SENECA NATION FINAL REPORT
Installation of a 1.5MW WIND TURBINE

DOE GRANT # DE-EE0006475

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I. Executive Summary

The Seneca Nation has long understood that energy resources have tremendous value. Recently, however, the Nation has come to appreciate the significance of the development and management of their own energy resources. Beginning with strategic energy planning that has resulted in a sound energy organization with a long-term Strategic Energy Plan, which is allowing the Seneca Nation to pursue a deliberate path to energy development and self-sufficiency.

The Seneca Nation has watched their resources be exploited for hundreds of years with little economic benefit, and in turn have inherited a legacy of environmental and safety hazards. Seneca Energy is working to reverse this trend through renewable energy projects such as the Cattaraugus wind turbine. The single turbine will reduce CO_2 output by 86,000,000 lbs./yr., equivalent to removing 147 cars off the road each year.

The development of distributed generation resources of energy on Nation lands can not only ensure a source of reliable and competitively priced electricity, but could also provide economic development opportunities and sustain the Nation's existence as a viable, functioning community for future generations. In exercising its sovereignty, the Nation wishes to develop its renewable resources as a means to permanent financial stability as well as to further their political and cultural viability both regionally and nationally.

The Seneca Nation, located on three primary territories in Western New York, has embarked on a

long-range energy planning mission to establish a strategic plan for energy self-sufficiency. The Strategic Energy Plan employs both renewable and non-renewable energy for the development of a culturally appropriate, self-sufficient economy and serves as a roadmap to accomplish this vision. With the long term goal of energy sovereignty, the Nation will endeavor to develop its resources to 1) develop economic opportunities and job creation within the territories, and; 2) provide an alternative, competitive source of energy for its governmental and business operations, and; 3) create a balanced portfolio of renewable and non-renewable sources of energy to achieve a stable and economically sound generation plan, and; 4) provide its members with programs for increased energy efficiency as well as cost savings for electric supply.

II. Description of Activities

The Seneca Nation of Indians is currently in Phase III of a four-phase planning process in realizing its energy vision. In July 2003, the Seneca Nation commenced a multi-phased, strategic energy planning project. Phase I was completed in March 2004, funded primarily with Nation funds, with some funding assistance from DOE and BIA. The objective of Phase I was to define the overall goals of the Seneca Nation's long-range energy vision as it relates to energy self-sufficiency, future needs and demand for services, and energy planning and development. Meetings and public gatherings were held to provide a forum for dialogue between leaders, community members and other stakeholders, to collaborate on energy options and ideas for development. The results were published in the "Long Range Energy Plan, Phase One" Report.

Phase II included a preliminary energy use and rate analysis, short term (3 years) use projections, a gas well inventory and condition report with recommendations for remediation, preliminary wind assessment research and preparation for a full wind study, and an overview of the natural gas resources and market dynamics. Some organizational development was initiated, and a high level review of the Right of Way, natural gas settlement and various other legal documents were also initiated. Recommendations for utility formation and more in-depth resource assessment were among the report conclusions.

In 2013 under Phase III the Nation created Seneca Energy, LLC thereby chartering a Seneca Nation utility organization capable of providing energy generation and distribution both on and off territory. The Utility now encompasses both electric and gas generation/production and delivery. The distributed generation initiatives are seen as an important component of the Seneca Nation's Strategic Energy Vision.

III. Project Overview

This project was initiated with an in-depth wind assessment on the Cattaraugus and Allegany Territories. The assessment confirmed that there is a vast wind resource on the Cattaraugus Territory off the coast of Lake Erie. The project was a culmination of years of planning and research to identify and select the most advantageous project to begin building the cornerstone of Seneca Energy's strategic vision.

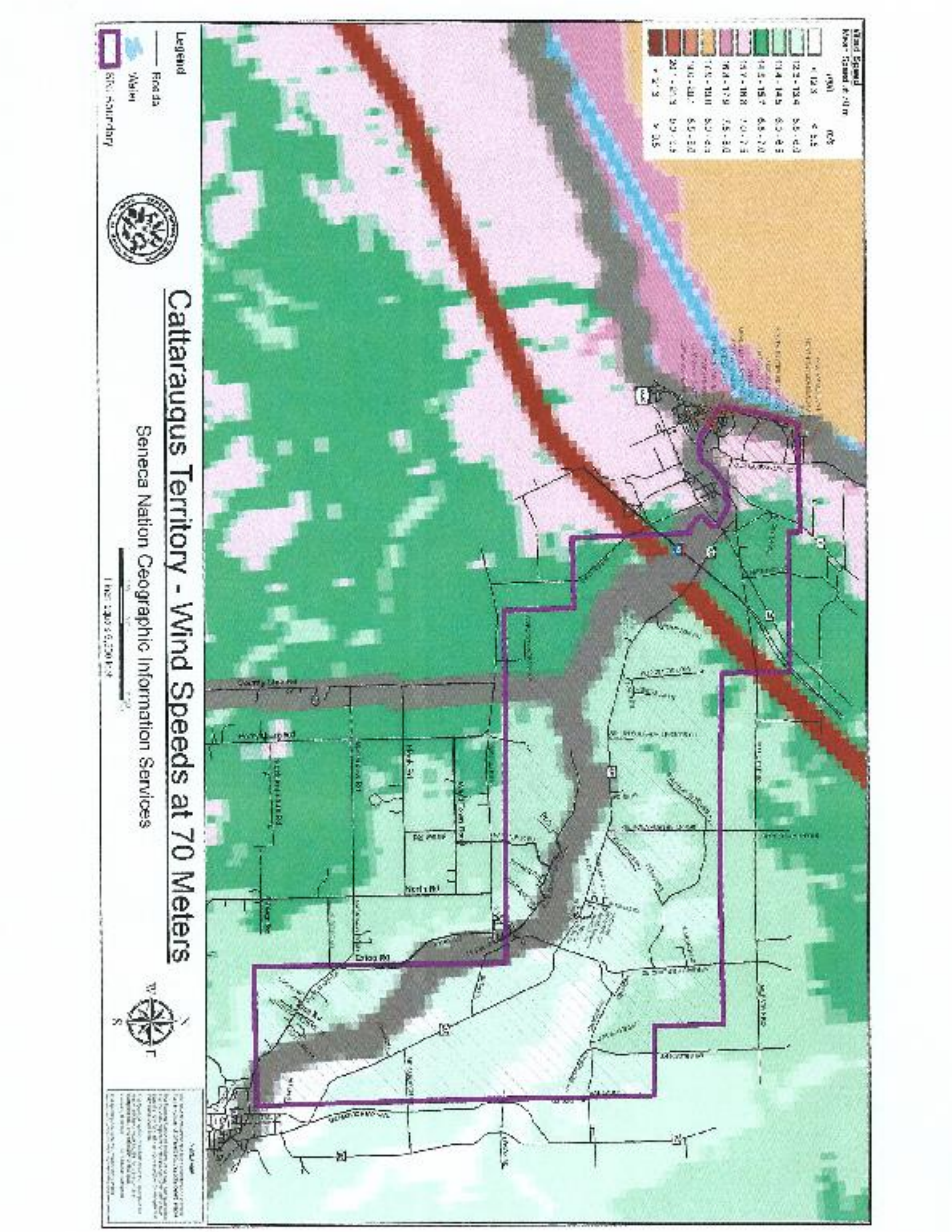
In February 2014, Seneca Energy and the Seneca Nation officially kicked off the Cattaraugus wind turbine project. The project began with a nine month NEPA study, which resulted in a Finding of No Significant Impact on 10/5/2015. The Seneca Construction Management Company was responsible for the oversight of the civil and foundation construction which commenced shortly after the FONSI was finalized.

With the winter coming, there was a delay in construction after the struggle to locate a single-turbine available for purchase. Seneca Energy failed to make ample progress in negotiations for a Turbine Sales Agreement (TSA) with both GE and Vestas. These are the top two turbine manufacturers in the market and neither was interested in working with the Seneca Nation on this project for various reasons. The difficulty in locating a turbine, was primarily due to the size of the project. These manufacturers are interested in selling dozens of turbines versus the one off purchase that the Nation was attempting to make. Sovereign immunity posed another challenge in contracting with these larger international companies. After months of little-to-no progress, Seneca Energy and Utility Reduction Specialists identified Vensys, a German turbine manufacturer with a solid track record and innovative technology.

The TSA and Long-Term Service Agreement (LTSA) were negotiated after numerous conversations and negotiations between the Seneca Nation, Sustainable Energy Developments and Vensys. In the end, a strong partnership was born. The strength of the partnership has been built through common values and beliefs between the contracting organizations.

The CESIR unveiled an enormous cost to interconnect the turbine to National Grid's (investor owned utility distribution system. National Grid quoted a $750,000 price to interconnect the 1.5MW turbine. There were also ~$250,000 of additional costs that were going to be realized by the Nation in order to interconnect the project. Subsequently, the Nation pushed back on the initial quote and eventually convinced National Grid to reduce the interconnection cost by ~$250,000 as well as reducing the overall time to commission the turbine.

The next challenge was the delivery of the turbine. All components manufactured in Germany were delivered to the Cattaraugus Territory on-time and in excellent condition. The tower, which was manufactured in Quebec, Canada was four months late due to the weight of the base component and trouble finding an acceptable delivery route through the Providence. We waited through the winter and thankfully the base arrived just in time to construct the turbine and stay on schedule.



IV. Project Team

Anthony Giacobbe – Director of Power & Gas, Seneca Nation/General Manager, Seneca Energy
Tony Memmo – Project Manager, Seneca Energy
Lana Kennedy – Project Manager, Seneca Energy
Jim Yockey – CEO, URS
Greg Faucher – Legal Counsel, Whiteman Osterman & Hanna LLP
Dave Strong – Senior Project Manager, SED
Luke Spencer – Design Engineer, SED
Mike Williams – CEO, SCMC

Theo Peters – Vensys
Greg Fasano – NWT
Daniel Yanosh, Jr. – Fisher Associates
Numerous Seneca Nation Departments and external partners

V. <u>NEPA Study</u>

The NEPA study entailed an initial and final scoping period as well as a full Environmental Assessment (EA) to determine whether or not there would be negative impacts on the environment and/or population as a whole. It was determined after many months of studies and analysis that there would be no significant impacts on any species. The Seneca Nation was provided with the below FONSI on October 5, 2015. Throughout the EA process, the Seneca Nation consulted with numerous Nation Departments, such as EPD, THPO, TERO and the Planning Dept. in addition to outside agencies such as the DOE, USFWS and FAA.

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

FINDING OF NO SIGNIFICANT IMPACT

THE SENECA NATION WIND

TURBINE PROJECT DOE/EA-2004

AGENCY: U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: DOE is proposing to authorize the expenditure of federal funding to the Seneca Nation of Indians (SNI) to design, permit, and construct up to a 2.0-megawatt wind turbine on Tribal common lands in the Cattaraugus Territory, New York (Proposed Project)[1]. In compliance with the National Environmental Policy Act (NEPA), DOE and SNI jointly prepared and completed the *Environmental Assessment for the Seneca Nation Wind Turbine Project Cattaraugus Territory Erie County, New York* (DOE/EA-2004) that identified and evaluated the potential environmental impacts of providing federal funds to SNI for this proposed project. The analysis completed in the environmental assessment (EA) supports DOE's finding that providing federal funding for the Proposed Project will not significantly affect the quality of the human and natural environment. The EA is hereby incorporated into this FONSI by reference.

SNI's proposed project involves the construction, operation and maintenance, and eventual decommissioning of a single wind turbine of up to 2.0 megawatts on 1.5 acres of SNI-owned sovereign land located northeast of Lucky Layne, within the western portion of the Cattaraugus Territory, Erie County, New York. Examples of the type of wind turbine being considered by SNI include the GE 103 1.7 megawatt and the Vensys 1.5 megawatt models. The proposed project includes the construction of a gravel access road, temporary crane pad, turbine foundation, and installation of transmission equipment and cables. Regardless of which wind turbine model is selected, it would have a maximum rotor diameter of approximately 330 feet and would connect at its hub (midpoint) to an approximately 265-foot-tall tower (maximum). The total maximum height of the wind turbine from the bottom of the tower to the blade tip at its highest point is expected to be approximately 430 feet. The current estimated project cost is $6 million. The project would reduce electrical demands on the existing electricity service provider from the existing SNI administrative buildings and be credited back to the Cattaraugus Territory residents and electricity users. The project would also equalize rates among SNI territories. Once installed, the turbine is anticipated to produce approximately 5,000 megawatt-hours of electrical power annually.

Prior to the issuance of this FONSI, DOE authorized SNI to use a percentage of the federal funding for preliminary activities, which included initial planning and design, environmental studies, and preparation of the EA. These activities are associated with the Proposed Project and do not significantly impact the environment nor represent an irreversible commitment by DOE in advance of this finding for SNI's wind energy project.

DOE places a strong emphasis on avoiding, minimizing, and mitigating potential adverse environmental impacts. SNI has committed to minimize or avoid potential environmental effects to air quality, visual resources, biological resources, cultural resources, health and safety of workers and the public, land uses, noise, socioeconomics and environmental justice, transportation, and utilities and energy through the implementation of best management practices (BMP) detailed in Section 3.4 of the EA. These commitments by SNI shall be incorporated through DOE's financial assistance agreement.

Context of Potential Impacts

DOE must evaluate the significance of an action in several different contexts, such as society as a whole (human and national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

The proposed project would be located on approximately 1.5 acres of SNI-owned sovereign land in the Cattaraugus Territory (approximately one acre of previously disturbed land will be graded). The project site lies approximately 630 feet northeast of Lucky Layne Road, is immediately east of New York State Route (NY) 5 and west of existing railroad tracks. Lake Erie is located approximately 1.5 miles west of the project site. The project site is currently undeveloped, consisting of some previously cleared land, grasses, shrub vegetation, and forested woodland. The site is adjacent to a larger parcel of land consisting of surface parking and a mix of commercial/industrial structures. These physical structures include a 135-foot-tall water tower immediately south of the project site, the Gil Lay Memorial Sports Arena, the SNI Bingo Hall and associated structures, roadway NY 5 directly west of the project site and a rail line directly east.

Based on the analysis in the EA, impacts of the Proposed Project would range from negligible to minor due to the nature of the proposed activities. The effects are limited to the local geographic area and are temporary and small-scale in nature. In addition, SNI has committed to implementing the BMPs listed in Section 3.4 of the EA to minimize or avoid potential environmental effects. The Proposed Project itself would not cause any significant or cumulative adverse effects nationally, regionally, locally, or at the statewide level.

Intensity of Potential Impacts

The determination of impact significance also considers the intensity, or severity or extent, of the impact. Intensity is evaluated against the factors listed in 40 CFR 1508.27, including:

1) Impacts that may be both beneficial and adverse:

In the EA, DOE considered and analyzed the beneficial and adverse impacts of the Proposed Project. Construction and operation of the Proposed Project would result in negligible to minor direct and indirect adverse impacts on the environment and would have slight beneficial impacts on air quality and socioeconomics in the area. The BMPs committed to by SNI would further minimize or eliminate the potential for adverse impacts to environmental resources.

The EA evaluated adverse effects of the Proposed Project separately from beneficial effects, to determine whether such adverse effects would have been significant in their own right, and no such effects were found to be significant. The Proposed Project would have potential beneficial, yet minimal or unmeasurable effects to air quality, the local economy, and to SNI's electric utility consumption. In no cases did the analysis in the EA use beneficial effects to offset the potential significance of any adverse effect. In addition, the EA did not use any long-term beneficial effects to offset the potential significance of any short-term adverse effects.

Accordingly, DOE concludes the Proposed Project will not have any significant adverse impacts and that the Proposed Project would have negligible to minor beneficial impacts to the resources evaluated in the EA.

2) The degree to which the proposed action affects public health or safety:

The EA evaluated whether the Proposed Project would have disproportionately high or adverse human health or environmental effects, and whether it would be a likely target for intentional destructive acts that could affect public safety. The EA addressed several potential impacts that the Proposed Project could have on public and worker health and safety — tower collapse and blade throw, shadow flicker and blade glint and glare, severe weather, exposure to electromagnetic fields, and hazards to roadways, railways, and airspace and aircraft. Analysis in the EA determined that the impacts to these resources would be non-existent to minimal.

SNI's committed BMPs for health and safety will further reduce the potential for adverse impacts to occur. SNI will ensure that all contractors adhere to construction- and operation-specific health and safety plans and that the wind turbine would be marked according to Federal Aviation Administration airspace safety regulations. SNI would prepare a health and safety plan to ensure that established policies and procedures are followed for a safe work environment.

Based on the findings in the EA and implementation of SNI's committed BMPs, DOE concludes that there will be no adverse effects to public and worker health or safety. The Proposed Project would not be a likely target for intentional destructive acts and it will not cause any significant, cumulative or long-term effects on health and safety.

3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

The Proposed Project is not located in any unique geographic or ecologically critical area, and there are no park lands, wet areas/wetlands, or protected rivers nearby that would be affected.

The New York State Cultural Resources Identification System (CRIS) lists an archaeological site in the Cattaraugus Territory located within approximately one mile of the proposed project site that is eligible for listing on the National Register of Historic Places (NRHP). SNI Tribal Historic Preservation Office (THPO) staff conducted an onsite preconstruction survey to evaluate the proposed site for the presence of archaeological or historic resources. Pursuant to Section 106 of the *National Historic Preservation Act*, the THPO made a finding of "no effect" to cultural resources from the SNI Wind Turbine Project.

