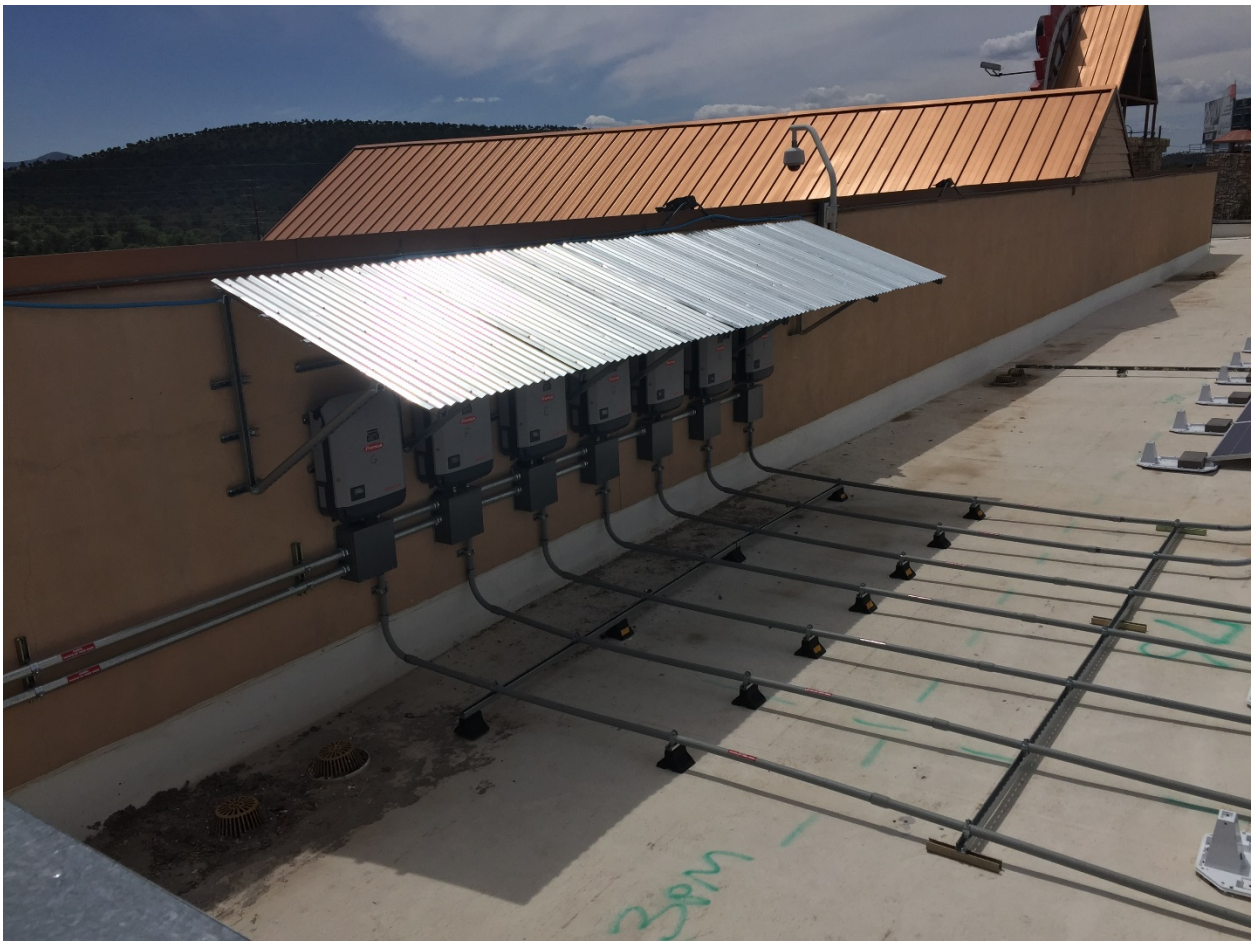
This was coordinated by the Tribe and consisted of financial and construction progress reporting to the granting agency along with the council. This type of communication was critical and helped see the project through to the end. The contractor supplied technical data and the tribal staff provided reports on progress, problems, challenges, and solutions.

Lessons Learned:

It not always easy to work within the guidelines and criteria's set by all the combined parties within a project of this nature. The Utility companies have on-going policy changes, including interconnection program requirements as more solar is adopted to the grid. Such interconnection net metering changes happened throughout the course of the application, planning, and implementation of this process. Paying close attention to rate cases and communicating with the Utility consistently is a lesson learned. In addition, AHJ's have new code to comply to, and construction can have unforeseen conditions that have be dealt with on the fly and still adhere to the framework of these projects. In this case we learned that communication is the most important factor and working hand in hand with the DOE during some of these challenges was key to the project's success overall.

Communicating with the Hotel facilities team was another key factor as not to impact their guests during power outages or equipment deliveries to ensure a seamless project with no site issues or injuries.

In closing the Tribe will continue its path towards energy independence and the application of renewable and energy efficient projects that provide this value. It will also keep looking for Grant opportunities and other funding support mechanisms available to them. The Tribal Energy Grant program is very special, and we thank them for the 2nd opportunity to execute another great solar energy project for our growing community.



