Tribal Renewable Energy – Final Technical Report

Recipient Organization:	Oneida Indian Nation
Project Title:	**Community-Scale Clean Energy Deployment Combined Heat and Power Project**
Covering Period:	September 1, 2015 through December 31, 2019
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Executive Summary

The Oneida Indian Nation (the Nation) is committed to continuous improvement and performance enhancement in terms of energy efficiency, waste reduction, and pollution prevention while encouraging economic development to support its operations, programs, and services. To support this commitment, the Nation utilized the results of an exhaustive energy analysis conducted in 2015 on Nation-owned buildings to develop the *Community Scale Clean Energy Deployment Combined Heat and Power Project.* The project was designed to upgrade and improve the operation of the Nation's Central Utility Plant (CUP) so that previously wasted energy could be captured and utilized to produce electricity. The results of the project include increased energy efficiency, reduced dependency on fossil fuels, and lower energy costs while maintaining sound environmental stewardship of natural resources.

This project is one of many Nation projects intended to improve energy efficiency and advance responsible environmental stewardship. As stated in the Oneida Indian Nation Environmental Protection Ordinance (#0-98-07, enacted 11/21/98), the long-term energy goal of the Nation is to establish "an internal environmental management system to help the Nation fulfill its responsibilities as trustee of the environment for the benefit of future generations; to ensure that all Nation Members and others who live, work on, or visit Nation lands or patronize Nation facilities or benefits have safe, healthful, productive, and aesthetically and culturally pleasing surroundings; and, to attain the widest range of beneficial uses of the Nation's environment without degradation, risk to human health and safety, or other undesirable and unintended consequences." Projects that support this long-term goal and achieve significant benefits are a priority for the Nation.

The goal of this project was to upgrade and improve the operation of the CUP to make it more energy efficient and environmentally sound by increasing the use of clean energy and reducing dependency on fossil fuels. This enables the Nation's primary enterprise, Turning Stone Resort Casino (TSRC), to operate more efficiently by reducing energy expenses which in turn allows TSRC to continue to reinvest in its operation and provide financial support to the Nation's essential government programs and services made available to Nation Members.

As the primary project activity, the Nation purchased, installed, tested, commissioned, and operated a condensing steam turbine generator (STG) and surface steam condenser (SSC) to capture and use up to 100% of the surplus thermal energy produced by the Nation's existing heat recovery steam generator (HRSG). Prior to the completion of this project, the surplus thermal energy vented to the atmosphere as waste steam. The new STG and SSC provide an additional system by which the Nation can now utilize that surplus thermal energy – steam – to generate additional electrical energy at the Nation's CUP, displacing electricity previously purchased from local utilities.

This project was successful as the energy generation and cost savings illustrate. There were a few setbacks to the timeline of the project, including a requirement by National Grid for additional studies and the replacement of faulty parts as described later in this report, but they did not significantly impact the final results. Now that the hurdles have been overcome, the Nation expects this new energy program to continue to perform well and allow the Nation to take

a great step forward in its goals for energy efficiency and self-sufficiency in terms of energy production.

Project Overview

The Oneida Indian Nation (the Nation) has a Combined Heat and Power (CHP) Plant, identified in this document as the Central Utility Plant (CUP), which supplies electricity, steam, and chilled water to the Turning Stone Resort Casino (TSRC). This project added a Steam Condensing Turbine Generator (STG) and a Surface Steam Condenser to the CUP. This new equipment directs 125psi steam, previously emitted as waste, from the CUP to the STG where it produces electricity by passing over the blades of the turbine and causing rotation of the connected generator. The resulting electricity from the turbines is fed into the TSRC electrical distribution system, reducing the amount of electricity imported from the local utility company.

Three feasibility obstacles needed to be overcome before the proposed project could be initiated: cost, timing, and modifications. Feasibility and engineering studies were conducted to help Nation leadership make an informed decision about the investment required to complete this project in light of the many competing priorities of the Nation. Nation leadership needed to be assured that the cost of the project and the return on the financial investment would be reasonable; the time required to implement the project would make an application for grant funding to support a portion of the project costs possible; and, the infrastructure modifications necessary to implement the project would be within the Nation's ability to support in terms of funding and/or timing. Fortunately, the Nation was able to address each issue successfully. The costs and expected return on investment were within the boundaries set by Nation leadership; the projections for the project timeframe fit within the grant funding parameters; and, the installation of the new equipment did not require infrastructure modifications that would significantly add to the cost or timing of the project. Once these obstacles were eliminated, Nation leadership chose to proceed with the project. The feasibility study commissioned by the Nation and completed in April 2015 identified the project described in this report as the best approach among three options studied to meet the Nation's clean energy and energy efficiency objectives.

The CUP houses a gas turbine generator (GTG), a single pressure heat recovery steam generator (HRSG), two boilers for back-up steam supply, and four centrifugal chillers for supplying chilled water to the TSRC. Steam is generated by the HRSG at 120 psig (pounds per square inch gauge) and delivered to the resort buildings via an export steam pipe and distribution system. The steam is utilized for space heating and domestic hot water uses. Steam is also used within the CUP by the deaerator. The HRSG has a bypass stack and diverter valve that allow the plant to operate in a thermal load following mode, matching steam production to demand by bypassing a portion of the gas turbine exhaust to the atmosphere via the exhaust diverter and bypass stack. Hence, a portion of the GTG exhaust energy was being wasted. The Nation identified this as an inefficiency of the CUP that needed to be addressed. From both an economic and environmental perspective, 100% utilization of the turbine-generated steam is essential.

Under this project, the full gas turbine exhaust flow is delivered to the HRSG to produce steam. This results in more steam flow being produced than is required by TSRC and the deaerator.

The excess steam is piped to the STG at 120 psig. The turbine exhausts to a water-cooled surface steam condenser which operates at a pressure of 1” to 3” HgA (inches of Mercury at one-atmosphere), depending on ambient conditions heat rejection load. Output to the STG can be as high as 1400kW (kilowatt), depending on the steam available. Circulating cooling water for the condenser is cooled in one of the existing evaporative cooling towers formerly used as part of the absorption chiller operation. Condensate from the condenser is pumped to the CUP’s condensate storage tank. The resulting electricity from the turbines is fed into the electrical distribution system and is used to provide power to the TSRC campus.

The Project Manager worked with TSRC Facilities personnel, Supply Chain, and others to identify vendors and the STG and SCC units that best met the Nation’s needs and system specifications. The Project Manager then worked in conjunction with Nation leadership and Department of Energy representatives and determined that the equipment, implementation plan, timetable, and budget were likely to produce the expected results and the decision was made to move forward with implementation.

The Nation executed a Department of Energy-approved sole-source contract with a preferred vendor to provide engineering consulting services for the project. The engineering contractor prepared the equipment specifications, they were approved by the Nation, and the equipment was ordered. Delivery of the STG took nearly twelve months. During this time, the Nation prepared and solicited bids and awarded the mechanical/structural, electrical, and plumbing contract; the engineering consultant prepared the technical specifications and drawings needed to complete the mechanical and electrical work; and, the contractor completed the pre-installation structural, mechanical, electrical, and plumbing activities. The major structural modifications to the CUP were the removal and relocation of an existing absorption chiller and construction of the foundation for the STG. Upon delivery the equipment was inspected, tested, and commissioned. The remaining mechanical and electrical work was completed and the equipment was tied into the Nation’s existing mechanical and electrical systems.

The new CHP system was tested, commissioned, and fully deployed upon Nation approval. The Project Coordinator and Evaluator monitor system performance and produce monthly reports of energy usage, energy generation, and energy costs following deployment. The Nation planned to provide a full calendar year of data to demonstrate the success of the project, but due to unforeseen circumstances that hindered full deployment as described in the Project Challenges section of this report, the STG was not operational for the full 2019 year. The Current Status section of this report includes the data from April 2019 through March 2020. The reports are used to determine the achievement of the stated project objectives and the overall success of the CHP Project and the Project Coordinator will continue to monitor the system performance for the foreseeable future.

The return on investment will be realized within the first few years of operation as the system continues to perform at a high level. Generation of electricity from what had been waste steam makes the system more efficient and saves energy costs for the Nation. Given the current energy needs of the TSRC campus and forecasts of expected use in the future, this project presents the Nation with the ability to further support its efforts to protect the environment for current and future residents and visitors on its lands as well as for the seventh generation to come.