Based on the analysis provided in the EA, DOE has concluded that the Proposed Project would not cause any adverse effects on unique characteristics of the geographic area.

4) The degree to which the effects on the quality of the human environment are likely to be highly controversial:

The analysis in the EA demonstrates that the effects of the Proposed Project on the natural and human environment would be minimal. During both the public scoping and public comment period, no factual evidence was presented that questioned the technical and scientific analyses of the EA or supporting documents.

5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks:

The possible effects on the human environment from wind turbine installation have been fully analyzed and supported by previous projects, studies, and publications (EA, Section 5.0). The Proposed Project does not involve new technology, and therefore, possible effects are readily ascertainable and would not involve unique or unknown risks.

6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration:

Neither scoping nor public comment for the Proposed Project raised any disputes pertaining to the appropriate scope of the Proposed Project, connectedness of other actions, or reasonably foreseeable future actions. The Proposed Project would increase the energy independence of SNI as a whole and create electrical utility rate cost equivalency between two SNI territories (Cattaraugus and Allegany), as well as result in energy cost stabilization and savings, which could motivate other Tribal communities to seek similar energy independence and long-term access to reasonably priced electric power. However, the impacts associated with the Proposed Project would be minimal, and it is unlikely that the project would establish a precedent for future actions with significant effects in other communities.

7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts:

DOE considered and analyzed in the EA the cumulative effects of the Proposed Project with other past, present, and reasonably foreseeable future actions. Information on existing and planned wind energy facilities was obtained from the New York State Department of Environmental Conservation renewable energy website. The Proposed Project would add one additional wind turbine to 314 existing wind turbines and 62 proposed wind turbines associated with several projects located within approximately 40 miles of the SNI wind turbine site. Also, the site is adjacent to several SNI business and industrial buildings and would result in grading and development of approximately one acre of forested land. Additional possible SNI development in the immediate area could include industrial or business parks and greenhouses.

The impacts of the Proposed Project are expected to be minor and localized so the spatial extent of potential cumulative impacts was limited to adjacent areas of the project location. Based on the above summary and the analysis in the EA, DOE has determined that there are no potential impacts to resources identified in the EA that would be cumulatively significant.

8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources:

CRIS identifies historic structures in the vicinity that are listed or eligible for listing on the NRHP and include numerous residential and other buildings in the Village of Silver Creek near the shore of Lake Erie, approximately 3.5 miles southwest of the proposed wind turbine location. In addition, CRIS identifies eight buildings and structures listed on the NRHP that are associated with the SNI administrative office location approximately six miles southeast of the project site. The potential historic context and experiences associated with the resources located in the Village of Silver Creek and in the area of the SNI offices would not be affected by the proposed wind turbine due to the general inability to see the turbine structure because of large distances involved and terrain and vegetation obstructions.

Based on analysis provided in the EA and consultations with the SNI THPO, DOE has concluded that the Proposed Project will not adversely affect cultural or historic resources in the area.

9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973:

DOE consulted with the U.S. Fish and Wildlife Service (USFWS) regarding the potential presence of listed species and critical habitat in the area. One species, the northern long-eared bat *(Myotis septentrionalis),* that occurs in Erie County in the region surrounding the project site has recently been listed as threatened by the USFWS (80 FR 17974, April 2, 2015). Although suitable summer and roosting habitat does exist for this species in a wider region from the project site in western New York, there is no known suitable hibernacula habitat in the immediate project area. DOE believes that mortality of a northern long-eared bat is extremely unlikely to occur because of project construction and operating procedures and BMPs (EA, Section 3.4). There are no critical habitat areas designated by the USFWS for any federally endangered or threatened species in Erie County.

Based on analyses provided in the EA and consultations with the USFWS, DOE has concluded that the Proposed Project "may affect, but is not likely to adversely affect" the northern long-eared bat. The USFWS concurred with DOE's finding on July 24, 2015.

10) Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment:

DOE recognizes the sovereign nature of Native American governments and lands, specifically SNI and the Cattaraugus Territory, in defining and regulating the environmental resources associated with proposed actions on SNI lands. As such, SNI regulatory agencies and processes comprise the main environmental compliance responsibilities associated with this project and are entirely consistent with other federal regulatory requirements for protection of the environment. SNI has committed to protecting the environment by implementing the BMPs as detailed in Section 3.4 of the EA. These commitments shall be incorporated through DOE's financial assistance agreement.

CONCLUSION: Based on the analysis in the EA and the above considerations, DOE finds that the decision to provide federal funding for the Proposed Project is not a major federal action that constitutes a significant effect on the human environment. This finding and decision are based on the considerations of DOE's regulations (10 CFR Part 1021) implementing NEPA (42 U.S.C. 4321 *et seq)* and the Council on Environmental Quality's criteria for significance (40 CFR 1508.27), both with regard to the context and intensity of impacts analyzed in the EA. Accordingly, the Proposed Project does not require the preparation of an environmental impact statement.

For questions about this FONSI or the final EA, please contact:

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For information about the DOE NEPA process, please contact:

Office of NEPA Policy and Compliance
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
http://energy.gov/nepa/office-nepa-policy-and-compliance

Issued in Golden, Colorado this_5 ft ay of October, 2015.

Timothy J. Meeks
Acting Manager

VI. CESIR Study – National Grid

Interconnection was a large challenge for a number of reasons. The Seneca Nation was required to pay National Grid (NGRID) ~$42,000 to conduct a line impact study. After the analysis, it was determined the interconnection would cost twice as much as the original quote provided by NGRID. This caused the Nation to appropriate an additional ~$700,000 to ensure the project continued. The Nation, SED and URS fought back against the utility and the increased costs to interconnect. Ultimately, the cost was decreased by ~$250,000 and the timeframe to interconnect was reduced by three months. The project would not have moved forward without the Seneca Nation pushing back against the utility and appropriating the additional money to cover the actual cost.

nationalgrid	**DISTRIBUTION PLANNING DOCUMENT** **Interconnection Study**	Doc. #**SP.NY-12544.2** Page 1 of 25
	Small Generating Facility	Version 1.0 – 2/22/2016
Project	**Seneca Nation of Indians – Irving, NY** **1,500 kW Wind Turbine**	Final

Coordinated Electric System Impact Review Study (CESIR)

Seneca Nation of Indians

1,500 kW Wind Turbine Generator

11093 Erie Road, Irving NY 14081

Angola Region

‘Delamater Road’ Station

13.2kV Feeder ‘07-09354’

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INTRODUCTION

This report presents the analysis results of the Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or the "Company") interconnection study based on the proposed interconnection and service plan submission from the Interconnect Customer in accordance with the National Grid Electric System Bulletin No. 756, Appendix B 'Distributed Generation Connected to National Grid Distribution Facilities per the New York State Standardized Interconnection Requirements'.

The intent of this report is to assess the project's feasibility, determine its impact on the existing power system, determine interconnection scope and installation requirements, and costs associated with interconnecting the Interconnection Customer's generation to the Company's EPS.

ACRONYMS/SYNONYMS USED IN THIS INTERCONNECTION STUDY

CDO - "Connecting Distribution Owner" or "Company"

CDO AF - "Connecting Distribution Owner Attachment Facilities"

CESIR – "Coordinated Electric System Impact Review"

Energization - "In Service"

DTT – "Direct Transfer Trip"

EPS – "Electric Power System"

ESB - "Electric System Bulletin"

ESO – "Electric Service Order"

GSU - "Generator Step-Up"

ICAF - "Interconnection Customer Attachment Facilities"

MP - "Metering Point"

NERC - "North American Electric Reliability Corporation"

NPCC - "Northeast Power Coordinating Council"

NYISO OATT - "New York Independent System Operator Open Access Transmission Tariff"

NY PSL - "NYS Public Service Law"

NY PSC - "New York Public Service Commission"

NYSSIR – "New York State Standardized Interconnection Requirements"

PCC – "Point of Common Coupling"

PCO - "Point of Change of Ownership"

POI - "Point of Interconnection"

PSU – "Plant Step Up"

SASUF - "Stand Alone System Upgrade Facilities"

SGF - "Small Generating Facility"

SIS - "System Impact Study"

SGF - "Small Generating Facility"

1.0 PROJECT DESCRIPTION

Seneca Nation of Indians ("Interconnection Customer") has submitted a PSC No. 220 application (Company Project File No. CLA 036-25.1-13.12544) for a 1,500 kW wind turbine generator installation at 11093 Erie Road, Irving, NY 14081 in accordance with the NYSSIR. The application was prepared by Sustainable Energy Developments, Inc. All technical comments and notice of acceptance are to be directed to Sustainable Energy Developments, Inc.

2.0 SCOPE

This feasibility and system impact study is performed in accordance with applicable NERC, NPCC, National Grid reliability and design standards, and in accordance with applicable National Grid study guidelines, procedures and practices. In addition to assessing the project impact on the power system, the interconnection study includes a list of the facilities required to interconnect the project to the Company's EPS, as well as non-binding good faith cost estimates to construct those facilities.

Performance criteria is covered defining regulations, restrictions, and requirements that shall be met by the Interconnection Customer for the engineering, design, construction, testing, energization and operation of the SPF(s) and ICAF(s) associated with the Project or SGF, as such facilities relate to the safe and reliable interconnection of the project to National Grid's EPS. Prescriptive specifications will be prepared and issued as necessary after receipt and review of the Interconnection Customer's final design and equipment specifications for the Project, including ICAFs and SPFs, and notice to proceed with funding under the terms of the Interconnection Agreement.

The following Company ESBs* pertain to this Project and are referenced by this CESIR study:

- ESB No. 750 – Specifications for Electrical Installations, April 2010 ("ESB 750")
- ESB No. 750 series Errata and Change Revision List, September 2010 ("ESB 750 Series Errata")

Other references pertaining to this Project include:

- PSC No. 220 – Niagara Mohawk Power Corporation Electricity Tariff <<http://www.nationalgridus.com/niagaramohawk/non_html/rates_psc220.pdf>>
- New York State Consolidated Laws, Public Service, Article 4, Section 65 ** <<http://public.leginfo.state.ny.us/menugetf.cgi?COMMONQUERY=LAWS then select "PBS">>

* All ESB's are available at http://www.nationalgridus.com/electricalspecifications.

** Refer to the note under the title of Part A in the Company's ESB 750-2010 "Specifications for Electrical Installations".

The application of this CESIR study assumes the Interconnection Customer's status **is not an "Electric Corporation"**, as defined by the NY PSL and is a retail customer under National Grid's electricity tariff, PSC No. 220.

Any revisions, changes, corrections and modifications deemed necessary for the Projects interconnection will be documented by the Company in the issuance of a revised version of this interconnection study.

2.1 Objectives

The objectives of this CESIR study include:

- Reviewing Company EPS impacts and identifying deficiencies, if any, by;
  - Performing steady state thermal and voltage analysis for peak loading conditions;
  - Performing a sensitivity study (steady state only) to assess the impact of the Project during light load conditions;
  - Performing a short circuit study to assess the impact of the project under fault conditions
  - Evaluating EPS equipment short circuit capabilities and identifying equipment with overdutied ratings due to the addition of the generation; and
  - Performing review of system protection requirements to be included for the Company's system and those at the generation facility/Customer service point(s).

  Note: Analysis of models are performed with and without the Project, in order to evaluate the impact of the Project on Company's EPS
- Providing the available symmetrical fault current at the delivery point of the Customer's service;
- Determining whether the proposed generation meets the applicable criteria considered in the NYSSIR CESIR process;
- Providing a good faith estimate of the total cost of completion of the interconnection of the proposed generation and a statement of cost responsibility for dedicated transformers or other required interconnection equipment including the Customer's assigned costs associated with any required modifications to the utility system, administration, metering, and on-site verification testing;
  - Recommended interconnection configuration with a list of SUFs required;
  - List of SPF upgrades required; and
  - The Interconnection Customer is obligated, under its Form G and Appendix C application with National Grid, to reimburse the Company of the required interconnection costs.
- Identifying the engineering design parameters, installation and operating requirements associated with the ICAFs and SPFs; and
- Identifying submittals required for review and acceptance of the ICAFs and SPFs at various stages of the Project, including: engineering design, construction, testing and commissioning, energization, synchronization and close out, and the process for completing such submittals.

2.2 Background

The Interconnection Customer would be served by the Company's 13.2 kV radial distribution feeder 07-09354 from the Delameter Rd. substation. The Interconnect Customer proposes to install a new primary net-metered service. This service new primary service would need to be connected at Pole 28, to the north of the existing recloser (R93400) that is located on Pole 26 (with an existing isolation switch on Pole 27).

Customer Site

The proposed generation site will consist of one (1) 1,500 kW Vensys "VE 1500" with integral 2000A breaker, connected to a unit substation with a 2000 A breaker, a 13,200 – 600/346 VAC, 1,750 kVA transformer (5.75% impedance), with a 100E fuse (FU-006) and disconnect switch (SW-006). This 13.2 kV connection continues underground to a grounding transformer (150 KVA), and a recloser (Viper VP378ER-12-1-ST with SEL-651R-2 relay) and on to a customer revenue meter. The remaining main connection (which is required to be near Pole 28) includes National Grid supplied meter transformer stand/mount and CT and PT metering transformers. From the meter cluster, the conductors continue to a 125E fuse (FU-002), then to a disconnect switch (SW-001)[1].

Note [1]: The proposed design is requested to change to be modified to have the surge arresters between the switch (SW-001) and fuse (FU-002). Ref. ESB-753, Figure 2.

Delameter Rd. 93 Substation

Delameter Rd. Substation is a 115/13.2 kV substation consisting of a 13/18/22 (OA/FA/FA) MVA transformer connected to a 13.2 kV bus that supplies four (4) distribution feeders.

Delameter 07-09354

The distributed generator is to be interconnected to distribution feeder Delameter 07-09354. The peak load has been recorded to be 6.8 MVA in 2015. Light load condition has been recorded to be 2,200 kW in 2015. The customer's POI location is 45,000 circuit feet from the Delameter Road substation.

Other Generation

There is 78 kW of existing and 1,500 kW of proposed (this CLA 12544) of distributed generation on feeder 07-09354.

There is 695 kW of existing and 4,202 kW of proposed (this CLA 12544 and a later in queue 2,000 kW solar under CLA 12681) ofdistributed generation on Delameter Rd. substation. For this CLA 12544, the additional 2,000 kW will not be included in the analysis, as it is later in the queue process in accordance to CLA numbering.

Voltage Regulator

There is two (2) voltage regulator sets located between the Customer and the substation (see table below).

Pole	**Location**	kVA$_{tot}$	**kV$_{LL}$**	**Phases**	**Capability**
41	Beach Rd.	500	13.2	3	Bi-directional
125	Erie Rd.	500	13.2	3	Bi-directional

Recloser

There is one (1) recloser (R93402) located between the Customer POI at Pole 28 and the substation (see table below) and one (1) recloser (R93400) located just beyond the Point of Common Coupling.

Pole	**Location**
126	Erie Rd. *(before PCC - Applicable)*
26	Erie Rd. *(after PCC – Not Applicable)*

Capacitor

There are two (2) capacitor banks located on the feeder totaling 450 kvar (See table below.)

Pole	**Location**	**kvar$_{tot}$**	**kV$_{LL}$**	**Phases**	**Type**	**Control**
2	Park Ave.	300	4.8	3	Fixed	Manual
23	Lakeshore Rd.	150	13.2	3	Fixed	Manual

3.0 UTILITY SYSTEM IMPACTS

After full review of this customer's generation location, there are extensive impacts, costs, and complications with the interconnection of a generator of this size in this location.

National Grid has reviewed and studied the proposed Interconnection Customer's distributed generation (DG) project to determine:

- if the project meets the applicable criteria considered in the CESIR process,
- if the addition of the DG to the Companies EPS results in any system impacts, such as relay coordination issues, changes in fault current that affect equipment ratings, voltage regulation problems, or changes to electric system operation,
- if the generation, as proposed, presents any potential to "island" existing load presently being served from the Company's EPS,
- if the generation, as proposed, can effectively re-synchronize after an outage to either the Company EPS, or an outage to the generator,
- a good faith, detailed estimate of the total cost of completion of the interconnection of the proposed system, and
- the Customer's cost responsibility for the required interconnection equipment. **3.1**

Thermal and Voltage Analysis

The total nameplate capacity of the generator was modeled on the Delameter Road 07-09354 feeder.

The Interconnection Customer shall be advised that, in order to maintain voltage within allowable limits set in ESB 756, the operational power factors at the PCC shall not be less than 0.90 p.f. (leading or lagging); and, the reactive power support at the retail load shall be such that the retail load power factor is not degraded at its delivery point.

The Project shall not actively regulate the voltage at the PCC nor shall it degrade the delivery voltage to neighboring customers on the Delameter 07-09354 feeder.

3.2 Voltage Flicker

The Company reserves the right to disconnect the Facility if unacceptable flicker and/or voltage fluctuations occur as a result of interconnection of the Facility.

3.3 Power Flow Sensitivity Analysis and Results

Distribution feeder considerations were evaluated for impact of the interconnection under normal feeder circumstances and the results are as follows:

1. Feeder Conductors

   The rated current output of the generation is less than the thermal rating of the EPS main line conductors serving the proposed generation facility.