Savings Analysis:

Based on production of the system and the avoided cost of solar, the facility savings is on par based on our initial grant application productions. The Tonto Apache Tribe has saved $46,099.60 in energy savings based on production and avoided cost of energy. The Utility bills reflect inaccuracies, and this was due to a billing error on the part of APS. The system is performing optimally, and with an LED retrofit of all the parking lot lighting (not included in this DOE grant) resulted in a wide reduction in kWH's for the Old Casino. The majority of exterior pole lighting was connected to the Old Casino meter thus skewing the results of the PV system standalone. The energy and savings analysis based on 2016 and 2017 electric bills is as follows:

TAT/SRS 2016/2017 DOE TEP Savings Justification Report: Utility Billings

Hotel APS Account # 5710990000 - meter number CK1971							
Months	2016 Dollars	2017 Dolars	Savings	2016 kWh's	2017 kWh's	Savings	kWh % offset
January	$ 6,220.54	$ 3,026.90	$ 3,193.64	68800	25600	43200	63%
Febrary	$ 5,271.77	$ 1,765.83	$ 3,505.94	56400	10040	46360	82%
March	$ 5,518.85	$ 2,556.33	$ 2,962.52	56000	15200	40800	73%
April	$ 5,703.19	$ 1,154.10	$ 4,549.09	58400	4500	53900	92%
May	$ 6,963.91	$ 1,521.94	$ 5,441.97	56400	6000	50400	89%
June	$ 7,681.64	$ 2,453.79	$ 5,227.85	64400	12800	51600	80%
July	$ 8,547.01	$ 3,239.00	$ 5,308.01	74000	22800	51200	69%
August	$ 8,897.99	$ 3,134.97	$ 5,763.02	80000	20800	59200	74%
September	$ 8,329.92	$ 2,950.78	$ 5,379.14	69200	19600	49600	72%
Oct	$ 7,830.26	$ 1,355.21	$ 6,475.05	69600	11200	58400	84%
November	$ 6,345.12	$ 2,153.24	$ 4,191.88	59600	15200	44400	74%
December	$ 6,011.18	$ 2,021.13	$ 3,990.05	64800	15720	49080	76%
	2016 Total $ saved YR 1		$ 55,988.16		**2016 Total kWh's saved YR 1**	598140	

Old Casino APS Account # 1528460000 - meter # DP8522							
Months	2016 Dollars	2017 Dolars	Savings	2016 kWh's	2017 kWh's	Savings	kWh % offset
January	$ 5,052.76	$ 5,128.49	$ (75.73)	61800	53200	8600	14%
Febrary	$ 5,880.19	$ 4,271.76	$ 1,608.43	64800	39600	25200	39%
March	$ 6,420.28	$ 2,335.91	$ 4,084.37	64000	24000	40000	63%
April	$ 6,408.11	$ 890.02	$ 5,518.09	60000	4580	55420	92%
May	$ 6,383.29	$ 886.63	$ 5,496.66	62800	4360	58440	93%
June	$ 7,215.12	$ 871.25	$ 6,343.87	59200	4240	54960	93%
July	$ 8,547.01	$ 774.91	$ 7,772.10	74000	2880	71120	96%
August	$ 8,533.03	$ 697.63	$ 7,835.40	70000	3120	66880	96%
September	$ 8,045.07	$ 727.83	$ 7,317.24	67200	3560	63640	95%
Oct	$ 6,665.66	$ 1,927.98	$ 4,737.68	53600	21960	31640	59%
November	$ 6,671.14	$ 2,372.04	$ 4,299.10	48400	27160	21240	44%
December	$ 5,590.11	$ 430.09	$ 5,160.02	48000	2080	45920	96%
	2016 Total $ saved YR 1		$ 60,097.23	**2016 Total kWh's saved YR 1**		543060	*energy efficiency added to kWh reduction

Total Combinned Savings 2016/2017 DOE Grant Project	$ 116,085.39	***Total Combined Projects kWh's saved 2016/2017 DOE Project***	1141200

The result of the solar DOE grant and energy efficient measures is displayed above. Due to the billing errors on behalf of APS, we performed another analysis based on solar production only, and using a base electric rate expense. Based on our analysis of solar production alone with the avoided cost of energy, we show the following energy savings:

TAT Casino Grant #2 Savings Calculation from Production								
	Consumption	khw production			Consumption	khw production		
2018	Hotel	Hotel	% offset		Old Casino	Old Casino	% offset	
March	68800	17,580	26%		61800	13,900	22%	
April	56400	23,130	41%		64800	21,890	34%	
May	56000	24,120	43%		64000	24,250	38%	
June	58400	23,720	41%		60000	23,630	39%	
July	56400	18,750	33%		62800	18,510	29%	
Aug	64400	21,610	34%		59200	19,750	33%	
Sept	74000	19,930	27%		74000	17,370	23%	
Oct	80000	18,810	24%		70000	15,550	22%	
Nov	69200	12,160	18%		67200	10,650	16%	
Dec	69600	11700	17%		53600	10420	19%	
Jan	59600	12100	20%		48400	11700	24%	
Feb	64800	15760	24%		48000	12100	25%	
total production		219,370				199,720		419,090
cost savings		419,090			x	$0.11		46,099.90
		total production				kwh cost		total savings

The results from both analyses meet the DOE criteria of % offset based on the Community Scale Grant awarded to the Tonto Apache Tribe.

Conclusion:

This project was extremely beneficial to the Tonto Apache Tribe. The rooftop mounted solar was not only the best value, it drastically reduces their energy consumption and expenses for years to come. The project was implemented as energy saving measures, however there is many green benefits to it for public relations. The DOE was extremely helpful in working with SunRenu Solar and the Tonto Apache Tribe in another successful solar project.

This project will have lasting effects and put the Tribe in a better financial and progressive position. Becoming less reliant on grid energy which can be mostly dirty energy, is a position the Tonto Apache Tribe strives for. The project was designed and implemented without drastic change and it was a smooth project overall.