Project Objectives

The project goal was to upgrade the existing CUP to make it more efficient and environmentally sound and enable TSRC, the Nation's primary enterprise, to function in a more fiscally efficient manner by reducing energy expenses. The improved financial status of the TSRC allows for continued reinvestment in the TSRC enterprise and financing of the Nation's essential government programs and services for Oneida Members through proceeds from the Nation's enterprises.

The project had three specific objectives:

1. Leverage the existing CUP system located at the TSRC campus to generate significant energy from a clean energy source, reduce dependence on fossil fuels, and recognize significant cost savings;
2. Utilize 100% of the thermal energy produced by the current 5.2 MW Solar Gas Turbine with HRSG currently located at the CUP for additional energy usage and production; and,
3. Reduce peak electrical usage by the facilities on the TSRC campus and achieve additional energy cost reduction by decreasing demand on the public utility.

The anticipated outcomes included an increase in overall operation efficiencies, reduced dependence on electricity produced using fossil fuels, reduced greenhouse gas emissions, and significantly reduced utility costs. Another, non-quantifiable but equally important outcome of the project was that it demonstrates the Nation's commitment to responsible stewardship of the Nation's resources for the benefit of its Members, now and to the seventh generation, by increasing self-sufficiency and reducing reliance on the public energy grid. Specifically, the project met the following important outcomes:

- The Nation generates electricity using a clean fuel source, natural gas, instead of relying on coal power suppliers to provide electricity; and,
- Electricity demand has been reduced by TSRC which frees up electricity during peak times on the public transmission grid, resulting in less stress and demand on the grid.

The Oneida Indian Nation improved the energy efficiency of its existing 6MW natural gas-fed Combined Utility Plant (CUP), increased the Nation's energy self-sufficiency, and reduced the Nation's energy costs by capturing and converting waste steam from its existing heat recovery steam generator (HRSG) to produce additional electrical energy on-site, reducing the amount of electrical energy purchased from local utilities. This enabled the Nation's primary business enterprise, TSRC, to operate more efficiently and at lower cost. This, in turn, allows TSRC to continue to provide financial support, through revenue generated by its business operations, for the Nation's essential government programs and services for Oneida Indian Nation Members. The Nation has begun to achieve significant benefits from this project including governmental self-sufficiency and economic independence while protecting the environment and reducing its dependence on fossil fuels.

Description of Activities Performed

Accomplishments

All Tasks and Sub-Tasks were completed and all Milestones were achieved during the implementation of this project. Timeline modifications were made due to circumstances related to unexpected requirements from the local utility provider and faulty parts. An extension was requested and approved to allow the Nation to complete the project. A Milestone Summary chart included at the end of this report illustrates the time adjustments and final completion dates.

Task 1.0 Project Start-Up

Task Summary: Convene Project Team, review work plan and budget, secure approval to proceed with project, meet with engineering consultant to clarify roles and responsibilities, and implement work plan.

Sub-Task 1.1: Work Plan & Budget Review by key project staff and Department of Energy (DOE).

Sub-Task 1.2: Approval by Nation and DOE to proceed with Project. **Go/No-Go 1.2**

Sub-Task 1.3: Kick-Off Meeting with Engineering Services Consultant, CHA. **Milestone 1.3**

Project Start-up took place as expected. Key project staff reviewed the Work Plan and Budget with DOE Project Monitors and made adjustments as needed. The final documents were presented to Nation Leadership and DOE and approval for the project was obtained. Key project staff met with the Engineering Services Consultant, CHA, to review project documents and finalize the plan for implementation. Nation/CHA Project Team conducted biweekly conference calls to discuss action sheets and monthly engineering reports.

Task 2.0 Purchase Equipment

Task Summary: Purchase STG and SSC equipment meeting technical specifications and in accordance with project budget and timeline.

Sub-Task 2.1: Prepare equipment specifications. **Milestone 2.1**

Sub-Task 2.2: Identify STG and SSC manufacturers and vendors.

Sub-Task 2.3: Make equipment selection based on specifications. **Milestone 2.3**

Sub-Task 2.4: Secure approval for equipment purchase. **Milestone 2.4**

Sub-Task 2.5: Order equipment. **Milestone 2.5**

Sub-Task 2. 6: Take delivery of equipment. **Milestone 2.6**

The purchase of equipment was achieved through competitive bidding pursuant to the Nation's Federal Grant Procurement Policy and applicable grant requirements. The Project Team received and reviewed responses to technical questions for the preferred bidders to use in the preparation of the conforming specifications for the STG and SSC units and selected Dresser-Rand and Maarky respectively. Ordering and purchasing of the equipment was delayed due to the requirement for National Grid interconnection studies and required certification and top entry design changes to the generator for the STG and SSC equipment, provided by Dresser Rand (STG) and Maarky (SSC).

Task 3.0 Select Contractors

Task Summary: Execute contracts with qualified vendors to complete Engineering, Mechanical/Structural and Electrical scopes of work.

Sub-Task 3.1: Issue sole-source contract to preferred vendor for engineering consulting services; **Milestone 3.1**

Sub-Task 3.2: Develop bid specifications for Mechanical/Structural & Electrical contracts.

Sub-Task 3.3: Solicit Bids for Mechanical/Structural & Electrical contracts. **Milestone 3.3**

Sub-Task 3.4: Select Contractors. **Milestone 3.4**

Sub-Task 3.5: Award Mechanical/Structural & Electrical contracts. **Milestone 3.5**

This task was changed during the implementation of the project. The Project Team determined that it would be more efficient and economical to bid the Mechanical/Structural and Electrical contracts together as one contract. The Department of Energy approved this updated approach. This streamlined the bidding process and provided a cohesive working relationship among the contractors and vendors. The contractor selection for this work was achieved through a competitive bidding process in accordance with the Nation's Federal Grant Procurement Policy and applicable grant requirements.

Task 4.0 Prepare Technical Specifications and Drawings - Milestone 4.0

Task Summary: Engineering consultant will conduct field investigation, review existing drawings and system information, gather additional information as needed, and prepare drawings and technical specifications for mechanical, electrical, and instrumentation and control activities.

Sub-Task 4.1: Conduct field investigation of existing site conditions and systems.

Sub-Task 4.2: Prepare process flow diagram, process and instrumentation and system descriptions for steam, condensate, cooling water, vents and drains (and compressed air if required).

Sub-Task 4.3: Prepare layout drawings of STG, SSC, and major piping and electrical tie-ins.

Sub-Task 4.4: Prepare technical specifications for the supply, erection, installation, construction, commission, and testing of mechanical components and systems and electrical equipment not included as part of the STG or SSC equipment packages.

Sub-Task 4.5: Prepare building and equipment grounding drawing and details and electrical layout drawings and single line diagrams.

Sub-Task 4.6: Prepare technical requirements for instrumentation and controls supply, installation and commissioning.

Specifications were completed, but the drawings took additional time as they were finalized based on National Grid's Remote Terminal Unit (RTU) requirements resulting from its interconnection studies and evolving structural design needs. Pipe stress analysis and major equipment layout including steam piping and cooling water piping were completed. Foundation drawings were completed after loading information was received from Dresser Rand.

Task 5.0 Complete Preparations for Equipment Installation

Task Summary: Complete structural modifications and complete mechanical and electrical work necessary to install and operate STG and SSC units at the CUP.

Sub-Task 5.1: Remove absorption chillers from CUP to accommodate STG & SSC. **Milestone 5.1**

Sub-Task 5.2: Complete construction foundation for STG and SSC.

Sub-Task 5.3: Complete other structural modifications.

Sub-Task 5.4: Complete pre-installation Mechanical/Structural scope of work. **Milestone 5.4**

Sub-Task 5.5: Complete pre-installation Electrical scope of work. **Milestone 5.5**

All preparations for equipment installation were completed after bids were solicited, received, reviewed, and awarded. A delay was experienced when the first round of bids for the Mechanical/Structural, Electrical, and Plumbing scope of work were much higher than anticipated. A closer review of the requirements with bidders resulted in two finalists and an award was made.

Task 6.0 Install Equipment

Task Summary: Complete installation of STG and SSC in accordance with vendor instructions, mechanical and electric specifications, facility layout-out, and technical drawings.