2. Feeder Reclosers

   There is one line recloser between the customer's proposed PCC and the substation. Relay setting changes are required at the recloser to accommodate the customer's generation.

3. Feeder Regulators

   There are two (2) regulator sets in between the customer's proposed PCC and the substation. While the regulators are bi-direction, the controllers will likely need changes to be compatible with generation.

4. Feeder Equipment Ratings

   The withstand and thermal ratings of the EPS equipment on the Delameter Road 13.2 kV feeder will not be required to be increased as a result of the generation at the project's location.

3.4 Operational Restrictions and Impact

The generator allowable operation will only be during those periods when the Delameter 07-09354 feeder is supplied via R540 circuit breaker in its entirety under normal EPS system configurations and conditions. For any configuration or condition other than the normal, the Company reserves the right to disconnect the parallel generation for the Company's EPS.

In the future, if it is determined that this paralleling generator adversely impacts the voltage at the PCC requiring National Grid to make system modifications or changes in order to bring the voltage to back within limits the cost of such modifications or changes shall be borne by the Interconnect Customer.

4.0 SYSTEM PROTECTION

4.1 System Protection Analysis

4.1.1 Short Circuit Analysis

The following are National Grid's estimated 13.2 kV system characteristic maximum values* on a 100 MVA base at the proposed project's 13.2 kV delivery point without any Interconnection Customer equipment contribution. This is presuming the delivery point is at the Point of Common Coupling at P.28, Erie Rd on the Delameter Road feeder. Future system reconfigurations or increase in fault current source strength may require the service equipment to have a larger interrupting rating. Any costs associated with changes to Interconnection Customer-owned equipment shall be borne by the Customer. The Interconnection Customer's interconnection facilities and equipment shall be suitable for the maximum fault current available at its supply.

Delameter 07-09354 – P.28 on Erie Rd.

~~$I_{(3\text{-Phase})}$ = 1096 Amps (3_{LLL})~~

$I_{(3I0)}$ = 690 Amps (1_{LG})

Z_1 = 1.38 + j3.73 p.u.

Z_0 = 3.95 + j10.26 p.u.

* Refer to Section 1.10 of the Company's ESB750--0410 regarding the use of the information provided by the Company. Also, refer to Section 1.7 of the Company's ESB750--0410 regarding their responsibility for their electric service operating and maintenance requirements. NFPA 70E provides information where to find work safety practices for premises wiring.

4.1.2 Coordination Study

This study was performed with the proposed generation added to the Delameter Road Feeder 9354 with the following results:

1. Anti-Islanding Protection

   The proposed generation greatly exceeds the Company's criteria for islanding a distributed resource on Delameter 07-09354 under light load conditions, therefore risk-of-islanding is a concern. This concern exists for situations in which the substation circuit breaker R540 opens as wells the condition in which the downstream recloser R93402 opens.

2. Feeder Fault Sensitivity

   Fault studies show that contribution from the generators for faults on the Delameter Road feeder will not have a significant increase in fault current seen by utility equipment. Aggregate source fault contribution with the addition of this generator is within the rated capabilities of EPS equipment.

3. Temporary Faults on Feeder and Fuse Operation

   The generator does not interfere with fuse operation for this feeder.

4. Substation Backfeed Concerns

   Fault flow study results show that there is not enough current contribution from the generator to trip the non-directional over-current protection at the station and de-energize the feeder.

5. Ground Fault Detection

The Customers system as proposed impacts the substation relaying for the feeder and the relaying for the mid-stream line recloser. Changes to the relay settings at both locations will be required. The Customer's system as proposed provides approximately 87A of primary 3I0 ground fault current for bolted line to ground faults toward the remote end of the feeder. The customer shall ensure that the CTs and relaying to be used for this system can appropriately detect and trip for faults on the EPS.

6. Overvoltage Caused by Faults

    1. The system as proposed does not create significant overvoltage conditions on the feeder during faults on the Company's EPS when the grounding transformers are in service.

    2. It has been determined that 3V0 protection is not required at the substation for this project.

7. SGF Protective Equipment

The Project shall conform to the NYSSIR and National Grid's ESB 756 Appendix B for protection requirements. In addition to the protection requirements listed above, the following protective relaying functions shall be included with Customer's relay:

- Function 27 Undervoltage – This function shall be included with the G&W Viper relay and shall initiate a tripping sequence to the respective breaker, as prescribed by the NYSSIR. Note: The Customer shall provide evidence that the total clearing times of the relay functions meet the requirements of IEEE 1547.
- Function 59 Overvoltage – This function shall be included with the G&W Viper relay and shall initiate a tripping sequence to the respective breaker, as prescriber by the NYSSIR. Note: The Customer shall provide evidence that the total clearing times of the relay functions meet the requirements of IEEE 1547.
- Function 81 o/u Frequency – This function shall be included with the G&W Viper relay and shall initiate a tripping sequence to the respective breaker, as prescribed by the NYSSIR. Note: The Customer shall provide evidence that the total clearing times of the relay functions meet the requirements of IEEE 1547.
- Function 51G Ground Time Over-current – This function shall be included with the relay and shall initiate a tripping sequence to the recloser for Ground Time Over-current conditions on the Utility EPS and on the customer's system and shall coordinate with the utility's protection. The Customer shall provide settings for review by the Company.
- Function 51 Phase Time Over-current – This function shall be included with the relay and shall initiate a tripping sequence to the recloser for Phase Time Over-current conditions on the customer's system and shall coordinate with the utility's protection. The Customer shall provide settings for review by the Company.
- Function 51C Voltage Controlled Phase Time Over-current – This function shall

initiate a tripping sequence to the recloser for Phase Time Over-current conditions on the Utility EPS and shall coordinate with the utility's protection. The Customer shall provide settings for review by the Company.

- <u>Relay Failure Protection</u> – For all tripping functions required by this section, either external relaying or relay failure protection, where a hardware or power supply failure for the relay automatically trips and blocks close of the associated protective device, is required. If the Customer chooses to provide relay failure protection, the relay failure method shall be submitted for review by the Company.
- <u>Utility Restoration Detection</u> – Following a trip of the generation's recloser, a Utility Restoration Detection function shall prevent manual and automatic reclosing of the customer's DG intertie device until the customer's relay has detected that the Area EPS steady-state voltage and frequency are restored to the ranges identified by IEEE 1547 section 4.2.6 for a period of five minutes. The five minute timer is required to restart if the utility voltage or frequency falls outside of this window.
- <u>Overcurrent tripping description:</u> A trip from an overcurrent function (51, 51G, 51C, etc) shall trip the recloser and drive the recloser to lockout, preventing auto reclosing.
- <u>Reclosing procedure:</u> Following a National Grid SCADA initiated trip or an overcurrent trip, the customer shall contact the National Grid system operator as described in the Interconnection Agreement to obtain permission to reconnect the generation to the National Grid EPS.

5.0SYSTEM OPERATING IMPACT

5.1 Reliability Issues

The generator limits of operation will normally be during those periods when the Delameter Road 07-09354 feeder is serving the interconnection point. During times when the source to the Customer's POI is switched from Delameter Road 07-09354 feeder to any other feeder out of Delameter Road or to another adjacent substation feeder the generator breaker shall be opened to disconnect the generator from the Company's EPS. This measure has become necessary due to operational concerns of the generator having the ability to establish a suitable voltage source to the underground cables and overhead lines of the alternate source. The presence of this voltage may contribute to miss-operation of protective devices on the Company EPS and could potentially lead to safety and equipment damage issues.

6.0 INTERCONNECTION METHOD CONCLUSIONS AND ALTERNATIVES

1. **Changes are expected** to the Company's Delameter Road 07-09354 line to accommodate the Interconnection Customer's connection to the local area EPS.

See Attachment 1 for an overview.

a. A new recloser will be necessary on Dawn Ave (~Pole 43)
b. A new 100K fuse on Lotus Point Road (~Pole 1); and 3) a new 80K fuse on Lakeshore Road (~Pole 27).

2. Two (2) Direct Transfer Trip schemes will be necessary for this project. The first between the Delameter Road Substation and the customer location; the second between recloser R93402 and the customer location. Various alternatives are being pursued (900 MHz radio or a power line carrier (PLC) design), with both having their own complexities and obstacles to overcome. These estimates are provided under Table 13-1.
3. The existing substation circuit breaker and line reclosers will also require relay setting changes to facilitate the connection of this generator.
4. National Grid requires an appropriately service rated disconnect switch to allow provision for utility personnel to disconnect the generator. This disconnect switch shall be accessible and visible to the Company and it shall have provisions for the Company to install a lock. Also, per the NEC this disconnect switch shall be identified, labeled and have a permanent directory plaque as to its location mounted at the service entrance.
5. Two National Grid distribution alternatives were conceptualized for this application location. **One distribution** feeder requires 35,000-feet of new 13.2 kV (~$1.5M to ~$2.0M for the extension, plus other costs associated with existing equipment upgrades). A **second distribution** feeder requires 9,000-feet of new 13.2 kV (~$500k for extension, plus other costs associated with existing equipment upgrades), and will also have the same recloser / DTT requirements of the existing feeder 9354 documented in this CESIR. Therefore, there are no National Grid alternative feeders for this interconnection. The nearest **non-distribution connect** are part of the 115 kV system on the east side of railroad tracks and is also not viable based on the railroad crossings and 115 kV customer substation requirements that would be imposed. The New York State Electric & Gas (**NYSEG**) territory also covers the Seneca Nation to the south of this location and may be a viable alternative if the wind turbine location can move.

7.0 INTERCONNECTION CUSTOMER ATTACHMENT FACILITIES REQUIREMENTS

7.1 Main Service Equipment Requirements

The Primary Meter Service for this project shall be installed in accordance with the NESC, NEC as well as ESB-753 and/or ESB-758. The details will be worked out during final design.

7.2 Grounding Requirements

1. The verification of ground grid integrity and ground grid resistance to remote earth is required to ensure safe step and touch potentials within the Interconnection Customer's facility.

2. The Interconnection Customer shall provide affirmation of their ground grid integrity for the ground grid resistance according to ESB-753 or ESB-758. The Company typically recommends the 4-point Fall-of-Potential Method of testing; refer to IEEE Std. 81 for testing method standards.

7.3 Balance of Interconnection Customer Facilities

The design and construction of the remaining Interconnection Customer-owned facilities shall be in accordance with the Company's ESB's 750 and 756 Appendix B; the latest edition of applicable ANSI and IEEE Standards; the "National Electrical Safety Code", the "National Electrical Code", and good engineering practice.

1. The Interconnection Customer will need to abide by the voltage, frequency and power factor requirements in ESB 756 Appendix B and as specified in this study. The Company will not be providing any compensatory load shedding. The Company will review for acceptance the Interconnection Customer's proposed settings of those relays that the Company's Protection Engineering Dept. designates as being required to satisfy the Company protection practices. For multifunction microprocessor based relays:
   - Any relay setting approved by the Company shall not be changed or modified at any time without the prior written consent of the Company.
   - The manufacturer and model of the relay protection shall be shown on the functional single-line diagram.
   - The proposed relay protection and settings shall be submitted for the Company's acceptance review along, with AC 3-line and DC elementary control drawings.
   - The Company-designated relays will be witness-tested/verified by the Company's personnel prior to energization.
2. The Interconnection Customer is solely responsible for the protection of their SGF plant equipment. The Interconnection Customer is required to provide electrical equipment and relays with ranges and rating that will allow proper SGF relay system coordination with Company protection systems. Coordination margins and parameters will be determined by the Company.
3. The Interconnection Customer shall ensure the duty rating of the service equipment and overcurrent devices meet the requirements of the latest edition of the National Electrical Code enforced by the authority having jurisdiction (AHJ).
4. The Company requires a Sequence of Operations (SOO) from the Customer. The Company also requires an operating description from the Interconnection Customer for normal, alternate and emergency (if proposed) operations, if the Customer desires to operate in these modes and in the event of any changes to the existing procedures have changed.

8.0 METERING AND TELEMETERING

8.1 Revenue Metering

The Customer has applied for net metering for this installation. A new net meter will be installed for this Project under the following assumptions and conditions:

- The instrument transformers and associated metering cluster mount for an outdoor overhead primary service installation will be furnished by the Company to be installed by the customer. The Customer will make all primary voltage connections.
- The Company will install a bi-directional meter upon the Company's acceptance of the Customer's generator installation. The Company will make all secondary voltage connections.
- Company supplied voltage transformers shall be 70:1 ratio for applications on a 13.2 kV service.
- Company current transformers will be a 25:5 or 30:5 (depending on storeroom availability) with a rating factor of 3.

8.2 Telemetering – National Grid's SCADA Interconnection

In accordance with ESB-756B 2014, Section 6.4.1, a connection to the National Grid EMS is required to connect to the National Grid system, based on this project's size and interconnection voltage. This could potentially utilize an SEL relay with DNP 3.0 values required via a telecommunication medium (specifically Telephone Company's Circuits)

The customer will be responsible for the following regarding Communications circuit ordering from the Local Servicing Telephone Company:

1. The customer shall provide a serial cable (between the relaying and routing equipment, a GarrettCom DX940), control power circuit (AC or DC), and the telephone circuit to the telecommunication equipment location.
2. Create an HVP high voltage protection form to be signed by customer and submitted to the telephone company.
3. Initiate a request into the telephone company for a 64K/MPLS circuit, routed to the National Grid EMS system (specifically, Network 24).
4. The customer / telephone company to determine either the necessity for Teleline Wireline Isolation (e.g. Positron cabinet) or an indoor phone board location for the Positron or optical multiplexer mounting.
5. The customer shall include mounting the cabinets in their scope of work.
6. The customer will install all underground 4-inch, Schedule 80 conduits to the telephone company street pole.
7. National Grid will terminate the cables on the telecommunication equipment.

8. The DNP addressing and points list for the customer's relay will be provided during relay setting review.
9. The customer will need to provide a dedicated serial port on the relaying, that is compatible with DNP 3.0 protocol for EMS use.
10. Tele-metering criteria and SCADA requirements to the National Grid Energy Management System (EMS) shall be in accordance with ESB-756 Appendix B. SCADA capability is required at the Customer's main service POI supplying their facility.

    The following monitoring points will be required from the Customer

    Analog DNP inputs:

    - 3 Phase MW
    - 3 Phase MVAr
    - Amps for each phase
    - Line to Neutral Voltage for each phase

    Digital DNP inputs:

    - Generator Interrupter Device status (i.e. PV-1)

      EMS tripping description:

    - Remote trip command of the recloser from National Grid's Regional Control Operator is required. This shall send the recloser control to lockout. Auto reclosing following this trip command is not allowed.

9.0 INSPECTIONS AND COMPLIANCE VERIFICATION

For this study, the Interconnection Customer Attachment Facilities (ICAF) will require a third party electrical inspection approval certificate from an agency acceptable to the local Authority Having Jurisdiction and the Company* of the SGF. The Company must receive the Interconnection Customer's final set of installation drawings, equipment data, and test plan for the functional verification tests **at least four (4) weeks before** the Company's field audit and witness testing.

The Interconnection Customer shall adhere to all other Company related verification and compliance requirements as set forth in ESB's 750 and 756 Appendix B. These and documented acceptance testing requirements of these facilities will be specified during the final design review of the Project prior to the Company's field audit and energization.

* A list of Company approved Electrical Inspection Agencies for New York is available at: http://www.nationalgridus.com/niagaramohawk/nonhtml/constrnyinspectors.pdf.

10.0 TESTING AND COMMISSIONING

The Interconnection Customer shall submit a final Testing and Commissioning Plan ("TCP") to the Company for review and acceptance, no later than **seven (7) days prior** to functional testing of the Company-designated protective devices in the SGF's final design. The Company shall reserve the right to witness test and examine the settings of the Company-designated protective devices associated with the SGF and audit the Interconnection Customer's generation equipment installation and service connection for compliance with the Company's requirements.

A letter, written by the Customer or their assigned agent, indicating the protection and control scheme has been functionally tested in accordance with the Customer's submitted design as accepted by the Company shall be completed **prior** to the Company's witness testing.

11.0 ENERGIZATION AND SYNCHRONIZATION

The switch at the PCC shall remain in the open position until successful completion of the Company's field audit and witness testing.

The Interconnection Customer is required to submit a final Energization Plan ("EP") to the Company for review and acceptance, no later than **fourteen (14) days prior** to the system being placed in service.

Further details of synchronization requirements will be specified during the final design review of the Project.

12.0 OPERATION AND MAINTENANCE

1. The Interconnection Customer is responsible for the operation and maintenance of their facilities up to the demarcation point of the Interconnection Customers service on the Customer's property in accordance with the Company Bulletins.
2. In addition to the requirements of ESB 756 Appendix B, the Interconnection Customer shall refer to Section 1.7 of the Company's ESB 750 regarding the Interconnection Customer's responsibility for their electric service operating and maintenance requirements.
3. Should the Project's generation impact the Interconnect Customer's 13.2 kV service voltage beyond nominal +/- 5%, the Interconnect Customer shall adjust their generator output accordingly and/or provide local voltage regulation device(s).
4. The Customer is required to maintain site loads within 2% voltage unbalance according to Section 3.9 of ESB 750.
5. Following a generator trip due to the loss of Utility voltage or frequency, the generator shall remain disconnected until such time as the source is recovered to acceptable voltage and frequency limits for a minimum of 5 minutes. This function shall be verified during the witness testing. Time delays and synchronization blocking for the required protection scheme will be further specified by the Company during the design.