Sub-Task 6.1: Set STG and SSC and complete assembly. **Milestone 6.1**

Sub-Task 6.2: Complete post-installation Mechanical scope of work.

Sub-Task 6.3: Complete post-installation Electrical scope of work.

Sub-Task 6.4: Tie STG and SSC into Mechanical systems. **Milestone 6.4**

Sub-Task 6.5 Tie STG into Electrical systems. **Milestone 6.5**

Installation and final assembly of STG and SSC were completed and tie-ins to Mechanical and Electrical systems were accomplished pursuant to engineer's drawings and specifications.

Task 7.0 Equipment Testing & Commissioning

Task Summary: Develop commissioning criteria, conduct testing, measure performance and make adjustments as needed to meet commissioning criteria**.**

Sub-Task 7.1: Coordinate testing with DOE and vendor representatives.

Sub-Task 7.2: Define commissioning criteria. **Milestone 7.2**

Sub-Task 7.3: Confirm all connections.

Sub-Task 7.4: Check all instrumentation.

Sub-Task 7.5: Confirm correct operation of key components.

Sub-Task 7.6: Complete performance testing. **Milestone 7.6**

Sub-Task 7.7: Document achievement of commissioning criteria.

Sub-Task 7.9: Commission equipment. **Milestone 7.9**

Testing and commissioning were completed after some scheduling delays. Initial attempts to start the steam turbine were not successful and technical assistance was required. Through meetings with the engineers and designers, the problems were rectified and the turbine went online in April 2019.

Task 8.0 Deploy New CHP System & Verify Performance

Task Summary: Deploy new CHP system, based on successful operation over test period and verify performance over continuous period of operation.

Sub-Task 8.1: Develop operational performance test plan.

Sub-Task 8.2: Implement performance test and assess results. **Milestone 8.2**

Sub-Task 8.3: Make modifications as indicated by test results.

Sub-Task 8.4: Deploy new CHP system. **Milestone 8.4**

Sub-Task 8.5: Complete period of continuous operation. **Milestone 8.5**

Sub-Task 8.6: Produce monthly and final reports of energy usage, electrical production, and energy cost savings for the project period. **Milestone 8.6**

Due to inconsistencies resulting from minor equipment issues, the system did not run reliably until April 2019. Operation was interrupted in June 2019 due to a part that required replacement and was not fully operational again until August. This downtime reduced the data collected during June and July 2019, but operation and data collection have been stable since August 2019. A data chart that includes Operating Capacity percentage, Energy Production in kilowatts, and Energy Costs Savings follows in the Current Status section of this report.

Task 9.0 Project Monitoring & Reporting

Task Summary: Conduct regularly scheduled project oversight meetings and conference calls and submit federal grant management and additional project task reports as specified.

Sub-Task 9.1: Conduct regularly scheduled project meetings/calls with key staff.

Sub-Task 9.2: Submit project updates to Nation Leadership as requested.

Sub-Task 9.3: Submit quarterly progress reports to DOE and quarterly financial reports to Payment Management System (PMS).

Sub-Task 9.4: Contractors to submit regular reports to Project Manager.

Sub-Task 9.5: Submit final project report to Nation Leadership. **Milestone 9.5**

The new system has been up and running since April 2019 with a gap in service from mid-June to early August when a faulty part caused a shutdown in operation until a replacement could be obtained and installed. Data collection began in April 2019 and continued through March 2020 (after the project end date) in an attempt to obtain a full 12 months of verification. Nation Leadership receives regular reports about the system operation and cost savings, and all Department of Energy required reports have been submitted.

Current Status

The CHP system is now fully operational and verification of results in ongoing. The following table displays the operating capacity, energy production, and energy savings determined since the start of the verification phase.

Month	Operating Capacity	Energy Production (kWh)	Energy Cost Savings
April 2019	52%	372,300	$24,068
May 2019	57%	422,100	$30,828
June 2019	17%	124,800	$7,450
July 2019	0%	N/A	$0
August 2019	45%	337,600	$20,748
September 2019	75%	537,900	$33,676
October 2019	53%	391,868	$26,121
November 2019	99%	716,500	$50,705
December 2019	59%	436,000	$27,178
January 2020	51%	379,300	$30,705
February 2020	62%	431,700	$32,702
March 2020	57%	423,400	$31,584
Total to date		**4,573,468**	**$315,766**

NOTE: Low steam production in December 2019 and January 2020 due to increased steam demand from TSRC. In response to the COVID-19 pandemic, the Turning Stone Resort Casino campus was closed effective March 16, 2020, which decreased demand for energy and production from the CUP system.

The upgraded CUP system is monitored and maintained in accordance with the TSRC “continuous commissioning” process. This process uses 24/7 computer monitoring and regular maintenance checks to ensure all equipment and systems are operating at peak capacity. The steam turbine operation continues to improve as it operates sustainably, and it is expected that the monthly energy production and savings will increase as the equipment reaches 100% capacity. An issue with the turbine in the month of June caused operation to stop while identification of the problem and repairs occurred. The issue was not resolved until the end of July which resulted in 0 energy production and $0 energy cost savings for the month of July 2019. The Nation may fall slightly short of the original projected goals of producing 6,773,340 kWh and saving over $600,000 in one year. However, every effort is being made to improve operation and increase capacity to reach those goals in the very near future.

Project Challenges

During initial stages of the project, the Project Team discovered that under the Nation's Interconnection Agreement with National Grid, the public utility that delivers electricity to the TSRC complex, the Nation was required to provide details about any proposed modifications to the CHP plant and allow National Grid to conduct a transmission study in order to obtain National Grid's approval of the project. This study came at additional cost to the Nation. The Nation completed and submitted the required forms quickly, but it took nearly six months for National Grid to complete its study and provide a response. In the National Grid study, it was determined that there was no significant issue with the interconnection; however, additional site equipment was needed to upgrade the existing Remote Thermal Unit (RTU). The updates were made, again at additional cost to the Nation, and the project with these updates was approved.

The Project Team made a change to the proposed approach and chose to consolidate the planned electrical, mechanical, structural, plumbing, and instrumentation and controls contracts into one multi-trade general construction (GC) contract award. The scopes of work were closely inter-related and required extensive and efficient coordination of the planning, scheduling, and execution of project and operating activities in a safe manner. Including all work to be completed in one bid solicitation and under a single GC contract was expected to facilitate communication, expedite decision making, limit scheduling delays, and reduce the risk of disputes among contractors. After making the decision, and receiving DOE approval, to solicit combined bids for the mechanical, electrical, and plumbing (MEP) work for the project, the received bids were approximately 50% over the estimated costs. New bids were provided and a contractor was chosen, but this also caused a project delay.

Another, smaller delay impacted the equipment deliveries from Dresser Rand (STG) and Maarky (SSC). Certification and top entry design changes of the generator for the STG and SSC equipment were required and had to be completed by the manufacturers.

Commissioning and testing was delayed as well after a scheduling conflict arose with the STG vendor. Once a date was set, the project team was unable to successfully start up the new steam turbine, which caused a several week delay while the problem was identified and fixed.

In January 2019, the Nation intended to fully deploy the new CHP system. Various operational inconsistencies caused several start-ups and shut downs in the first three months while the system was being fine-tuned and optimized; however, all issues were addressed and the CHP system was running reliably by April 2019. In June 2019, a defective part caused the turbine to shut down. Replacement parts were delivered in July 2019 and repairs were made by the vendor under the existing warranty. The CHP system was up and running, and has continued to run, since July 29, 2019. Due to the system shut down, the energy and cost savings for June and July were lower than anticipated.

Project Management

Ray Halbritter, Nation Representative and Chief Executive Officer, provided direction and guidance throughout the implementation of this project.

Peter Carmen, Chief Operating Officer, supervised the key project personnel and received regular project progress reports.

Michael Vaccaro, Director of Engineering for Turning Stone Resort Casino, was the Project Manager for this project until his retirement in July 2019. The position was transitioned to Brad Miller, current Director of Facilities for TSRC, who has brought a fresh perspective to the project. In this position, both were responsible for project oversight (including design, supply, installation, testing, and commissioning) and served as the Nation's liaison to consultants, suppliers, contractors, and the DOE. The Project Manager regularly reported project progress to the Turning Stone Senior Vice President (VP) of Hospitality and the Nation's Chief Operating Officer (COO), presenting issues that required leadership resolution and direction including the Go/No-Go decision.

William Hollenbeck, Senior Facilities Specialist, served as the Project Coordinator and acted as assistant to the Project Manager, providing day-to-day oversight of contractor performance. The Heating, Ventilation, and Air Conditioning (HVAC) Specialist provided expertise in the installation of the proposed system. The Project Coordinator and HVAC Specialist reported directly to the Project Manager.

Timothy Lillis, Financial Support Manager/Manager of Financial Analysis, calculates and verifies the energy cost savings and reduction in use of fossil fuels and energy from the grid. Mr. Lillis reported all project-related analyses to the VP of Hospitality and the Nation's COO. The Financial Support Manager/Manager of Financial Analysis is the Project Evaluator. He conducts the financial and energy analysis, verification, and reports to the Turning Stone Senior VP of Hospitality and the Nation's COO.

The Grants Administrator coordinates with and assists the Project Manager and Project Evaluator to prepare, complete, and deliver all relevant reports identified on the "Federal Assistance Reporting Checklist" including quarterly progress reports and this comprehensive final report to the DOE. Other departments provided support and assistance to the project as needed including the Nation's Legal Department, Finance Department, Supply Chain Department, IT Department, and Human Resources Department.

CHA Consulting, Inc. (CHA) was the chosen engineering and construction management firm and supplied all engineering services for the project. Joe Thomson, VP and Senior Project Manager at CHA served as the primary contact for this project and worked closely with the Project Manager to oversee the successful completion of all project tasks.

J. W. Danforth, Contractor, completed the Mechanical/Structural and Electrical work necessary to facilitate the preparation, assembly, and installation of the project equipment.

Conclusions and Recommendations

The Oneida Indian Nation was able to overcome the project challenges to achieve the goals set for this project. The existing CUP is now more efficient and environmentally sound and is performing at a very high rate – as much as 99% in November 2019. The related cost saving is significant and will continue to increase as the system continues its high performance. Those cost savings allow the Nation to support the programs and services provided to Nation Members.

This project is only beginning to demonstrate the ultimate impact it will have on the stated objectives:

1. Leverage the existing CUP system located at the TSRC campus to generate significant energy from a clean energy source, reduce dependence on fossil fuels, and recognize significant cost savings.

   The Nation upgraded the existing CUP system to make significant improvements in cost and environmental impact. Although the purchase of a STG and an SSC were necessary, those costs were much less than an entirely new system and the return on the investment will be realized within a few years.

2. Utilize 100% of the thermal energy produced by the current 5.2 MW Solar Gas Turbine with HRSG currently located at the CUP for additional energy usage and production.

   The Nation took what was a byproduct, waste steam, and turned it into electricity that helps to meet the Nation's energy and environmental stewardship goals. Seasonal variations may be experienced, but it is expected that this upgraded system will operate at close to 100% efficiency for most of the year.

3. Reduce peak electrical usage by the facilities on the TSRC campus and achieve additional energy cost reduction.

   The additional electricity generated through this project addresses the issues of peak electrical usage by the TSRC campus facilities and lowers the related energy costs. This is an additional benefit of the project.

This project also achieved its proposed non-quantifiable outcomes of the project. The Nation demonstrated its commitment to responsible stewardship of the available resources for the benefits of Nation Members, now and the seventh generation to come, by generating electricity using a clean fuel source, natural gas, which is obtained at a reduced price, and reduced stress and demand on the public utility grid during peak usage times. Furthering the guidance provided in its Environmental Protection Ordinance, the Nation has used this project to enhance its internal environmental management system and improve the environment for all those who live, work on, or visit Nation lands or patronize Nation facilities.

Lessons Learned

The local utility provider, National Grid, advised the Nation that a transmission study was required to allow the project to proceed as planned. A month later, National Grid notified the Nation that the transmission department also had to analyze the study. The transmission study took nearly five months and the results indicated no significant issues with the interconnection between the Nation's CHP and National Grid; however, additional SCADA (Supervisory Control and Data Acquisition) equipment was required to upgrade the existing Remote Terminal Unit. Altogether, this process took more than six months, causing a substantial delay to the project and an additional $160,000 to the project costs.

- Earlier inclusion of National Grid in the project planning process may have made this process simpler and prevented the long project delay.

During the commission and testing of the equipment after installation, several problems arose and required troubleshooting. Investigation by project and vendor staff led to successful adjustments, but this process created a delay in sustained functioning of the equipment for two to three months. The verification process could not begin until the new system was fully operational.

- This type of problem in not unexpected in a project such as this one that involves the delivery and installation of extraordinarily large and complex equipment. A longer estimated implementation schedule may have allowed for a full year's project data verification.

A defective part ceased operations in June 2019 and continued through July 2019 until a replacement part was obtained and installed. There was no data to collect during the downtime, so the planned full year of verification was interrupted.

- No one could have foreseen or prevented this incident, but due to the diligence and commitment of the Nation staff, the downtime was minimal and the system has been running without problems since the problem was resolved.

Milestone Summary Table						
Recipient Name:		Oneida Indian Nation				
Project Title:		Community Scale Clean Energy Deployment Combined Heat and Power (CHP) Project				
Task #	Task or Subtask (if applicable) Title	Milestone Number (Go/No-Go Decision Point Number)	Milestone Description *(Go/No-Go Decision Criteria)*	Milestone Verification Process *(What, How, Who, Where)*	Anticipated Date (Months from Start of the Project)	Actual Month of Completion from Start of Project
1	Project Start-Up	1.2	Approval to Proceed	Written approval by Nation leadership & DOE to proceed with project	1	1
1	Project Start-Up	1.3	Kick-Off meeting	Minutes of meeting with engineering consultant	1	4
2	Equipment	2.1	Equipment specifications	Project Manager accepts specifications prepared by engineering consultant	2	5-7
2	Equipment	2.3	Select equipment	Project Manager decision	4	5-7
2	Equipment	2.4	Secure purchase approval	Nation purchase request	5	14-16
2	Equipment	2.5	Order equipment	Nation purchase order	6	14-19
2	Equipment	2.6	Equipment delivered	Equipment and delivery documents	16-18	19
3	Contractors	3.1	Issue engineering contract	Executed sole-source contract for engineering services	1	23-25
3	Contractors	3.3	Solicit bids for Mechanical/Structural and Electrical contracts	Request for bids	7-8	23-25
3	Contractors	3.4	Bid selection	Review and approval document	9	23-25
3	Contractors	3.5	Award contracts	Executed contracts	10	28
4	Technical Specs	4.0	Complete technical specifications and drawings	Acceptance of engineering documents by Project Manager	1-7	30

Milestone Summary Table						
Recipient Name:		Oneida Indian Nation				
Project Title:		Community Scale Clean Energy Deployment Combined Heat and Power (CHP) Project				
Task #	Task or Subtask (if applicable) Title	Milestone Number (Go/No-Go Decision Point Number)	Milestone Description *(Go/No-Go Decision Criteria)*	Milestone Verification Process *(What, How, Who, Where)*	Anticipated Date (Months from Start of the Project)	Actual Month of Completion from Start of Project
5	Pre-Installation	5.1	Remove chillers from CUP	Relocated by Mechanical/Structural contractor	6	29-31
5	Pre-Installation	5.4	Pre-installation Mechanical/Structural SOW completed	Sign-off by contractor and Project Manager	10-16	29-31
5	Pre-Installation	5.5	Pre-installation Electrical SOW completed	Sign-off by contractor and Project Manager	18	33
6	Installation	6.1	Set and assemble STG and SSC units	Sign-off by Project Manager	16-18	32-34
6	Installation	6.4	Tie STG and SSC into mechanical systems	Sign-off by Project Manager	18-20	32-34
6	Installation	6.5	Tie STG and SSC into electrical systems	Sign-off by Project Manager	18-20	38
7	Commissioning	7.2	Define commissioning criteria	Equipment Testing & Commissioning checklist and performance criteria	19	35-40
7	Commissioning	7.6	Performance testing	Testing plan and documentation of results	21	40
7	Commissioning	7.9	Commissioning	Commissioning document	22	41-43
8	Deployment	8.2	Operational performance testing	Report of short-term operational performance testing results	22	41-43