6. This interconnection study and service plan does not address the future operations and maintenance (O&M) associated with National Grid's distribution system.

13.0 CONCEPTUAL COST ESTIMATE

The following are general descriptions of, and non-binding good faith conceptual estimated costs for, the Company's components that are determined to be required by the Project and are estimated under rates and schedules in effect in accordance with PSC No. 220:

Table 13-1: Planning Grade Estimate

CLA 12544 - Seneca Nation of Indians						
National Grid Scope of Work	**Planning Grade Cost Estimate**				**Tax Liability $ @ Applied to Capital**	**Total Project Cost**
Line Item Costs	**Capital**	**O&M**	**Removal**	**Pre-Tax Total**	**27.04%**	**Total $**
Customer Documentation Review , Field Verif cation, and Witness Testing	$0	$54,300	$0	$54,300	$0	$54,300
Direct Transfor Trip Installation (GridEdge or 900 MHz Radio)						
Station Aspect	$200,000	$0	$0	$200,000	$54,080	$254,080
Distribution Line Aspect	$260,000	$0	$0	$260,000	$70,304	$330,304
Distribution Line Equipment (Recloser, Fuses, Voltage Regulator Controllers)	$62,400	$0	$0	$62,400	$16,873	$79,273
SCADA System Connection and Equipment (RTU)	$30,000	$0	$0	$30,000	$8,112	$38,112
TOTAL Project Costs	**$552,400**	**$54,300**	**$0**	**$606,700**	**$149,369**	**$756,069**

1. These estimated costs are based upon the results of this study and subject to change. All costs anticipated to be incurred by the Company are listed. Technical Sales and Engineering Support shall determine which costs (with the assistance of Customer Program Finance) are to be the responsibility of the Customer, and owed to the Company as directed for contribution in aid of construction (CIAC). CIAC costs will be based on the requirements of the NYSSIR.
2. Upfront payment of the final estimate is required upon receipt of the Interconnection Customer's written acceptance prior to the Company proceeding with any further review, design, procurement, construction, and energization activities for the project. *It is important to note that the Company will reconcile the charges after project completion, and the Interconnection Customer will be responsible for all final charges, which may be higher or lower than estimated according to this*

interconnection study/service plan and NMPC PSC No. 220.

3. The conceptual cost estimate provided in this plan is in accordance with the Company's rates and schedules in effect as of June, 2013 and will be deemed withdrawn if not accepted by the Interconnection Customer within 90 days. The estimate includes contingency on direct labor and material costs and sales tax only on materials. The accuracy of this "planning grade estimate" is a good faith estimate of the total cost of completion of the interconnection of the proposed system.
4. This planning grade estimate provided in **Table 13-1** includes:
   - property taxes,
   - gross up for income tax,

   and does not include:
   - additional interconnection study costs,
   - additional application fees,
   - applicable surcharges,
   - overall project sales tax,
   - future operation and maintenance costs,
   - adverse field conditions such as weather and Interconnection Customer electrical equipment obstructions,
   - extended construction hours to minimize outage time or National Grid's public duty to serve,
   - the cost of any temporary construction service, or
   - any required permits.
5. Cost adders estimated for overtime would be based on 1.5 and 2 times labor rates if required for work beyond normal business hours. Meals and equipment are also extra costs incurred for overtime labor.
6. The Company's Technical Sales and Engineering Support Department shall be consulted for the Interconnection Customer's payments in accordance with the Company's filed tariffs, NMPC PSC No. 220.

14.0 SCHEDULING AND INTERCONNECTION CUSTOMER'S PROGRESS CHECKLIST

The Interconnection Customer's schedule may be effected by and depends upon receipt of funds along with notification to proceed, executed Interconnection Agreement, weather, equipment delivery, public opposition to right-of-way and untimely Customer design submittals. Close coordination is required to sequence construction and planned interruption events. *As a result, any final schedule requires mutual agreement and would be subject to change*.

- The Interconnection Customer is required to submit a project schedule that includes the necessary coordination activities to both themselves and the Company to provide for the design, installation, compliance verification, and energization of the Interconnection Customer's interconnection to the Company's sub-transmission system*.
- The Company's project for applicable system upgrades will begin once receipt of written commitment to proceed with necessary funding is made along with an executed Interconnection Agreement. Lead time discussed in this study excludes any installation of phone circuits by the local communications provider.

* The Interconnection Customer's desired In-Service, Initial Synchronization, and Commercial Operation Dates are subject to mutual agreement with the Company. Any agreed-upon schedule is subject to change based whether third-parties permits, rights-of-way, and authorizations have been obtained; upon the Company's work force resource availability; and upon the Company's other public service requirements.

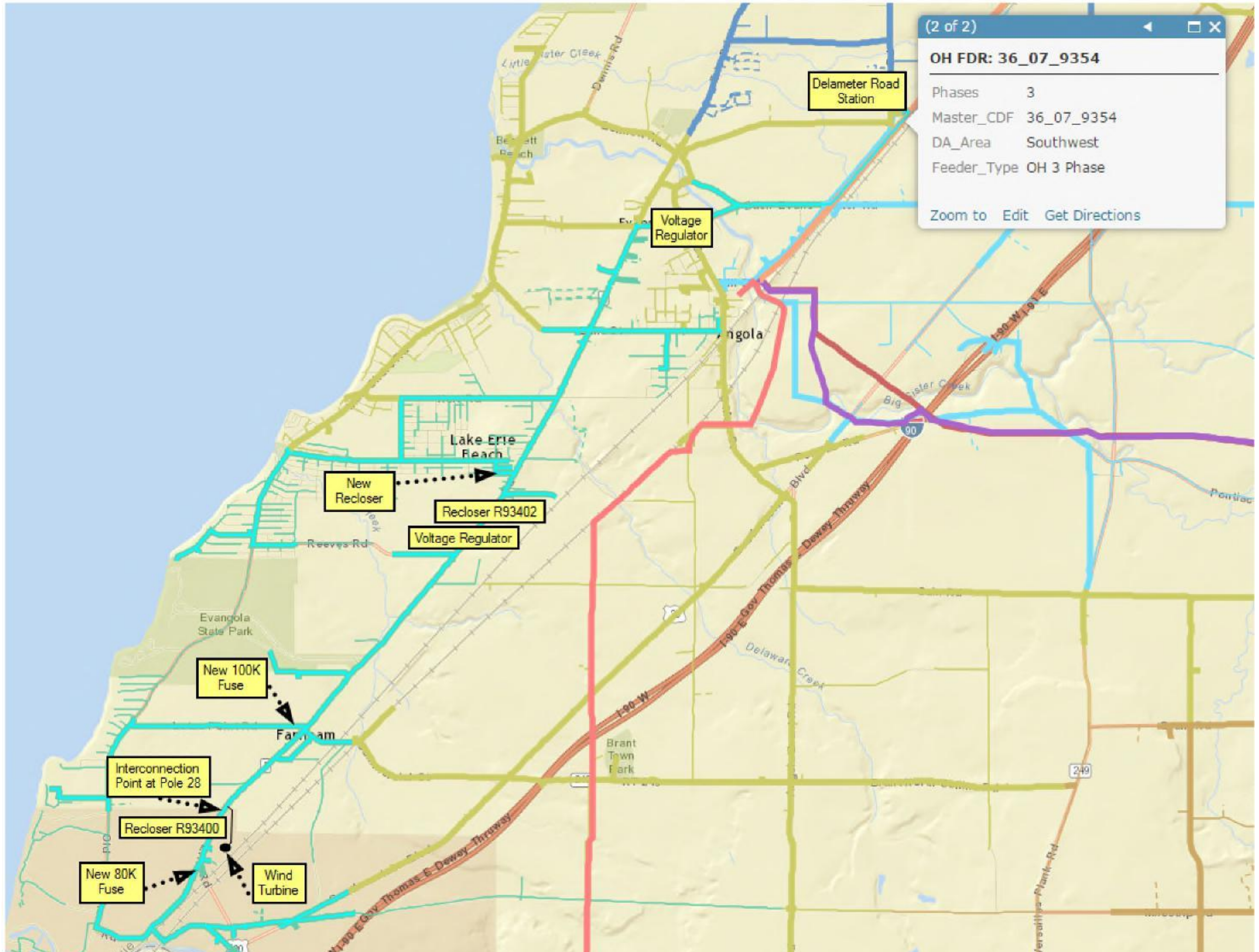
In summary of the above, the Customer shall provide to National Grid the following corrections:

- E-101: Incoming conductor likely to be 336.4 kcmil ACSR.
- E-502: Transformer metering stand will be provided by National Grid, along with instrument transformers for metering.
- E-502: All dimensions necessary for metering pole (phase-to-phase; phase-to-ground) for all clearances. Reference ESB-753, Figure 6.
- General: MCOV for surge arresters expected to be 8.4 MCOV. Ref. ESB-753.
- E-601: Rearrangement of equipment at POI (switch, arrester, fuse).

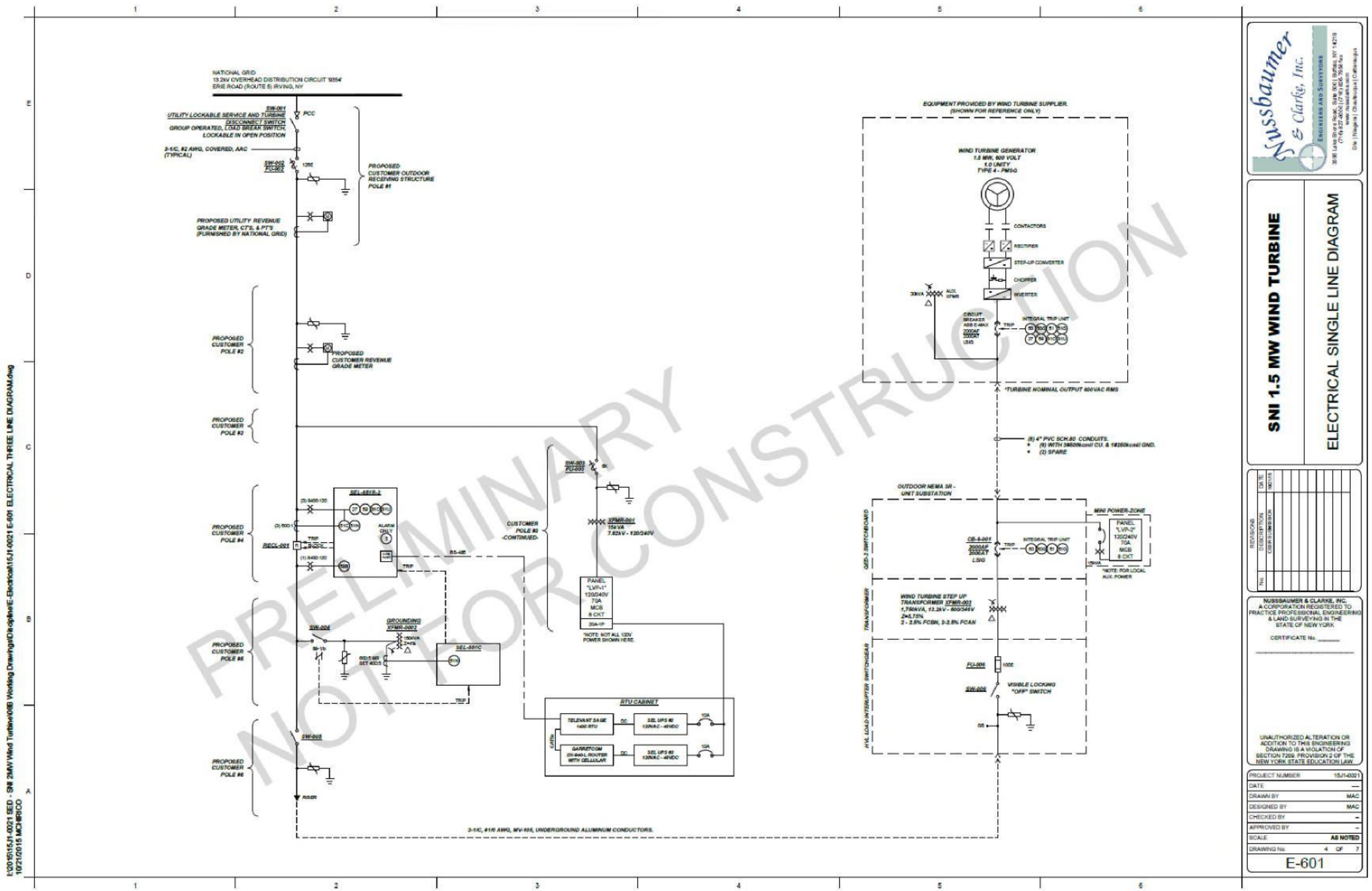
15.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	2/22/2016	Final CESIR for Seneca Nation of Indians

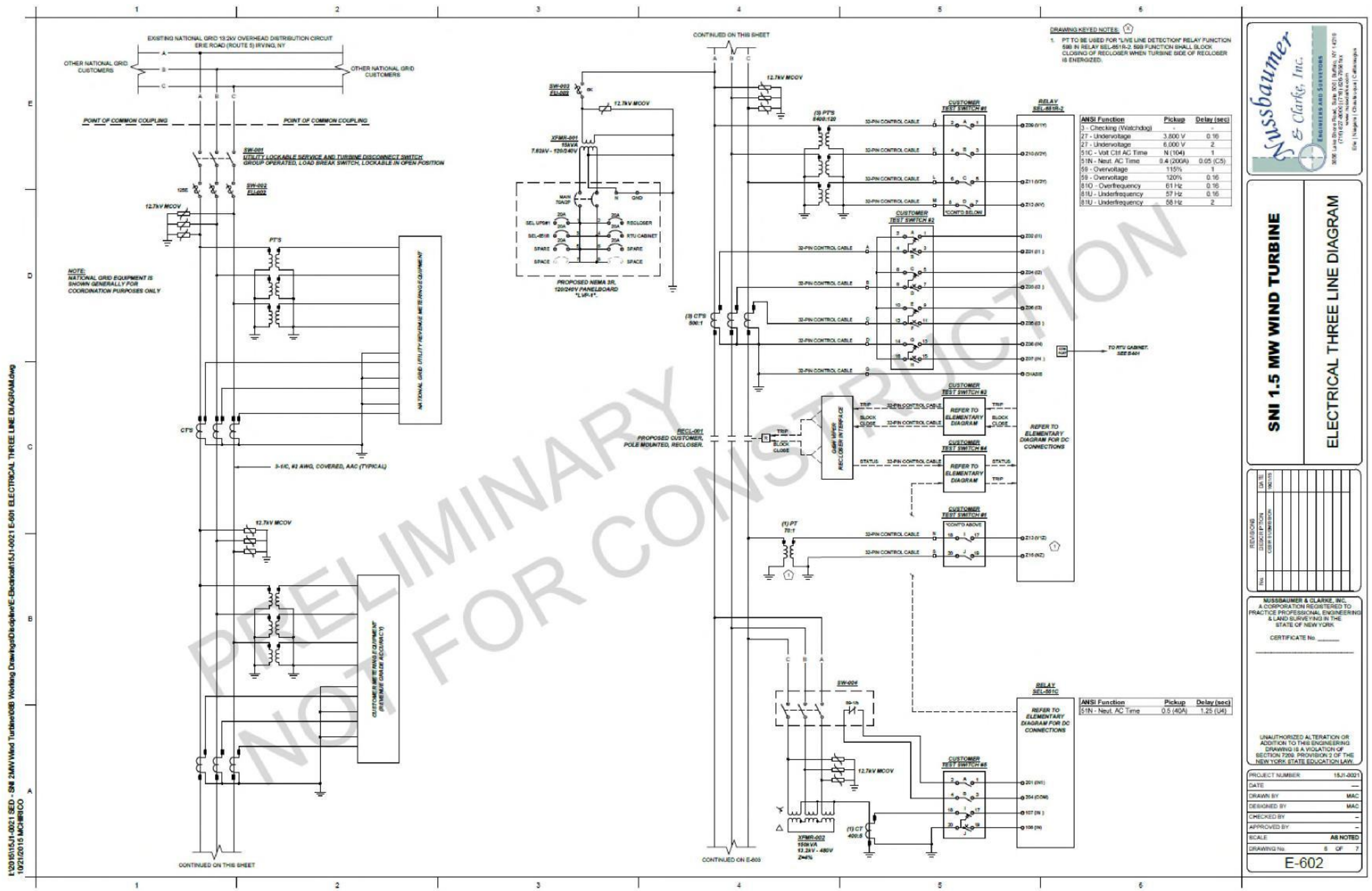
ATTACHMENT 1: GIS of Distribution Feeder and Necessary Changes