Milestone Summary Table						
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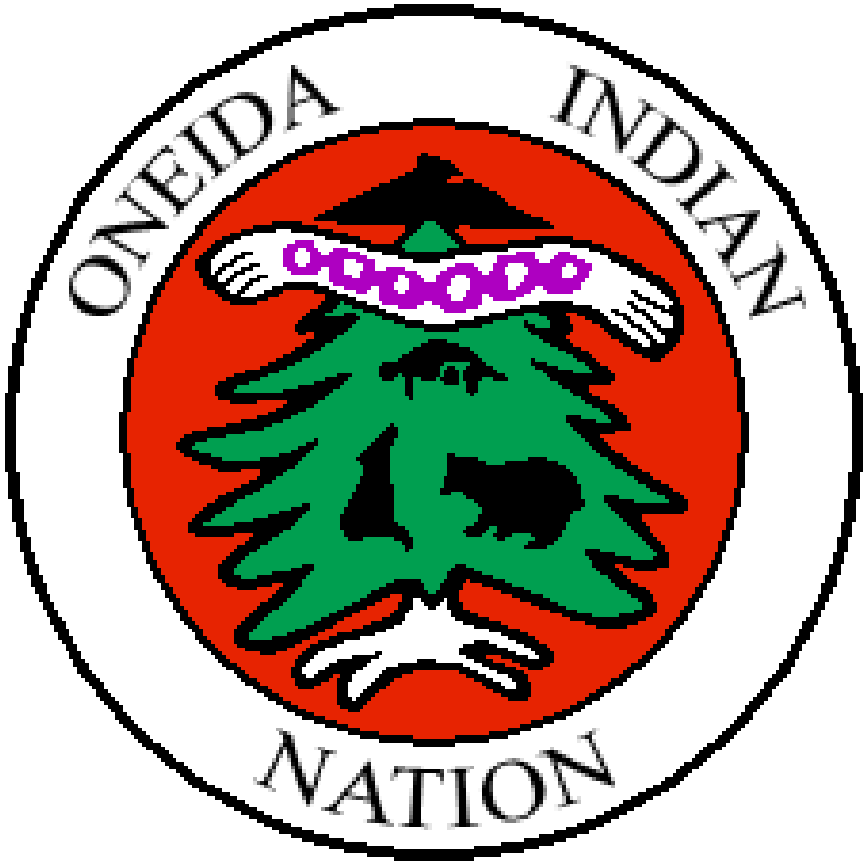
8	Deployment	8.4	Deployment decision	Deployment document	23	41-43
8	Deployment	8.5	Continuous operation	Operation log	24-36	41-43
8	Deployment	8.6	Verification of energy usage, production and cost	Monthly reports	24-36	44-46
9	Reporting	9.6	Final Report	Submission of final report to Nation Leadership	36	52

Oneida Indian Nation



U.S. Department of Energy

Community Scale Clean Energy Deployment Combined Heat and Power Project

Who We Are

- Federally recognized, self-governing sovereign Indian tribe with approximately 1,000 enrolled members.
- The Oneida Indian Nation is Governed by Council and is comprised of up to three members from each of the Nation's clans (Wolf, Turtle, and Bear). Council selects one or more Nation Representatives to represent the Nation in governmental and business affairs. Ray Halbritter has served as Nation Representative since 1975 and is currently the sole Nation Representative.

The Nation's three long-range goals to guide the social and economic development of its community;

1. Help the Nation's members achieve their highest potential in education, physical and mental health, and economic development;

2. Implement the legal and administrative structure necessary for the stability and protection of Nation sovereignty, treaty rights, and government-to-government relationships; and

3. Acquire, develop, and secure resources to achieve economic and social empowerment and self-sufficiency.

Who We Are (Cont.)

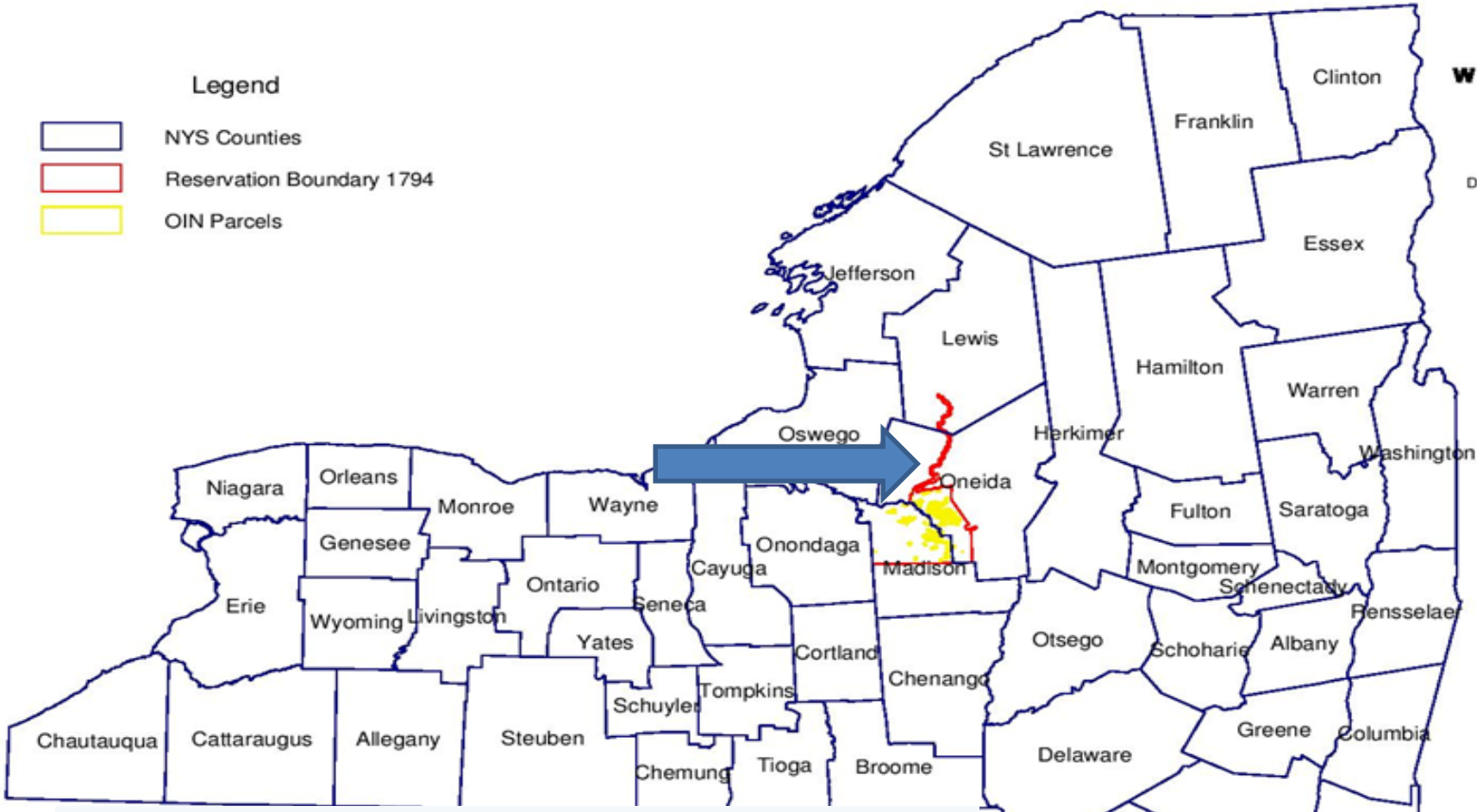
- Approximately 6,475 acres in Madison County and Oneida County, which are the location of Nation government, health, education, and cultural facilities and activities;

- Member housing; hunting lands; and numerous non-gaming Nation enterprises, including 13 gas stations and convenience stores, three marinas, and agricultural operations;

- Approximately 7,467 acres in Madison County and Oneida County containing undeveloped, active and inactive agricultural lands; and

- The Nation's **3,200,000** square foot Turning Stone Resort campus.

Where We Are



Approximately 300,000–acre reservation that was created and recognized by the 1794 Treaty of Canandaigua.

The Nation reacquired approximately 17,949 non-contiguous acres of its reservation land located within a 350.6 square mile area of Oneida (137.5 sq. miles) and Madison (213.1 sq. miles) counties located in central New York.

ONEIDA INDIAN NATION GOVERNMENT PROGRAMS AND SERVICES

Oneida Indian Nation Government Programs and Services Include:

- Health Services- Providing top medical, dental and behavioral health care for all generations is the number one priority for Oneida Indian Nation Health Services, which serves nearly 3,500 clients.
- Elders Program- Oneida Elders and American Indian clients participate in educational, nutritional and social programming at the Ray Elm Children and Elders Center
- Recreation & Youth Development
- Education, including early education programs and language learning
- Housing programs
- Oneida Indian Nation court system
- Oneida Indian Nation police
- Oneida Indian Nation Codes/Environmental management

ONEIDA INDIAN NATION ENTERPRISES

Turning Stone Resort Casino- Award Winning

- **700 Hotel Rooms –** Over 4.5 million guests per year
- **5 Golf Courses-** Many PGA Championship Tournaments
- **15 Restaurants-** 3 – AAA 4 Diamond Awards
- **2 Spas**
- **Golf Dome and Sports Complex**
- **World Class Entertainment and Venues**
- **RV Park**

Yellow Brick Road Casino – Chittenango NY

Point Place Casino – Bridgeport NY

12 gas stations and convenience stores

3 full service marinas

3,000-acre hunting game preserve

Salmon Acres Fishing Lodge

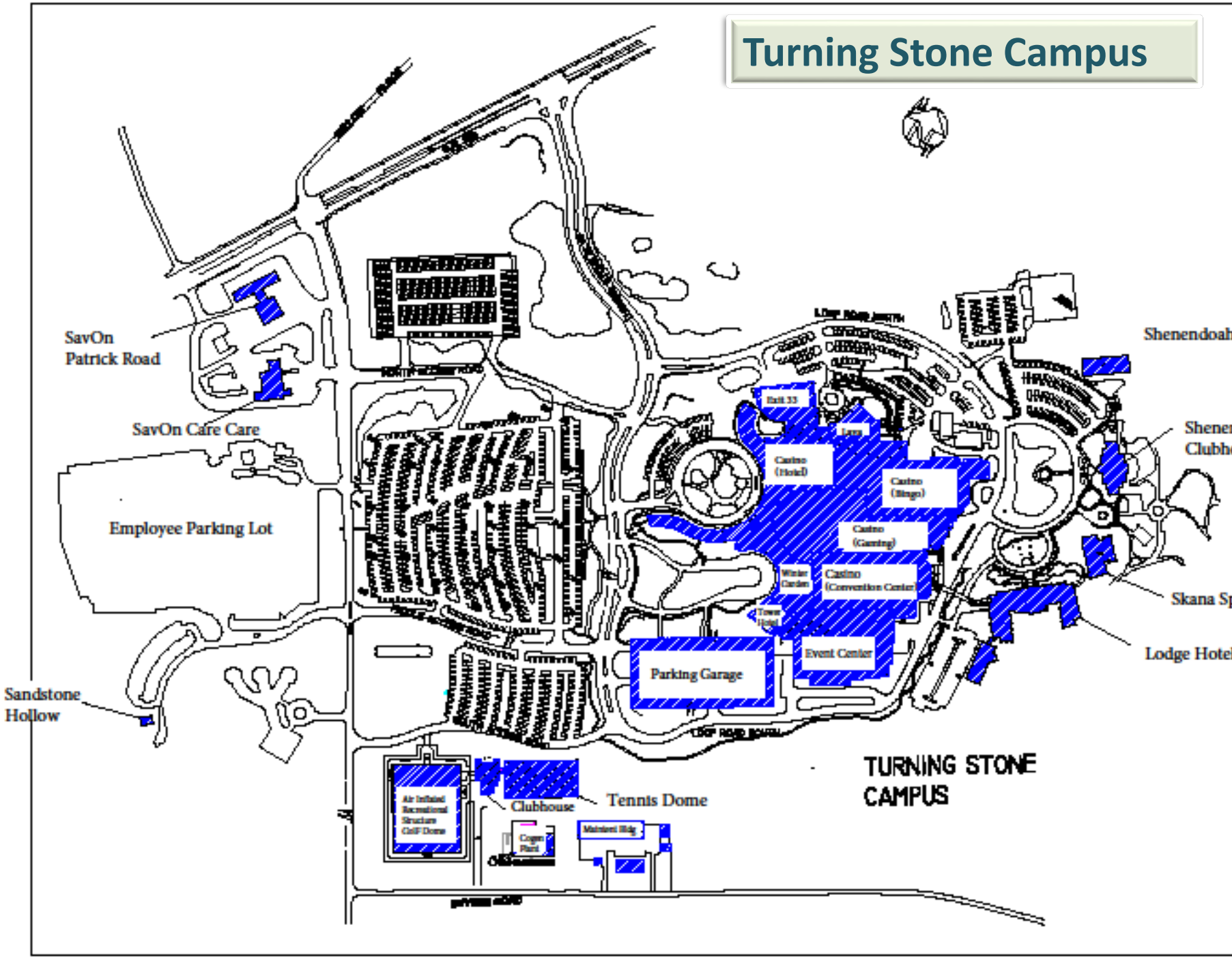
Largest employer in Oneida and Madison counties and the fourth-largest employer in the 16 counties of Central New York. Overall, the Nation employs approximately 4,000 Native and non-Native people across all of its governmental programs and commercial enterprises.

The Oneida Indian Nation's Turning Stone Resort & Casino

(Project Location)

Turning Stone offers world class gaming, lodging, gaming, entertainment, golf, etc.

Turning Stone Campus



Turning Stone is the area's largest consumer of energy

- It has its own electrical sub-station - bring in power from the public utility 115,000 volts
- Voltage decreased from 115,000 volts to 13,200 volts where it is distributed around the campus
- The voltage is then reduced again from 13,200 volts to 480 volts before it enters the building
- Multiple stand-by generators with UPS systems and a central utility plant that can supply 6000 tons of chilled water
- Pre-project Natural gas fired, 5 mega watt CHP (combined heat & power) turbine that can also generate 28,000 lbs/hr of 350 deg F, 125 PSI steam which is used for heat and domestic hot water.
- Prior to this project Turning Stone was not able to use all of the steam being generated from the CHP turbine, which was inefficient.

Long Term Energy Goals

- ***Goal*: One of the primary sources of the Turning Stone Resort campus' energy comes from the CUP (Central Utility Plant), which runs on natural gas. The goal of the project is to upgrade the existing CUP to make it more efficient and environmentally sound. This will enable Turning Stone Resort to function in a more fiscally efficient manner by reducing energy expenses.**

- **The specific objectives of the Nation for this project:**

  - Leverage the existing CUP system to generate significant energy from a clean energy source, reduce dependence on fossil fuels and recognize significant cost savings;

  - Utilize 100% of the thermal energy produced by the current 5.2 MW Solar Gas Turbine with a Heat Recovery Steam Generator (HRSG) for additional energy usage and production; and

  - Reduce peak electrical usage by the facilities on the Turning Stone Resort campus and achieve additional energy cost reduction.

Long Term Energy Goals

- This project was on the back burner for the Nation for many years due to competing priorities and cost considerations.

- The $1 MM US Department of Energy Grant awarded in 2015 pushed this project across the line to make it a priority for the Nation.

Oneida Indian Nation
Community Scale Clean Energy Deployment
Combined Heat and Power (CHP) Project

Project Goal**: **Upgrade and improve the energy efficiency of the Nation's Central Utility Plant (CUP) that supplies energy to the Nation's Turning Stone Resort campus by increasing the Nation's self-sustaining use of clean energy (natural gas) and reducing dependency on fossil fuels.

Project Summary: Add a Steam Condensing Turbine Generator (SCTG) to the CUP;

- Direct the 125 psi steam, currently emitted as waste from the CUP to the SCTG where it will pass over the turbine's blades, causing rotation of the connected generator producing electricity; and then
- Feed resulting electricity from the turbines into Turning Stone's electrical distribution system, reducing the amount of electricity imported from the local utility company.

Project Impact: An increase in overall operation efficiencies from 35% to 60% via an estimated additional electrical production of 1,390KW from waste steam, which assuming an 85% uptime, equates to over 10.34 Million kWh/year, with no greenhouse gas emissions and considerable energy cost savings.

Result*: Additional* in-house production of electricity utilizing waste steam as an energy source, thereby reducing dependence on fossil fuels and external energy sources to power the Nation's primary business center for the benefit of its tribal community.