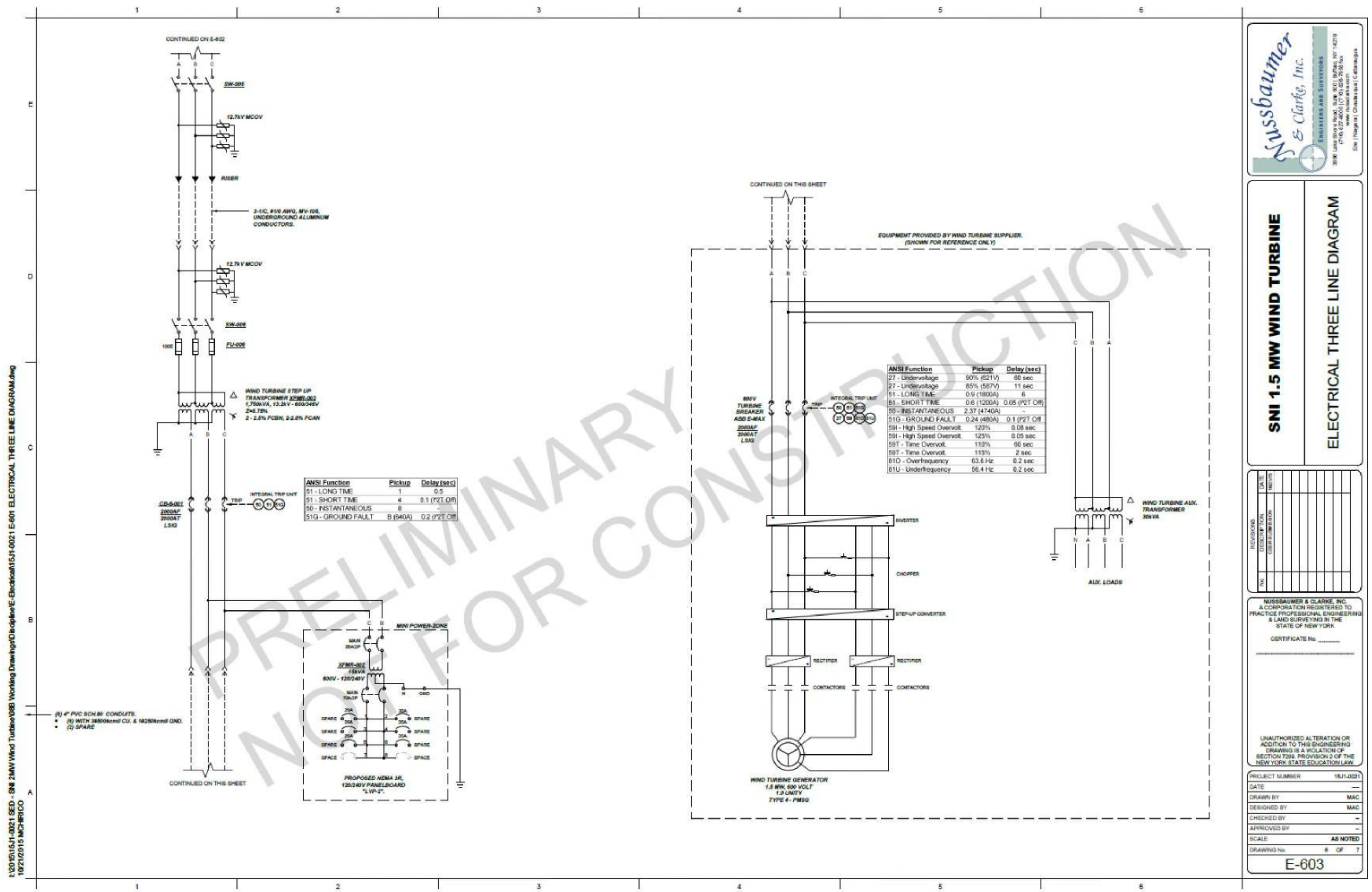
ATTACHMENT 2: Interconnection Customer's Proposed One-Line Diagram E-601



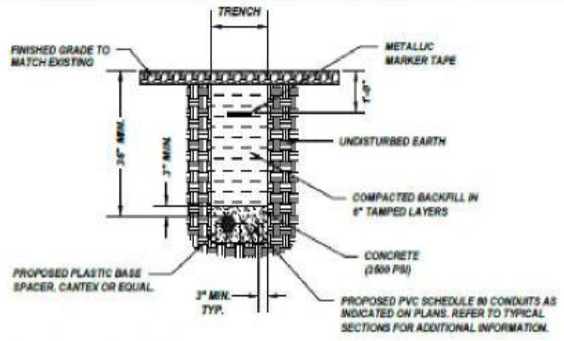
ATTACHMENT 3: Interconnection Customer's Proposed Three-Line Diagram E-602



ATTACHMENT 4: Interconnection Customer's Proposed Three-Line Diagram E-603

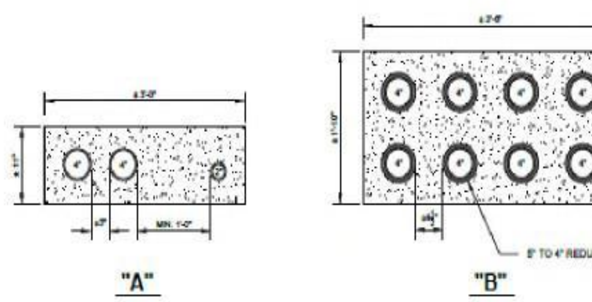


ATTACHMENT 5: Interconnection Customer's Proposed Site Plan E-101



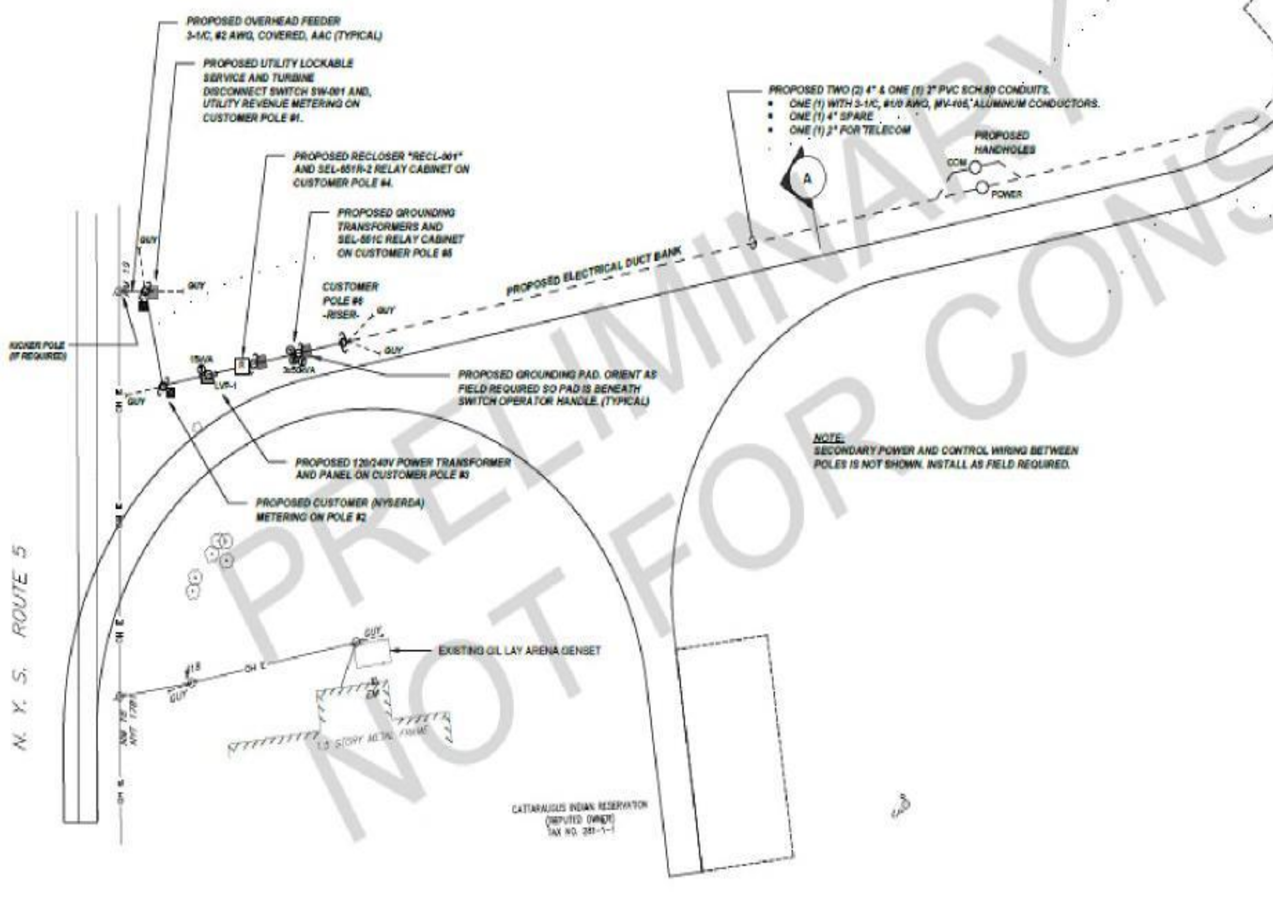
2 PROPOSED ELECTRICAL DUCT BANK (TYPICAL)

SCALE: NOT TO SCALE



3 PROPOSED DUCT BANK SECTIONS

SCALE: NOT TO SCALE



1 ELECTRICAL SITE PLAN

SCALE: 1" = 40'-0"

VII. Final Design

Sent to Lizana Pierce & Jami Ally via email due to size.

VIII. Vensys

Vensys is a German manufacturer with state-of-the art technology. VENSYS wind turbines don't need high-maintenance gear units that are highly susceptible to wear. They are based on the generator concept of a synchronous machine with permanent magnet excitation. The rotating speed of the rotor is transferred directly to the multi-polar generator. The gearless technology combined with savings in excitation power result in a higher energy yield. With the 1.5 MW platform, the generator is cooled by outside air. The VENSYS frequency converter is also air-cooled.

Permanent Magnet Technology

High energy conversion efficiency = higher yield
VENSYS makes it possible to utilize permanent magnet technology as used in electric drives in navigation and electric vehicles for wind energy technology. VENSYS wind turbines are equipped with a directly driven synchronous generator with permanent magnet excitation. High-quality permanent magnets are fixed to the outer shell of the rotor. Simple yet innovative.
No excitation losses = even higher yield

In contrast to electrical excitation, permanent magnet technology does not have the disadvantage of additional excitation losses. The savings in excitation power are thus fully available as additional energy yield in VENSYS wind turbines.

This is a major asset especially when working in the partial-load range and helps to reduce the heat in the generator. Also, there is no need to transfer the excitation power with slip rings

The Blade Pitch System

Special technical feature of VENSYS wind turbines are the lubrication-free and low-maintenance toothed belt which transmits the force between the pitch drive and the rotor blade. The drive system minimizes wear and increases safety.

The drive of the blade is equipped with an energy storage device, which makes it possible to drive the blades into braking position in the event of a grid blackout. The capacitors can deliver the necessary power even in low temperatures.

VENSYS 1.5 MW

Rev. E

Date: 14th September 2011

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1. Content

2. List of changes

Changes in the content of this technical description lead to a new version with updated revision number.

No.	Revision No.	Page	Remark	Date	Name
1	Rev. A		first issue	13.11.06	Weinhold
2	Rev. B	all	change of the company's adress	01.09.08	Maringer
3	Rev. C	3,14	adaption of WEC types, power curve	03.04.09	Maringer
4	Rev. D	5, 9	new graphics	01.02.10	Maringer
5	Rev. D1	15-17	pages taken out	14.10.10	Maringer
5	Rev. E	3,6,7,10,15	VENSYS87 addded	14.09.11	Weber-Winter

The following „Technical description of the VENSYS 1.5 MW" was updated in October 2010. Further development of the product in the future can involve changes in the current version of the description. In this case, the technical description will be updated. This revision dated October 2010 is subject to technical changes.

3. Types of WECs

This technical description is valid for the following types of wind energy converters:

type	hub height	rotor blade	wind zone	wind class
VENSYS 70	65 m	LM34	DIBt 3	IEC IIA
VENSYS 70	85 m	LM34	DIBt 3	IEC IIA
VENSYS 77	61,5 m	LM37.3P2	DIBt 3, 2	IEC IIA, IIIA
VENSYS 77	85 m	LM37.3P2	DIBt 3, 2	IEC IIA, IIIA
VENSYS 77	100 m	LM37.3P2	DIBt 2	IEC IIIA
VENSYS 82	70 m	LM40.3P2	not available	IEC IIIA
VENSYS 82	75 m	LM40.3P2	not available	IEC IIIA
VENSYS 82	85 m	LM40.3P2	DIBt 2	IEC IIIA
VENSYS 82	100 m	LM40.3P2	DIBt 2	IEC IIIA
VENSYS 87	85 m	LM42.1P2	DIBt 2	IEC IIIB
VENSYS 87	100 m	LM42.1P2	DIBt 2	IEC IIIB

4. General information

The VENSYS 1.5 MW – wind energy converters are gearless wind turbines with three-blade rotor, pitch control and a rated power output of 1.500 kW. They produce electric current which is fed directly into the public grid. The turbines can be operated at variable speed, thus reaching the optimal aerodynamic rotor efficiency at every wind speed.

The VENSYS 1.5 MW wind energy converters stand out due to the:

- **highly efficient multipole generator**

  -> direct connection between the multipole generator and the rotor
  - no gearbox needed
  - practical application of innovative technology

  -> synchronous generator with permanent magnet excitation
  - high efficiency, especially at partial load
  - no energy loss in the field coils
  - no slip rings needed for the transmission of the field current

  -> generator as external rotor
  - compact design, small diameter of the generator

  -> passive air cooling system
  - no temperature control needed

- **safety system and blade pitch system**

  -> toothed belt drive used for pitching the blades
  - no lubrication needed
  - low-wear
  - low-maintenance

  -> double layer capacitors for energy storage
  - no need for failure-prone and heavy lead-gel batteries
  - brushless drive motor
  - increased lifetime
  - no maintenance necessary

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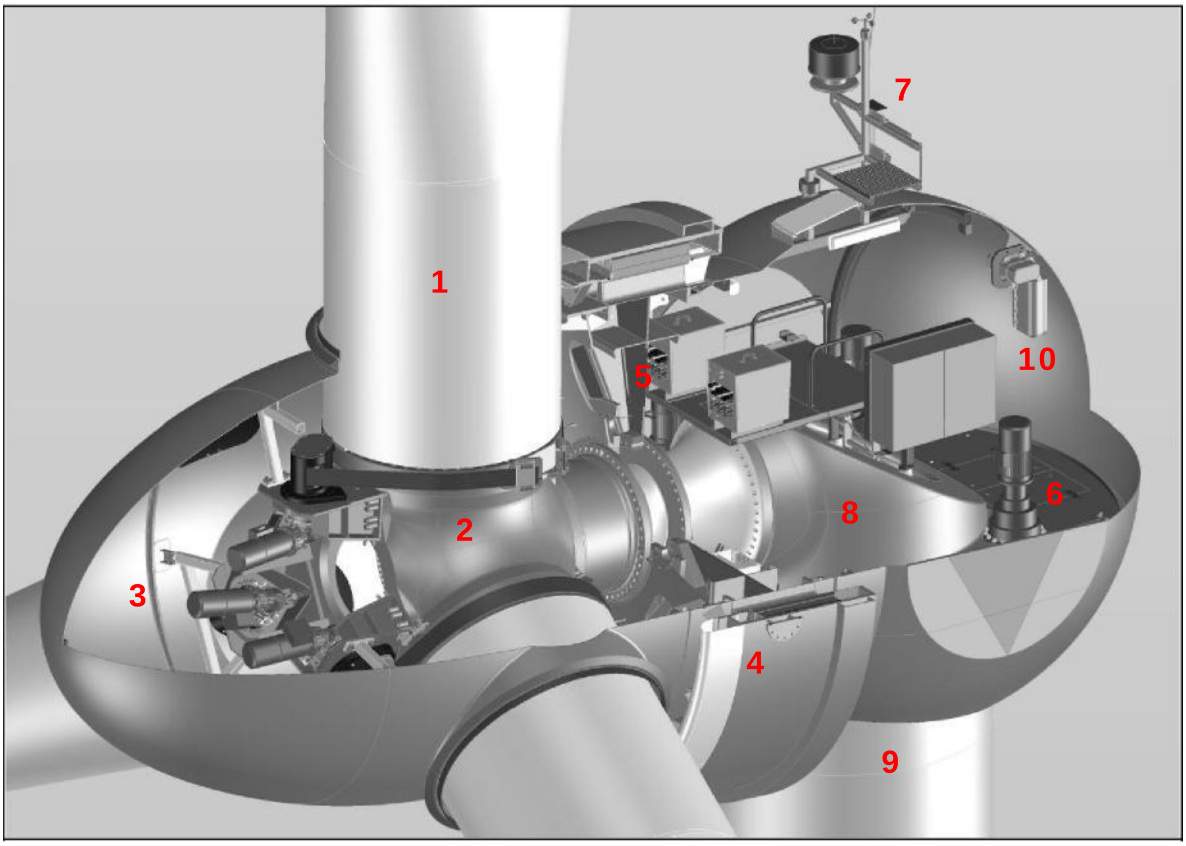
5. The design of the base frame



Picture 1: VENSYS 1.5 MW – Base frame

1	Rotor blade	**6**	Yaw drive
2	Casted hub	**7**	Wind measuring equipment with obstruction lights
3	Blade pitch system	**8**	Main frame
4	Generator-rotor	**9**	Tower
5	Generator-stator	**10**	Auxiliary crane

6. The rotor

The aerodynamically formed rotor blades of the VENSYS wind energy converters dissipate the energy of the wind into the rotary motion of the rotor.