Who We Are (Cont.)

- Approximately 6,475 acres in Madison County and Oneida County, which are the location of Nation government, health, education, and cultural facilities and activities;

- Member housing; hunting lands; and numerous non-gaming Nation enterprises, including 13 gas stations and convenience stores, three marinas, and agricultural operations;

- Approximately 7,467 acres in Madison County and Oneida County containing undeveloped, active and inactive agricultural lands; and

- The Nation's **3,200,000** square foot Turning Stone Resort campus.

Feasibility

Overcoming Barriers: The Nation faced and overcame three feasibility obstacles in the completion of this project:

- ***Cost*** – In the event the feasibility and engineering study resulted in a cost that was significantly higher than anticipated for this project, Nation leadership would need to review, discuss, and determine whether the increased expense is prohibitive given the many competing priorities of the Nation.

- ***Timing*** – If the feasibility study came back with a timeframe that was not within the parameters required by this grant for the project, the Nation would need to consider whether it was worth pursuing in the absence of funding.

- ***Modifications*** – If the scope of any infrastructure modifications recommended by the Nation's engineering partner to accommodate the turbine system would significantly increase the cost of the project or the timeframe for completion, the same considerations described above would apply.

Status of Project

The project currently fully operational. As of October 2019, the project has produced approximately 2.2 Million kWh and continues to increase efficiency and capacity.

Major Project Milestones:

- September 1, 2015- Project Kickoff & Go/No-Go Decision
- November 2015- Nation, with assistance from a consulting firm, complete specifications for the main components- the Steam Turbine Generator (STG) and Surface Steam Condenser (SSC)
- December 2015- Nation issues STG and SSC RFQ
- March 2016- Nation selects the SSG and SSC vendors
- September 2016- National Grid Completes Interconnection Studies
- March 2017- Nation purchases the STG and SSC (delivery occurs in early 2018)
- March 2018- CHA and Nation complete MEP specifications; MEP RFP released
- June 2018- SSG and SSC installed at project site
- July 2018- Nation selects and engages the MEP contractor
- December 2018- MEP equipment installation complete
- January 2019- Testing and commissioning Complete; Verification begins

Barriers and Lessons Learned

Barrier: **Interconnectivity with National Grid - Utility Provider Delays**

- April 20, 2016 National Grid (the utility) advised that this project needed to follow the FERC SGIP (Small Generator Interconnection Procedures) process which required the utility to perform a transmission study.
- On May 11, 2016 National Grid advised us that since the project involves the 115 kV transmission line, the study also needed to be looked at by the transmission dept. for a total cost of $35,000 to the Nation.
- September 26, 2016- Transmission study was completed by National Grid. At this point it was determined that there were no significant issues with the interconnection between the Nation's CHP plant and National Grid, but additional SCADA (Supervisory Control and Data Acquisition) equipment was to upgrade to the existing RTU (Remote Terminal Unit), at a cost of $125,000.00.
- Trouble shooting during commission and testing resulted in delays of between 2-3 months before the system was fully functioning for verification purposes.
- Defective part caused system to be down for most of June and July 2019.

This resulted in delay to the project schedule. Project staff consulted with Nation leadership and with DOE throughout the project to navigate these delays and obtain time extensions as necessary for the project.

Key Project Participants

U.S. Department of Energy

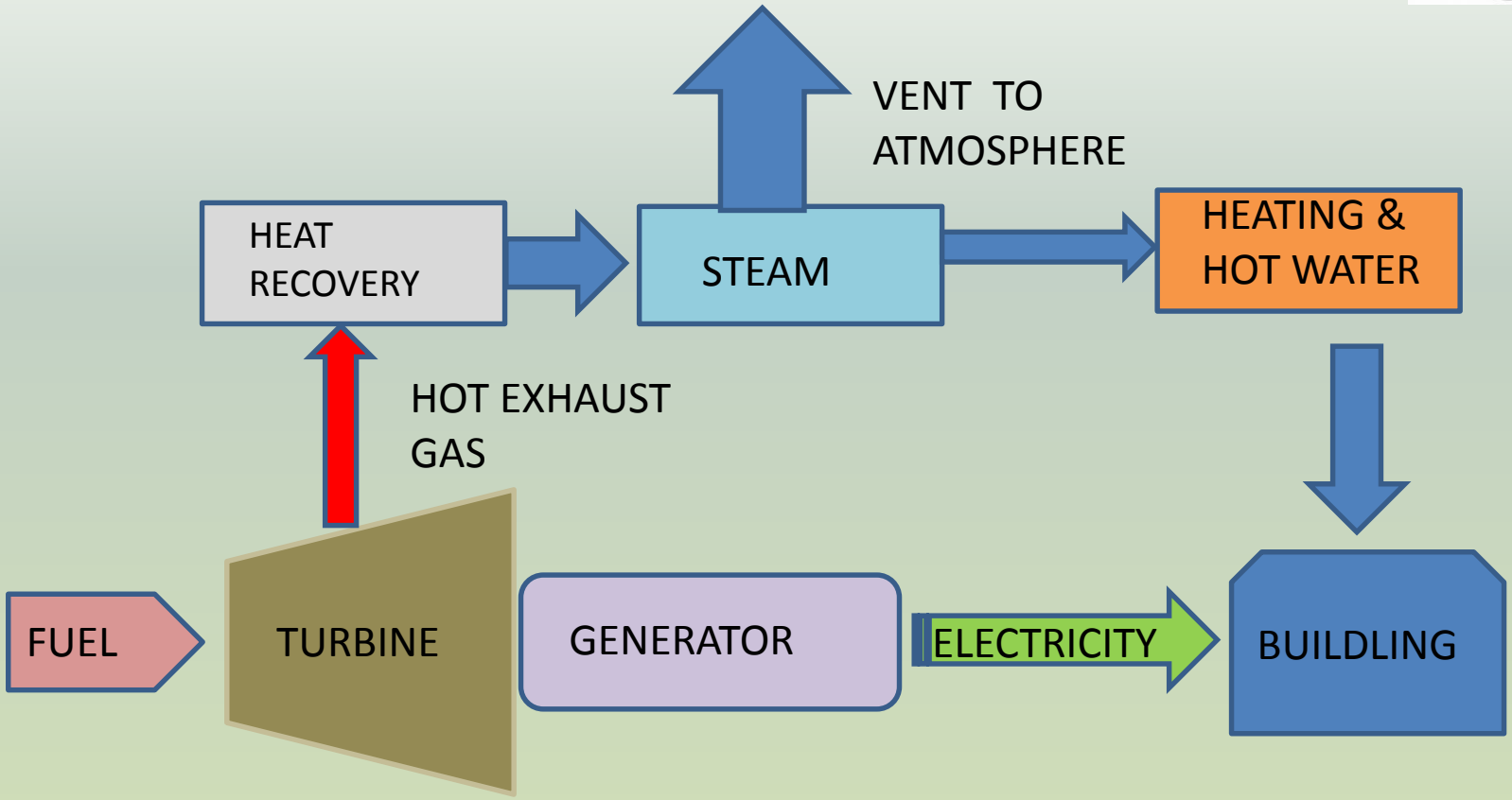
Oneida Indian Nation

- Nation Representative & Chief Executive Officer – Ray Halbritter
- Chief Operating Officer – Peter D. Carmen
- P*roject Manager* – Michael Vaccaro P.E. , Director of Engineering (Retired);
- *Director of Facilities - Brad Miller*
- *Project Coordinator* – William Hollenbeck, Senior Facilities Specialist;
- *Project Analyst/ Evaluator* – Timothy Lillis, Financial Support Manager/Manager of Financial Analysis;