The three blades of the VENSYS 1.5 MW turbine's rotor are moved with an active blade pitch system (pitch). The blades themselves are made of glasfiber reinforced plastic (GRP). The rotor has a diameter of 70 m, 77 m, 82m or 87 m and the swept area amounts to 3.886 m^2, 4.637 m^2, 5.026 m^2 resp. 5.890 m^2. Lightning strokes are transmitted from the rotor blade via the casted parts and the tower into the foundation.

The rotor blades are screwed with the slewing bearings, which connect them to the casted hub. The pitch system moves the rotor blades automatically according to the wind speed, to limit the rotor in its power output or to slow the rotor down without causing wear in the components. During maintenance, the rotor is locked with a positive-fitting locking system.

7. The multipole synchronous generator

The generator dissipates the rotational energy of the rotor into electric current. It is a multi-pole synchronous generator with permanent magnet excitation and is driven directly by the rotor that is to say that no gearbox is needed. The generator is composed of the parts:

- Generator-stator with three-phase winding
- Generator-rotor with permanent magnets

The generator operates wearfree and all components, with the exception of the main bearing, are maintenance-free.

- **The generator-stator**

  The stator is a welded construct which is fixed to the nacelle. It is used as supporting structure for the laminated core and the three-phase windings.

  The laminated core is made of single segment sheets. To reduce the eddy currents as far as possible, the sheets are insulated against each other. After the six-phase winding has been mounted, the stator is impregnated with high quality insulating resin.

  Cooling fins are punched into the electric sheets to create a larger surface for heat dissipation. The patented passive cooling system (DE 19636591C) leads the incoming air through an air duct directly on the outside of the laminated core. This cooling method makes it possible to encapsulate the electrically active parts, thus preventing corrosion on the windings.

  The power output of the turbine is increased with the wind speed and the temperature of the generator will rise. This heat must be dissipated to avoid overheating. However, at the same time, the increasing wind speed swells the flow speed of the air in the air duct and thus the cooling effect. This self-regulating mechanism avoids the use of active ventilators or pumps for the regulation the heat.

The generator-rotor

The generator-rotor of the VENSYS turbine is a welded construct that is designed as external rotor. The use of permanent magnets and the design as external rotor make it possible to keep the outer diameter of the generator considerably smaller compared to the usual design with field coils. The VENSYS 1.5 MW external rotor is only a bit larger than the diameter of the air gap, while the standard design protrudes considerably over the height of the laminated core and the stator's supporting structure. This special VENSYS-design offers many advantages: The smaller the generator, the lighter it is and so it is a lot easier to transport.

The generator-rotor is connected directly to the rotor of the turbine, which drives the generator directly. The permanent magnets on the inside of the rotor piling create the necessary magnetic field. The use of this direct driven multipole synchronous generator avoids the use of a main gearbox, which currently cause many problems in the megawatt turbines due to their limited lifetime and their sensivity to overload.

It has several advantages not to use a gearbox: First there will be no problems caused by the reduced lifetime or the sensivity to overload of the gearbox. Then there are no energy losses due to the gearbox, which are most obvious at partial load. Another advantage is that the noise emission of the turbine will be reduced, as gearboxes normally create at lot of noise, which must be damped with extensive silencing measures. Finally, there is no need for oil changes and no danger of oil leakages. The permanent magnets do not have the same energy losses as the field coils and the slip rings which are normally used to transport the necessary excitation energy.

All these advantages lead to a higher energy yield, lower insurance costs, an increased lifetime of the turbine and lower general expenses / costs for maintenance.

8. The converter

The converter and the transformer, which is located downstream to the converter system, connect the turbine with the public grid. Both components are located inside the tower base of the turbine, thus it is not necessary to install an additional, separate transformer station.

The converter, which has been especially designed for the use with a synchronous generator, feeds the whole power output of the turbine into the public grid. Thus, it is possible to decouple the generator totally from the grid. This feature makes it possible to operate the turbine at variable speed between 9 and 19 rpm (VENSYS 70) resp. 9 and 17.3 rpm (VEN-SYS 77, VENSYS 82, VENSYS 87). This improves the energy yield at partial load and reduces the loads on the turbine's structure at full load.

A 12-pulse uncontrolled rectifier with a step-up chopper, which is located downstream to the rectifier, is used on the generator side. This system is simple and robust and avoids voltage peaks (du/dt loads) in the generator's windings.
In the converter part on the grid side, two separate IGBT systems are uses per phase, leading to very low harmonic loads on the grid. The whole converter system is air-cooled.

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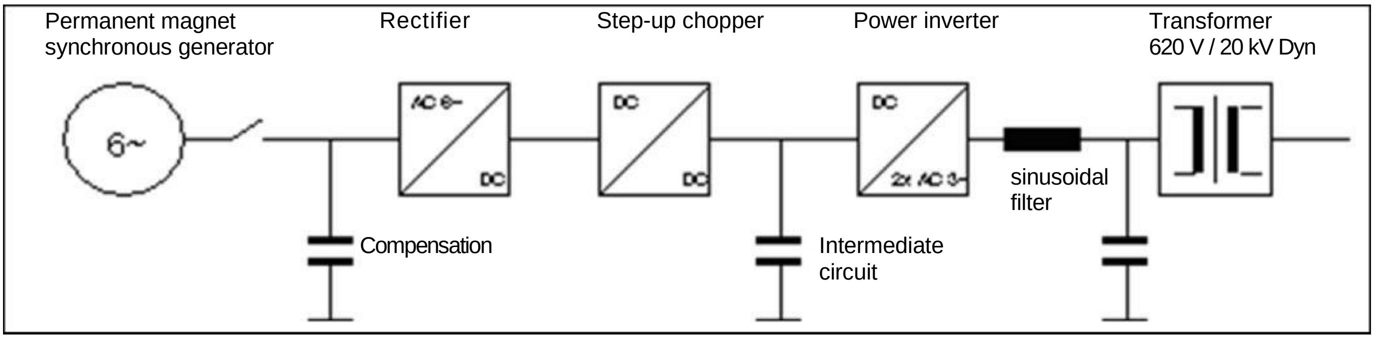

Picture 2: Design of the converter system

The VENSYS converter system offers the following advantages:

- no torque peaks in case of grid failures
- 50 Hz or 60 Hz grid frequency without hardware modification
- no need for angular transmitters on the generator
- symmetrical intermediate circuit avoids HF – loads on the generator side (leakage currents and du/dt – loads in the windings)
- no HF – loads in the tower cable
- two IGBT – power amplifiers to reduce the harmonic loads
- integrated grid filter
- extensive speed range
- high efficiency with uncontrolled rectifier
- no need for audio frequency suppressors
- freely adjustable power factor
- fixed power factor (only available for certain markets)
- control of the power factor to stabilize the grid voltage, even applicable if the turbine is not working
- meets the EON – guideline regarding the behavior of the turbine in case of grid failures

9. The blade pitch system and the braking system

The blade pitch system of the VENSYS 1.5 MW turns the rotor blades around their centre line (so called “pitching”) and is used to control the power output and to slow the rotor down. At rated wind speed and above, the power absorption of the rotor is limited to 1.500 kW by pitching the rotor blades, to avoid overloads in the generator and converter system. The control program of the turbine monitors constantly the power output of the turbine and the pitch angle of the blades and will adapt them to the current wind conditions. Thus the power output of the turbine is optimized by this variable speed operation.

The three blade pitch systems are also used as main brake. To this end, the systems move the rotor blades into their safe vane position, reducing the rotor’s drive torque resp. reverse it and act thus as a brake. Hence the speed is reduced until the turbine is stopped. The blade pitch system is made of three independent electrical motors with energy storage, which transmit their energy with toothed belts. Each motor is composed of a brushless AC motor, a

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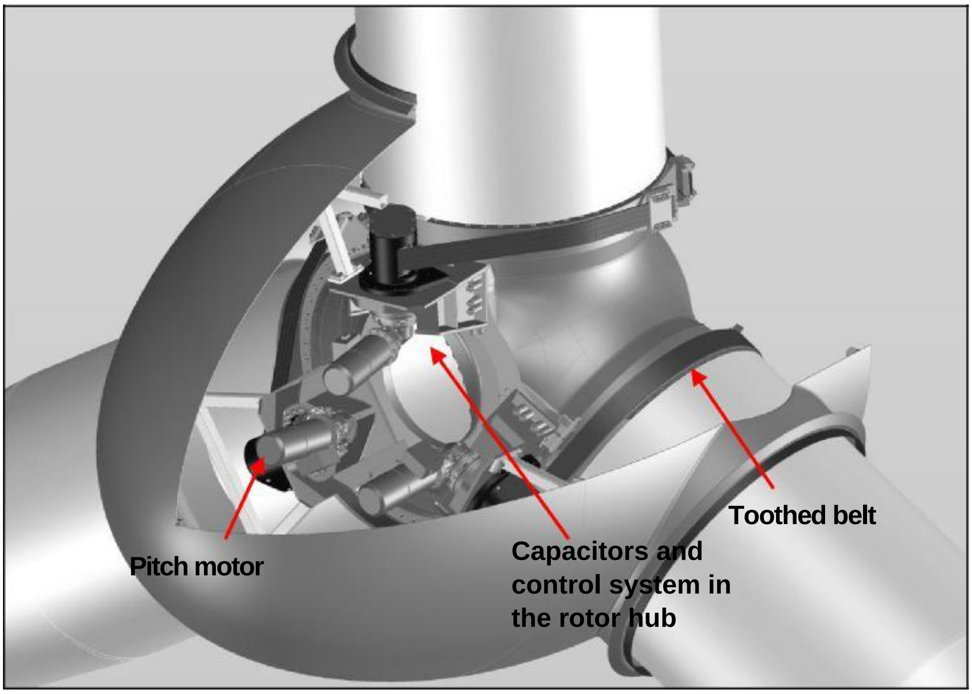
converter, a power supply unit, an absolute position sensor and energy storage made of double-layer capacitors. No heavy lead-gel accumulators are needed. All signals are transmitted with a DC isolated profibus connection, which is also protected against overvoltage.

The VENSYS 1.5 MW is the only wind energy converter that uses toothed belts for the transmission of the energy between motor and blade. This connection is insensitive to blows, as, in contrast to other methods, there are always several teeth in contact with the blade. The toothed belt does not need to be lubricated and is insensitive to humidity and dirt.



Picture 3: Design of the blade pitch system

10. The nacelle

The nacelle is used to transfer all static and dynamic loads, which affect the rotor and the generator, into the tower. It houses the top box, the auxiliary crane and the yaw system, which keeps the turbine in the direction of the wind. The nacelle is the supporting structure for the wind measurement equipment (anemometer / wind vane). It is basically made of three parts: a casted part for the transmission of the loads, an accessible platform and a casing made of GRP.

The casted part is connected with a slewing bearing which is fixed to the tower, thus forming the connection between tower and rotor resp. generator. The generator-stator and the shaft with its bearing are fixed with the casted part, whereas the generator-rotor and the rotor are pivot-mounted on the shaft. The platform, which is fixed to the casted part, supports the necessary components for the system.

The yaw system is fixed directly to the casted part. The nacelle can be reached by climbing a ladder from the upmost tower platform and offers enough room on the inside for the maintenance personnel, who can access all components well. Beneath the auxiliary crane on the opposite side of the rotor, there is a hatch through which loads can be lifted from the ground into the nacelle using the crane.

11. The yaw system

The yaw system adjusts the position of the rotor towards the direction of the wind that is detected by the wind vane on top of the nacelle. The data recorded by this system are the basis for the necessary corrections of the nacelle's position, which is calculated by the main computer. The nacelle is moved by electrical yaw motors, which are connected to the external tooth system of the bearing between tower and casted part.

The nacelle is fixed in its position by hydraulically operated brake callipers. These callipers mesh with the brake disc which is screwed with the tower. If the wind speed is very high, the nacelle is moved into the direction of the wind even if the turbine is not operating. Thus, the loads affecting the turbine due to the strong wind are reduced.

12. The control system

The VENSYS 1.5 MW turbine is microprocessor controlled, i. e. it adjusts itself automatically to the ambient conditions. Thus it is not necessary to monitor or control the turbine constantly from the outside. A control unit with appropriate management software takes over all these functions.

The control unit is supplied by a variety of sensors with all information regarding the ambient conditions (e. g. wind speed, wind direction) and the state of the turbine itself (e. g. power output, rotor speed, blade angle, temperatures). Based on this information, the management software controls the turbine in a way that it is constantly in a safe and optimal condition and that the best possible energy yield is guaranteed.

At partial load, the rotor speed is adjusted to the current wind speed by changes in the generator output. At full load and above, the output is limited by changes in the blade angles. This concept converts gusts into a speedup and not into torque peaks, as it is the case with the conventional design with fixed speed. Compared to these conventional systems with fixed speed, the VENSYS 1.5 MW turbine is able to "absorb" sudden changes in the wind speed. Here, the rotor is also used as temporary energy storage.

The turbine operates in a wind speed ranging between 3 m/s and 25 m/s (VENSYS 70) or 22 m/s (VENSYS 77, VENSYS 82 and VENSYS 87). If the wind speed exceeds this maximum, the turbine is stopped automatically.

The turbine's data, including operational data, log sheets and information about the status of the turbine, can be retrieved with a remote control system composed of a computer with modem and telephone connection.

13. The tower

The steel tubular tower supports the nacelle and the rotor and transfers the loads and torques, which affect the turbine, into the foundation.

Depending on its height, the tower is made of several segments which are connected with screwed flange connections. The so called embedded steel can connects the tower with the foundation. The yaw bearing is screwed directly onto the top of the upmost tower segment. The tower base houses the control cabinet with the control system, the frequency converter, the transformer and the medium voltage switch gear. On the inside of the tower, a ladder with a guard rail in its middle leads up to the nacelle and platforms are mounted in regular distances. From the upmost platform, a separate ladder leads into the nacelle. Tower and nacelle are both equipped with appropriate illumination. Emergency lights guarantee the safety in case of a power cut.

The power cables as well as the failure-free fibre optic cables used for the transmission of the signals are laid inside of the tower. They are suspended in the upper section to enable the movement of the nacelle. After several turns, the turbine untwists the cables automatically. A staircase and a door grant access to the tower from outside.

14. The foundation

The foundation of the VENSYS wind energy converters ensures the stability of the turbines. It is a flat foundation made of reinforced concrete. A special embedded steel can transfers the loads from the tower into the foundation.

The foundation is constructed in two steps: First, the foundation plate is concreted. This plate is then used as support for the embedded steel can. After the reinforcement has been added, the base of the foundation is concreted as well.

15. The technical data of the VENSYS 70

Power output	Cut-in wind speed	3 m/s
	Rated wind speed	14,5 m/s*
	Cut-out wind speed	25 m/s
	Survival wind speed	59,5 m/s

Rotor	Diameter	approx. 70 m
	Swept area	3.886 m^2
	Speed range	9 - 19 rpm
	Speed limit	variable, microprocessor controlled
	Number of blades	three
	Type of rotor blades	LM 34.0
	Power control	Pitch
	Brake system	Single blade pitch system, triple re-dundant
	Holding brake	Bolt lock

Tower	Type	steel tube
	Hub heights	65 m and 85 m

Foundation	Type	Flat foundation

Generator	Type	Multipole synchronous generator with permanent magnet excitation
	Design	Direct drive
	Rated power	1.500 kW
	Rated voltage	Y 690 V
	Insulation class	F

Converter	Type	IGBT - converter

Yaw system	Design	electric motor
	Yaw system	Brake, ten-fold

Transformer	Type	Cast resin transformer 1.670 kVA
	Input voltage	620 V at 50 Hz 600 V at 60 Hz
	Output voltage	20 kV (others are possible)

Control system	Operating mode	microprocessor controlled, DFÜ

Certification	all hub heights	DIBt WZ III, IEC IIA

*10 % turbulence

16. The technical data of the VENSYS 77

Power output	Cut-in wind speed	3 m/s
	Rated wind speed	13,0 m/s*
	Cut-out wind speed	22 m/s
	Survival wind speed	52,5 m/s (IEC IIIA) 59.5 m/s (IEC IIA)
Rotor	Diameter	approx. 77 m
	Swept area	4.637m²
	Speed range	9 -17.3 rpm
	Speed limit	variable, microprocessor controlled
	Number of blades	three
	Type of rotor blades	LM 37.3P2
	Power control	Pitch
	Brake system	Single blade pitch system, triple redundant
	Holding brake	Bolt lock
Tower	Type	Steel tube
	Hub heights	61.5 m, 85 m and 100 m
Foundation	Type	Flat foundation
Generator	Type	Multipole synchronous generator with permanent magnet excitation
	Design	Direct drive
	Rated power	1.500 kW
	Rated voltage	Y 690 V
	Insulation class	F
Converter	Type	IGBT - converter
Yaw system	Design	electric motor
	Yaw system	Brake, ten-fold
Transformer	Type	Cast resin transformer 1.670 kVA
	Input voltage	620 V at 50 Hz 600 V at 60 Hz
	Output voltage	20 kV (others are possible)
Control system	Operating mode	microprocessor controlled, DFÜ
Certification	for 61.5 m and 85 m for 100 m	DIBt WZ III, IEC IIA DIBt WZ II, IEC IIIA

*10 % turbulence

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17. The technical data of the VENSYS 82

Power output	Cut-in wind speed	3 m/s
	Rated wind speed	12,5 m/s*
	Cut-out wind speed	22 m/s
	Survival wind speed	52,5 m/s

Rotor	Diameter	approx. 82 m
	Swept area	5.026 m²
	Speed range	9 -17.3 rpm
	Speed limit	variable, microprocessor controlled
	Number of blades	three
	Type of rotor blades	LM 40.3P2
	Power control	Pitch
	Brake system	Single blade pitch system, triple redundant
	Holding brake	Bolt lock

Tower	Type	Steel tube
	Hub heights	70 m 75 m 85 m 100 m

Foundation	Type	Flat foundation

Generator	Type	Multipole synchronous generator with permanent magnet excitation
	Design	Direct drive
	Rated power	1.500 kW
	Rated voltage	Y 690 V
	Insulation class	F

Converter	Type	IGBT - converter

Yaw system	Design	electric motor
	Yaw system	Brake, ten-fold

Transformer	Type	Cast resin transformer 1.670 kVA
	Input voltage	620 V
	Output voltage	20 kV (others are possible)

Control system	Operating mode	microprocessor controlled, DFÜ
Certification	all hub heights	IEC IIIA

*10 % turbulence

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18. The technical data of the VENSYS 87

Power output	Cut-in wind speed	3 m/s
	Rated wind speed	9,9 m/s*
	Cut-out wind speed	22 m/s
	Survival wind speed	52,5 m/s

Rotor	Diameter	approx. 87 m
	Swept area	5.890 m^2
	Speed range	9 -17.3 rpm
	Speed limit	variable, microprocessor controlled
	Number of blades	three
	Type of rotor blades	LM 42.1P2
	Power control	Pitch
	Brake system	Single blade pitch system, triple redundant
	Holding brake	Bolt lock

Tower	Type	Steel tube
	Hub heights	85 m 100 m

Foundation	Type	Flat foundation

Generator	Type	Multipole synchronous generator with permanent magnet excitation
	Design	Direct drive
	Rated power	1.500 kW
	Rated voltage	Y 690 V
	Insulation class	F

Converter	Type	IGBT - converter

Yaw system	Design	electric motor
	Yaw system	Brake, ten-fold

Transformer	Type	Cast resin transformer 1.670 kVA
	Input voltage	620 V
	Output voltage	20 kV (others are possible)

Control system	Operating mode	microprocessor controlled, DFÜ
Certification	all hub heights	IEC IIIB

*10 % turbulence

Power Curve

VENSYS 82 - 1.5 MW

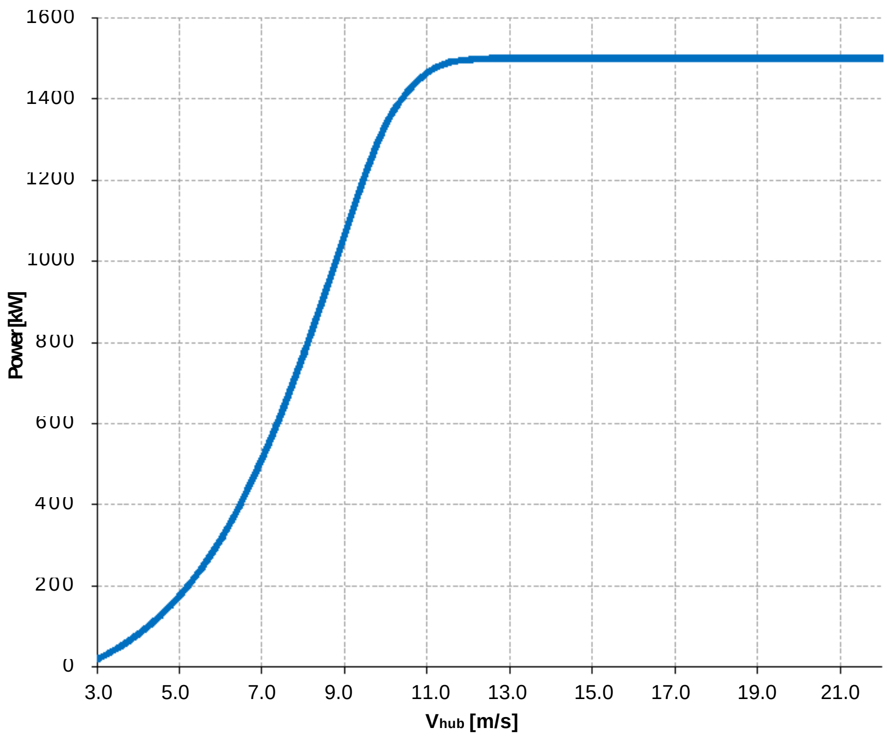
Wind turbine data:

Turbine:	VENSYS 82
Rated power:	1500 kW
Rotor diameter	82 m
Cut-in wind speed:	3.0 m/s
Cut-out wind speed:	22.0 m/s

Determination for the power curve verification:

Verification according to:	IEC 61400-12-1:2005
Wind speed at hub height:	10 min average
Measurement of power:	Low voltage side, 620 V
Air density:	1.225 kg/m^3
Turbulence intensity:	6% ≤ Ti ≤ 12 %
Wind shear exponent:	0 ≤ α ≤ 0.2
Wind flow inclination:	0° ± 2°

V_{hub}[m/s]	Power [kW]
3.0	20.7
3.5	48.7
4.0	83.8
4.5	126.7
5.0	179.4
5.5	244.1
6.0	320.8
6.5	412.7
7.0	518.3
7.5	639.7
8.0	775.2
8.5	921.9
9.0	1073.3
9.5	1222.8
10.0	1343.8
10.5	1418.9
11.0	1466.8
11.5	1489.6
12.0	1496.3
12.5	1499.3
13.0	1500.0
22.0	1500.0

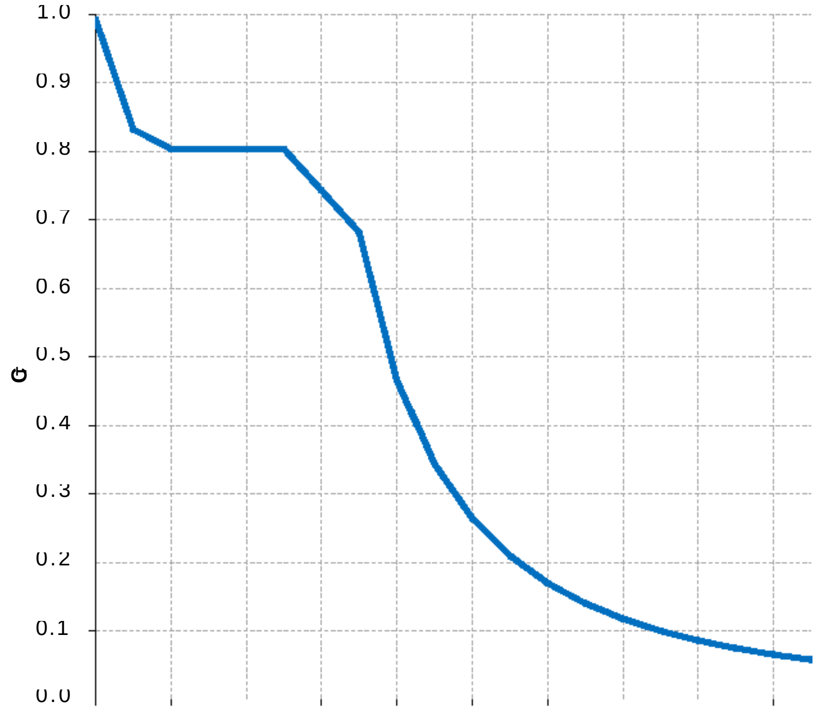


Subject to technical modifications

Thrust coefficient

Simulation: static

V_{hub}[m/s]	C_T
3.0	0.993
4.0	0.832
5.0	0.804
6.0	0.804
7.0	0.804
8.0	0.804
9.0	0.743
10.0	0.682
11.0	0.467
12.0	0.343
13.0	0.264
14.0	0.209
15.0	0.170
16.0	0.140
17.0	0.118
18.0	0.100
19.0	0.086
20.0	0.075
21.0	0.065
22.0	0.058



IX. Post-Construction Monitoring

The Seneca Nation's Conservation Department has conducted post-construction monitoring surveys three times a week since the turbine was commissioned. There have been no negative impacts to any avian or bat species since commissioning. The Nation will continue to monitor per the attached PCM plan below.

POST-CONSTRUCTION AVIAN AND BAT FATALITY MONITORING PLAN

FOR

THE SENECA NATION WIND TURBINE

CATTARAUGUS TERRITORY
ERIE COUNTY, NEW YORK

AUGUST 2016

CONTENTS

1.0 INTRODUCTION

The Seneca Nation (SNI), with the assistance of funding through the U.S. Department of Energy's (DOE) Tribal Energy Program under the Office of Energy Efficiency and Renewable Energy, has constructed a 1.5-megawatt wind turbine on SNI-owned sovereign lands in the Cattaraugus Territory, Erie County, New York. The hub height of the wind turbine is 278 feet (85 meters) with a rotor diameter of 270 feet (blade length of approximately 135 feet) (82 meters) and maximum height (hub height plus blade length) of approximately 413 feet. The wind turbine is being constructed on approximately 1.5 acres of land northeast of Lucky Layne Road on the east side of New York State Route 5. The wind turbine site is largely undeveloped land consisting of previously cleared land, grasses, shrub vegetation, and forested land. The site is adjacent to a larger SNI land parcel with parking lots and a mix of commercial structures including the Gil Lay Memorial Sports Arena and SNI Bingo Hall.

In October 2015, DOE and SNI published the *Environmental Assessment for the Seneca Nation Wind Turbine Project* (DOE/EA-2004; Wind Turbine EA) (DOE 2015) and subsequent Finding of No Significant Impact pursuant to the requirements of the *National Environmental Policy Act* (42 U.S.C. § 4321 et seq.). In the EA, DOE and SNI concluded that the wind turbine project "may affect, but is not likely to adversely affect" the federally threatened northern long-eared bat (*Myotis septentrionalis*). However, because of uncertainty over the presence of the northern long-eared bat and the potential for migratory birds in the project vicinity, SNI has decided to conduct avian and bat mortality monitoring. This *Post-Construction Avian and Bat Fatality Monitoring Plan* describes those actions that SNI is taking to monitor any potential bird and bat mortality caused by the wind turbine.

2.0 MONITORING OBJECTIVES

The objectives of this Plan are to accomplish the following:

- Document the species of bird or bat fatalities in the project vicinity, if any;
- Estimate the number of bird and bat fatalities, if any, during the spring, summer, and fall based on standardized searches with adjustments for searcher efficiency, carcass removal rates, and a search area correction factor (i.e., when searching less than 100 percent of the area); and
- Use the data and information to identify the potential need for any adjustments to wind turbine operations.

3.0 WIND TURBINE CURTAILMENT

Research at operating wind energy facilities suggest that curtailing, or delaying the operation of a turbine until winds reach a higher speed (i.e., the "cut-in" wind speed), will significantly reduce bat mortality because bats are known to be more active at lower wind speeds and reduce activity (foraging, migrating, and swarming) at higher wind speeds and, thus, minimize their exposure to rotating blades (Horn et al. 2008; Baerwald et al. 2009; Arnett et al. 2011). In the Wind Turbine EA, SNI decided on a cut-in wind speed of 6.9 meters per second (15.4 miles per hour) between dusk and dawn from April 1 through October 31. This time of day (darkness) and year (late spring through early fall) coincides with the time of greatest potential bat activity and bird migration. This curtailment speed may be modified in the future based on results of the monitoring studies described in this plan (see Section 7).

4.0 MONITORING PROTOCOL

The monitoring protocols include all the actions and processes undertaken to achieve the objectives specified in Section 2. Field procedures have been prepared for many of the protocols described in the following sections to provide specific guidance and direction to the SNI field staff implementing these actions. The field procedures will also ensure that monitoring activities are uniformly and consistently implemented regardless of who performs the tasks. The procedures also will provide training documents for the SNI staff.

4.1 Delineation of Search Area and Visibility Mapping

4.1.1 Search Area

The search area comprises the area surrounding the base of the wind turbine on which birds and bats are likely to fall if struck by the turbine blades. There are several recommendations for the size of the search area, such as maximum tip height of the turbine measured along the ground from the tower base, twice the turbine blade length, 50 percent of tip height, rotor hub height, and one and one-half times the rotor diameter. Other studies suggest that most bat mortalities occur within a smaller area around the base of the turbine. Poulton and Erickson (2010) found that bat carcasses were generally found within 130 feet of the tower and that nearly all bat fatalities occurred within a radius of 50 percent of the tip height distance measured along the ground. Kerns and Kerlinger (2004) reported that most bat fatalities fell within a 98-foot (30-meter) radius around the base of the turbine. Bird fatalities typically are found over a larger area than bat fatalities. SNI defined the search area surrounding the wind turbine in conjunction with characteristics of the remaining vegetation surrounding the tower.

4.1.2 Vegetation and Visibility Mapping

The ability to find carcasses (i.e., searcher efficiency), if present, is greatly dependent on vegetation. Bare ground and short-mown grass fields would have the greatest visibility for finding carcasses. Areas that are forested or covered with shrub thickets are typically unsearchable. SNI has defined the types of land cover surrounding the wind turbine as well as the different visibility classes.

4.1.3 Searchable Area

The searchable area is a subset of the search area discussed in Section 4.1.1, selected because it is the area in which fatalities are reasonably expected to be found based on vegetation characteristics (see Section 4.1.2). The searchable area is the area that would actually be searched to locate any potential bird and bat fatalities; this area has been delineated, marked in the field, and will be mapped in a geographic information system (GIS).

4.2 General Survey Protocol

General search protocol covers a variety of survey procedures for conducting the field surveys. These include establishing and marking of transects, determining the period and frequency of surveys, monitoring weather, and searching for the carcasses.

4.2.1 Transects

Transects are the linear paths that are walked while searching for bird or bat carcasses. The transects for the SNI wind turbine are spaced approximately 16 feet (5 meters) apart to allow about 8 feet of searchable space on either side. Field surveyors could space transects closer together if vegetation height reduces visibility. Although transects are typically linear in orientation, the actual search path used by a surveyor can or should be a zig-zag path centered on the transect line to allow closer inspection of the ground area.

SNI has established transects and marked them within the entire searchable area to ensure complete coverage. Transects will be mapped and integrated into a GIS map coverage of the study area. Pre-establishing and marking transects makes it easier to conduct consistent, repeated surveys.

4.2.2 Survey Period and Frequency

The survey period is the annual period during which birds and bats are potentially present and most at risk for mortality caused by the wind turbine. For the SNI wind turbine, this time period is April 1 through October 31, as specified in the Wind Turbine EA (DOE 2015). This is the time period in which fatality surveys will be conducted. Although monitoring at other wind energy facilities in the United States indicates that mortality can occur throughout this period, the data clearly suggest that, at least for bats, a higher rate of mortality occurs in August and September during a period of increased bat activity, possibly related to breeding and fall migration (Arnett et al. 2008; Baerwald and Barclay 2011).

Survey frequency is how often surveys are conducted. Frequency is often expressed as a search interval or number of days between successive surveys. This interval maybe lengthened or shortened depending on the estimated carcass removal rates (see Section 4.3). If carcasses are being actively scavenged and removed (e.g., avian or mammalian predators, domestic cats, or insects), a shorter search interval may be necessary.

The distribution of potential mortalities across the annual time period is important not only for understanding potential impacts to birds and bats but also from a wind turbine operational perspective. Therefore, surveys are distributed throughout April 1 through October 31 to coincide with major ecological events such as peak spring raptor and songbird migration and spring bat dispersal (April and May), resident bird and bat activity (June and July), and fall bird and bat migration (August through October). Both birds and bats are more vulnerable to turbine blade strikes during periods of increased activity and movement (e.g., migration, foraging, and breeding). Until data are obtained from the carcass removal rate trials, SNI will conduct surveys using a 7-day search interval; that is, transects would be walked, searching for bird or bat carcasses every 7 days. Once the data are obtained, the search interval will be reevaluated annually between November and March, and any changes will be documented by revising the implementing survey protocol. If surveys indicate that few or no fatalities occur during certain time periods, potential adjustments to the turbine cut-off speeds could be justified (see Section 7).

4.2.3 Weather Monitoring

Weather influences the activity of both birds and bats. During stormy periods of rain and/or high winds, birds and bats are less likely to be active. Conversely, activity is likely to increase during calm weather (Baerwald and Barclay 2011). Weather conditions during the field search will be recorded along with the general weather conditions during the night hours preceding the search and several days prior to the search. The overnight weather conditions can affect the number of birds or bats that will fly and how they are distributed in the airspace. Conditions to note include temperature (minimum temperature for overnight conditions), average wind speed and direction, cloud cover and precipitation, and moon phase. Surveyors will use data from a local weather station or the nearest National Weather Service station.

4.2.4 Carcass Searches

Searches will be initiated in the early morning. If multiple surveyors participate, the surveyors will slowly walk parallel transects, looking for carcasses until the entire searchable area has been covered. If a carcass or suspected mortality ("e.g., a feather spot") is found, the location will be marked with a plastic surveyor's flag and the search continued until the area is covered. After the search has been completed, each carcass or location marked will be processed and documented.