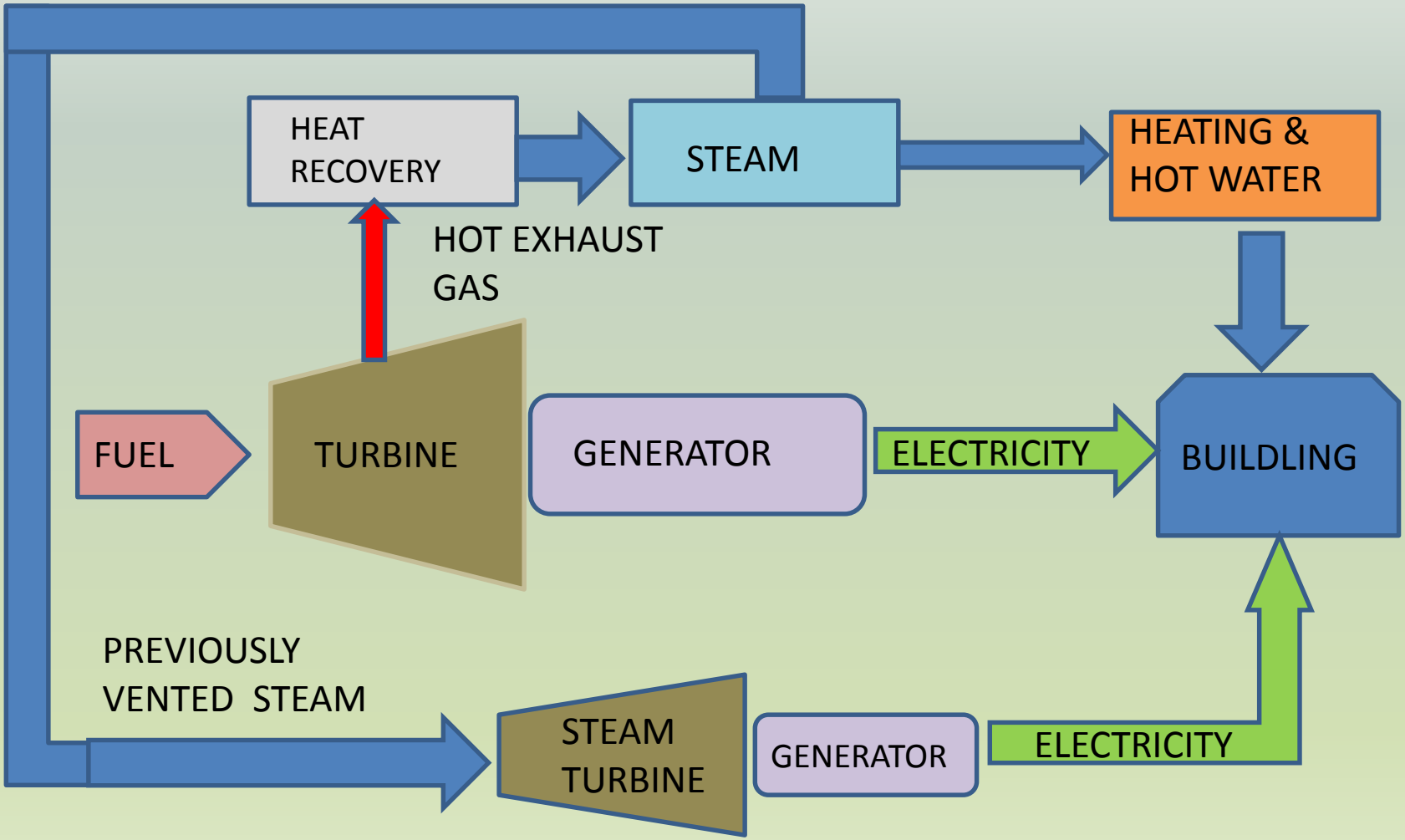
Primary Contractor/Consultant

- CHA Consulting, Inc.
- JW Danforth - Contractor

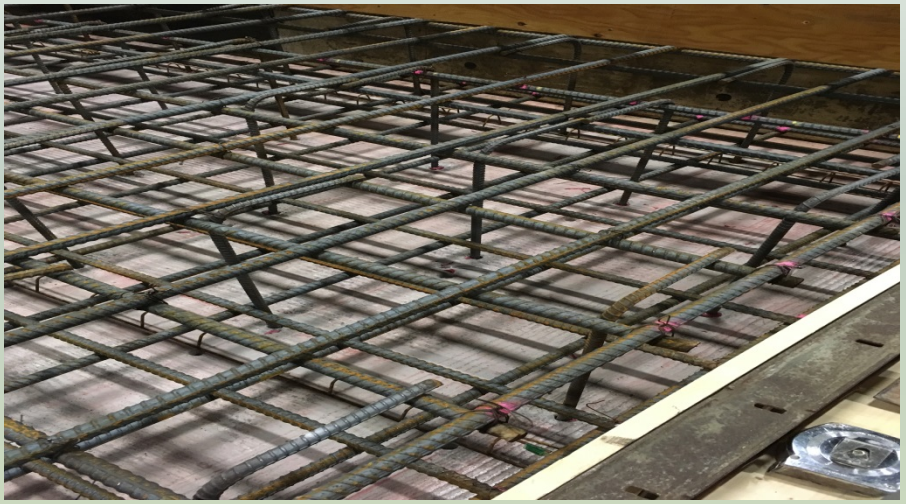
PRE-PROJECT SYSTEM



MODIFIED CHP SYSTEM

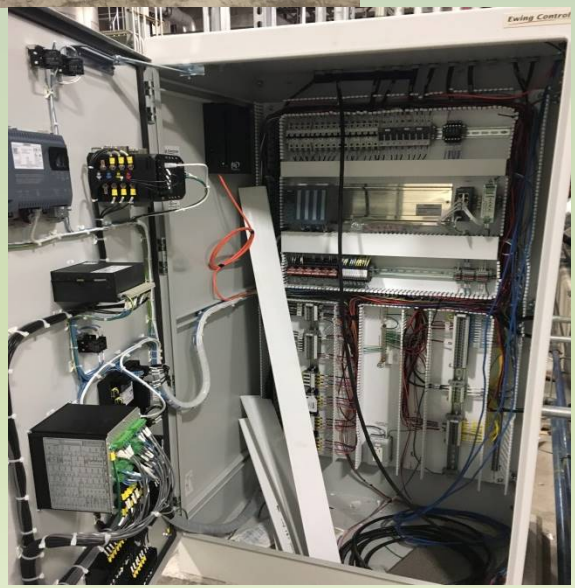


The Foundation



Setting Equipment

Piping and Electrical Connections

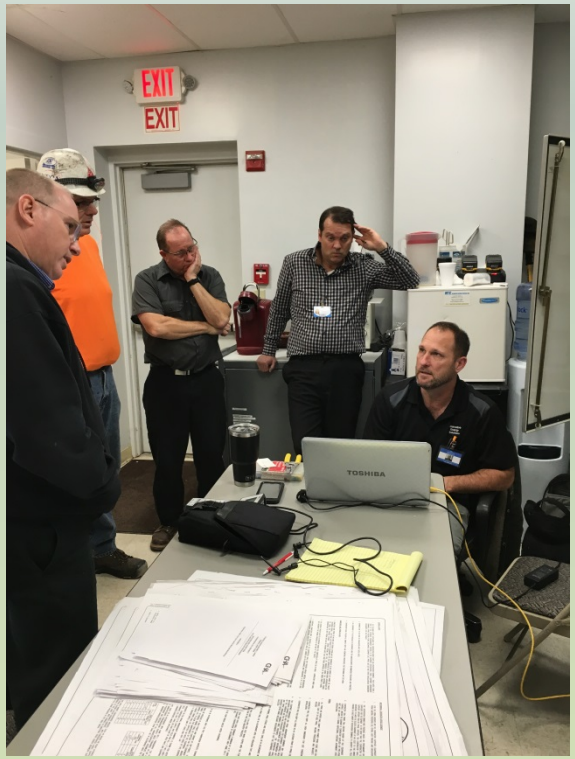


Commissioning

Coordination meetings twice a day that involved status reports from:

- Electrical Contractor
- Mechanical Contractor
- Millwrights
- Steam Turbine Field Service Rep.
- Electrical Generator Field Service Rep.
- Controls Field Service Rep.
- Systems Integrator
- Utility Plant Operator(s)

Commissioning



Current Outcomes and Results

- ***Outcomes:***
  - The installation of the Steam Turbine Generator system has resulted in an increase in overall operation efficiencies, reduced dependency on grid supplied electricity, and reduced utility bills.
  - Another, non-quantifiable—but equally important—outcome of the proposed project is that it demonstrates the Nation's commitment to stewardship of the Nation's resources for the benefit of its members, now and to the seventh generation, by becoming more self-sufficient and less reliant on energy from the public grid.
    - The Nation is generating electricity using a wasted thermal energy; and
    - Electric demand by Turning Stone has been, resulting in less stress and demand on the grid.