Prior to moving any carcass or animal parts, the site will be photographed. Field surveyors will examine the carcass for evidence that it was killed by a turbine blade strike. The carcass will be collected in a resealable plastic bag along with a carcass identification number on waterproof paper. Not every carcass may be readily identifiable to species. Therefore, specimens will be kept frozen until an adequate identification can be made. The following information will be recorded on standardized data forms:

- Date, time, and surveyor name
- Distance and compass direction of carcass location from turbine tower
- Global positioning system coordinates of carcass
- Ground cover type and height
- General weather conditions (see Section 4.2.3)
- Carcass identification number
- Carcass species identification (if known), age (juvenile or adult), sex, and reproductive condition
- Carcass condition (evidence of decomposition or scavenging)
- Photographs of the carcass (ventral and dorsal sides) after the initial site photo is taken
- General notes as applicable (if it is believed the carcass was not a turbine-related fatality, state the reasons why)

Fatalities encountered outside the bounds of an official search (such as during routine maintenance) should be collected with the same information above but noted "incidental." Incidental fatality finds may or may not be added to the official calculation of mortalities depending on the circumstances.

4.3 Field Bias and Error Assessment

Two primary sources of bias and error in mortality surveys include: (1) scavenger removal of carcasses before they can be observed, and (2) searcher efficiency; that is, the probability a searcher (i.e., observer) detects (finds) the carcass given that it has not been scavenged and is available for detection. Both are components of the overall detection probability of a carcass that falls within the searchable area. Both sources of bias and error, if present, cause an underestimate of actual mortality and must be accounted for in fatality estimates.

4.3.1 Carcass Removal Estimation

Carcasses, whether caused by natural or human mortality factors, are typically scavenged (eaten or moved) or decompose over time, eventually disappearing from the environment. If the disappearance time of carcasses is shorter than the time between successive carcass searches (search interval), the loss of carcasses will negatively bias (underestimate) the estimate of mortality because the carcass is not available to be detected by a surveyor. In a review of bat fatality studies, Arnett et al. (2008) reported that bat carcasses lasted on average 1.9 to 12 days and bird carcasses as long as 23 days.

The potential bias from carcass disappearance is typically corrected by estimating a carcass disappearance rate using bat and bird carcasses found during previous fatality searches. However, SNI will not have carcasses available. Other studies, such as Drake et al (2012), have used mice or juvenile rat carcasses obtained from a pet store when bat carcasses were unavailable, ensuring the pelage color is similar to bat species (e.g., brown house mice [*Mus musculus*]). Carcasses are placed in the searchable area and the location clearly marked. The surveyors then visit the carcasses each day for the first four to five days and then every two to three days for days 6 through 15, and once per week until the trial end after 20 to 25 days unless all carcasses disappear before the end of the trial. Any carcasses remaining at the end of the trial will be removed. During each visit, the surveyor would record the condition of the carcass, if still present. Sources for bird carcasses may have to be researched; possibilities include gamebird breeders or animal control companies. Care must be taken not to place too many trial carcasses in a small area at one time to avoiding attracting scavengers. Decisions will be based on the size of the searchable area.

4.3.2 Searcher Efficiency

Observer bias is a function of both the individual person conducting the survey and the vegetation condition, which may result in an underestimate of mortality if carcasses are not found. In a review of bat fatality studies, Arnett et al. (2008) reported that searcher efficiencies ranged from 25 to 75 percent and was lowest in forested sites in the eastern United States (25 to 42 percent). That is, less than 50 percent of the carcasses available in the field for detection were actually being found.

Searcher efficiency trials are conducted by placing known carcasses within the searchable area prior to a regularly scheduled search without the knowledge of the surveyors. The search efficiency is calculated by dividing the number of known carcasses found by the total number placed in the field. Surrogate carcasses such as mice or juvenile rats of similar pelage color to bats may have to be used if bat carcasses are not available. The number of carcasses to be used (sample size) will be determined prior to the trials and based on the size of the searchable area. Carcasses used for the searcher efficiency trial may also be used for the carcass removal trials by marking and leaving the carcasses in the field.

4.4 Estimates of Fatalities

The probability of detecting a carcass is almost always less than 1 because of the influence of the searchable area, searcher efficiency, and carcass removal. Because of the less than perfect detection rates, there is not a simple, direct relationship between the number of recorded carcasses and the actual number of fatalities. A variety of formulas have been proposed to estimate the number of fatalities at wind turbines along with implementing software (Huso 2010; Huso et al. 2016). The impetus behind development of mathematical and statistical tools is the need to accurately estimate fatalities at commercial wind farms with multiple wind turbines. For the purpose of the SNI single wind turbine, a relatively simple estimator has been used while still accounting for some of the major known influences. The simple estimator is the following:

> $F = 1/\pi \sum c_j/g$, where F is the estimate of fatalities, c_j is the number of fatalities actually observed in one search in a series of consecutive search intervals (j), g is the probability of detection of a carcass (influenced by searcher efficiency and carcass removal), and π is the proportion of the search area that is actually searchable. An estimate of the probability of detection in its simplest form is $g = pr$, where r is the probability of persistence based on the carcass removal trials and p is the probability of being observed given that a carcass has persisted to be observed (searcher efficiency).

5.0 PROCEDURE DEVELOPMENT AND TRAINING

SNI has developed field implementing procedures for the different elements of the monitoring program to (1) provide specific direction and guidance to field staff, (2) use as training documents, and (3) ensure that tasks are consistently implemented regardless of who performs the task. The procedures include:

- Delineation of search area and vegetation mapping,
- Performing fatality searches and recording data,
- Searcher efficiency and carcass removal trials, and
- Estimating fatalities.

6.0 REPORTING AND DOCUMENTATION

Reporting and documentation includes all recordkeeping and documentation of actions performed and the results of those actions. Specific records and documentation have been identified in the applicable implementing procedures and include a GIS map of the searchable area, field forms and equivalent electronic records of searches, results of carcass removal and searcher efficiency trials, and estimates of fatalities. The development of reports will be evaluated after data are available and will be reassessed annually between November and March and documented in the reporting protocol.

7.0 ADAPTIVE MANAGEMENT

In addition to monitoring for potential impacts to birds and bats, another goal of this Plan is to evaluate whether operational changes to better utilize the wind resource are possible while maintaining the conservation goals for birds and bats. The SNI Wind Turbine Project has a relatively conservative 6.9 meter per second cut-in speed from dusk to dawn from April 1 through September 30. Depending on monitoring results, it may be possible to adjust the curtailment speed from 6.9 meters per second to 5.0 to 5.5 meters per second without measurably affecting bird or bat mortality rates and thereby increasing the amount of electricity generated. Research has concluded that the largest gain in reducing wind turbine mortalities occurs when cut-in speeds are adjusted from 3 to 4 meter per second (standard) to 5 to 5.5 meter per second (Arnett et al. 2011). Operational adjustments will be evaluated annually between November and March and will be based on the monitoring results. Adjustments will be documented in the operational protocols.

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X. Marketing/Publications

The Seneca Nation hosted a groundbreaking and ribbon cutting event that were attended by DOE, various Departments, various external partners, community members and numerous local media outlets. Articles and videos that were produced from those events and subsequent interviews are attached below.

DOE NREL ARTICLE

SENECA NATION OF INDIANS LEVERAGES DOE SUPPORT FOR WIND TURBINE PROJECT

April 28, 2016 - 11:19am

Tweet

Office of Indian Energy Chris Deschene (third from the right) was among those in attendance at a groundbreaking ceremony the Seneca Nation of Indians held for its 1.5-MW wind turbine on April 27. Photo by Ken Parker, Food Is Our Medicine.

The people of the Seneca Nation of Indians (Seneca Nation or SNI), an Iroquois Tribe, live and work on the same lands the Seneca people have inhabited for more than 1,000 years, which consist of five distinct and noncontiguous territories in western New York.

In 2003, SNI identified energy development as a strategic tool for exercising its sovereignty, creating economic development opportunities, providing new jobs and revenue streams, and effectively managing its energy resources. To build the political and business consensus needed to prioritize energy development and comprehensively address energy-related issues on SNI lands, the Seneca Nation sought support from the U.S. Department of Energy (DOE) to develop a strategic energy plan. SNI was competitively selected for a **First Steps grant** to develop its vision of energy self-sufficiency, quantify its energy needs and resources, and identify its energy options.

As the Nation prepared to transition from the planning phases to the development phase, it secured **additional DOE funding in 2007** to develop a formal energy organization focused on executing its strategic plan. In addition to federal support, by 2007 the Nation had garnered community buy-in for its strategic energy plan, broadly supported by tribal government and business leaders as a keystone of SNI's economic diversification strategy and a pathway to strengthening its sovereignty and economy while perpetuating the Tribe's cultural and environmental values.

Challenge:

As SNI transitioned from planning to development, it began to focus its efforts on achieving long-term energy security. In particular, SNI wanted to stabilize electricity rates of tribal members in the Cattaraugus Territory. Tribal members in the Allegheny Territory have access to low-cost electricity through New York Power Authority hydropower, but tribal members in the Cattaraugus Territory do not have access to this low-cost power and pay two to three times as much for electricity. SNI was also looking to displace fossil and nuclear fuel sources with SNI-owned renewable power, a long-term strategic goal of the Seneca Nation and a way to reduce greenhouse gas emissions. Finally, SNI sought to create a tribal utility organization, another key goal of the Seneca Nation's strategic energy plan.

"The Tribe saw opportunities to diversify its economy, reduce emissions, and deploy renewable energy," said Anthony Giacobbe, general manager of Seneca Energy, a wholly owned subsidiary of SNI and the foundation for the new tribal utility organization.

Solution:

To advance its ongoing efforts to identify renewable and nonrenewable energy options, in 2007 SNI sought technical assistance through DOE's National Renewable Energy Laboratory (NREL). Under NREL's Anemometer Loan Program, the Seneca Nation installed meteorological towers in several locations from November 2007 through February 2009 to assess the available wind resource potential on SNI land. An installation near Lake Erie revealed a substantial resource favorable to the development of a community-scale wind energy project.

After examining potential environmental impacts at that location, the Seneca Nation decided to move the planned turbine site about a mile south of the lakefront, in part to avoid the disruption of wildlife, including turtle populations. SNI also used the 2007 DOE First Steps Grant to develop a tribal energy organization and a DOE Energy Efficiency and Conservation Block Grant to refine its proposed wind project. To capitalize on that early wind resource monitoring and fund the installation of the wind turbine, the Tribe applied for funding under DOE's Fiscal Year 2013 Community-Scale Clean Energy Projects in Indian Country Funding Opportunity Announcement (FOA).

In response to the DOE FOA, SNI proposed to install a 1.8-megawatt community wind turbine with a maximum hub height of approximately 265 feet, maximum rotor diameter of approximately 330 feet, and overall maximum height of approximately 430 feet on the selected site. The project was estimated to produce approximately 4.5 million kilowatt-hours (kWh) of electricity per year, resulting in a 35% annual energy savings for the Tribe. In 2014, the SNI Wind Turbine Project was competitively selected to receive $1.5 million in DOE funding to supplement the Tribe's $4.5 million investment in the installation of the wind turbine.

"Since the Seneca Nation first applied for a DOE First Steps grant to develop a strategic energy action plan in 2003, they have compounded the returns on that initial DOE investment, demonstrating progressive forward movement in their pursuit of energy sufficiency through clean energy development," said Lizana Pierce, Program Manager for DOE's Office of Indian Energy. "It is wonderful to see those initial seed funds evolve into the installation of a wind turbine that can power half the Seneca Nation."

Working with Sustainable Energy Developments (SED) of Rochester, New York, SNI advanced to the implementation phase of the project. The Nation held a groundbreaking ceremony for its 1.5-MW turbine on April 27, and is scheduled to be operational by the end of 2016.

"Today's groundbreaking marks a final milestone on the path to displacing fossil and nuclear fuel sources with tribally owned renewable power, which has been a long-term strategic goal of the Seneca Nation," said Office of Indian Energy Director Chris Deschene. "The Office of Indian Energy is proud to stand shoulder-to-shoulder with the Seneca Nation and other tribal governments working to identify and implement viable, innovative energy and infrastructure solutions that are foundational to creating stability, preserving their way of life, and improving quality of life in their communities."

Benefits:

- Intertribal—This successful community-scale tribal wind energy project can serve as a model for other tribal nations, as Giacobbe and others share successes and lessons learned with tribes and intertribal organizations interested in pursuing wind energy development.
- Societal—The installation has resulted in the hiring of three SNI members for construction management alongside SED, and 10–15 other tribal members for construction. Further, the Nation is considering a solar energy project on another site, which could result in another full-time position managing the Nation's renewable energy assets.
- Economic—Using aggregated net-metering through National Grid, Inc., the Nation will be compensated for electricity at the rate of $0.08 per kilowatt-hour, which could save the Nation an estimated $360,000 annually. As a result, some 1,000 SNI households will see monthly reductions in their electric bills.
- Environmental—The new wind turbine is expected to cut 86 million pounds of carbon dioxide emissions annually, as well as reduce other greenhouse gas emissions.

"The Department of Energy has supported the Seneca Nation throughout this long process, which we really appreciate" Giacobbe said. "We've made great strides in the last couple of years to meet those early strategic energy goals as well as provide price parity across our Territories. This project is the first step towards building an even stronger Nation for future generations."

—Written by **Ernie Tucker**

Channel 4 Buffalo TV News Media

Seneca Nation to break ground on $6M wind turbine project

By **Mark Belcher, News 4 Digital Producer** Published: April 25, 2016, 3:57 pm

IRVING, N.Y. (WIVB) — A large construction project will begin Wednesday in Irving that will change the area's skyline.

Seneca Nation officials say a $6 million project will construct wind turbines on the nation's Cattaraugus Territory on Erie Road in Irving.

The project, which is backed by the Department of Energy Deployment and New York State's NYSERDA authority, is expected to be completed before 2017.

Wind turbine projects near Lake Erie have been hotly contested by wildlife conservationists who say the large structures will impact migratory patterns for local fowl and birds.

Buffalo Business First Print Media

James Fink Reporter - *Buffalo Business First*

The Seneca Nation of Indians has started work on a wind turbine that will help reduce… **more**

Calling it a milestone in its energy independence long term goal, the Seneca Nation of Indians has started work on a wind turbine that will help reduce reliance on outside energy sources for its Cattaraugus Territory.

The $6 million project, jointly funded by the Seneca Nation of Indians, U.S. Department of Energy and New York State Energy Research and Development Authority, is being constructed on a 1.5 acre site near Irving off of Lucky Layne Road and the Gil Lay Sports Arena.

Officials expect the turbine to be operational by the end of the year.

“We are harnessing the tremendous power of natural resources to generate new economic opportunities for our people and bring about a long sought level of self-reliance for the Seneca Nation,” said Maurice John Sr., Seneca Nation of Indians president.

John said the turbine will reduce energy costs on the Cattaraugus Territory by an estimate 40 percent, with the savings spread to residents and businesses on that portion of the Seneca Nation territory.

The turbine has the capacity to produce up to 1.5 megawatts, or 4.5 million kilowatt hours, of electricity.

Jamestown Newspaper

Seneca Nation of Indians Break Ground on Muliti-Million Dollar Wind Turbine

By Mark Goshgarian
Wednesday, April 27, 2016 at 05:21 PM EDT

IRVING, N.Y. -- There was a slight, yet fitting breeze Wednesday in Irving, Chautauqua County as members of the Seneca Nation of Indians broke ground on a $6 million new wind turbine project. The turbine is expected to produce 1 1/2 half megawatts of electricity and help power the Cattaraugus territory.

"This is really a milestone. Renewable energy really aligns with the Nation's core values and how we approach projects, in this case infrastructure," said Michael Kimelberg, Seneca Nation Chief Operating Officer.

The project is expected to promote economic development and sharply reduce carbon emissions, which aligns with the Nation's other renewable energy projects.

"We have a solar array down in Allegany that's going to help everyone, reduce their cost of living, but also promote these renewable energy sources that are available to us," said Todd Gates, Seneca Nation Treasurer.

Energy leaders say the goal is to promote sovereignty, generate revenue, preserve the environment and expand energy infrastructure.

"I'm really proud to say with this project, we're doing all four of those, so it is a strong first piece as we move toward achieving our strategic energy plan," said Anthony Giacobbe, Seneca Energy General Manager.

Funding for the project came from state and federal grants through the Department of Energy.

"We are charged with working to help tribes throughout the country whether through technical assistance, whether through financial assistance, grant in this case but also developing programs," said Christopher Deschene, Office of Indian Energy Policy and Programs Director.

Seneca leaders say not only will the project benefit the environment, it'll also generate a significant savings for the rate payers living on the Nation's territories.

"I know everyone pays their electric, and we want to see that come down a little bit," said Gates.

The turbine is scheduled to be installed and operational by the end of the year.

XI. Pictures/Time-Lapse Video

Seneca Nation – Time-Lapse Construction Video

https://www.youtube.com/watch?v=5eTVBLFQnbs

Seneca Nation – State of the Nation Address 2017
https://www.youtube.com/watch?v=29xK-sibdGY

Robert Woods Foundation – Award Video
http://www.rwjf.org/en/library/features/culture-of-health-prize/2017-winner-seneca-nation-ny.html


CRANE

XII. **Outcomes/Conclusions**

The turbine has generated 1,210,000/kWh to date, which is comparable to the expected production, but we are slightly behind top end productions over the first six months of operation. This is due to a few routine maintenance shutdowns including our 500 hr. maintenance. Also, summer months generally provide less average wind speeds than winter months.

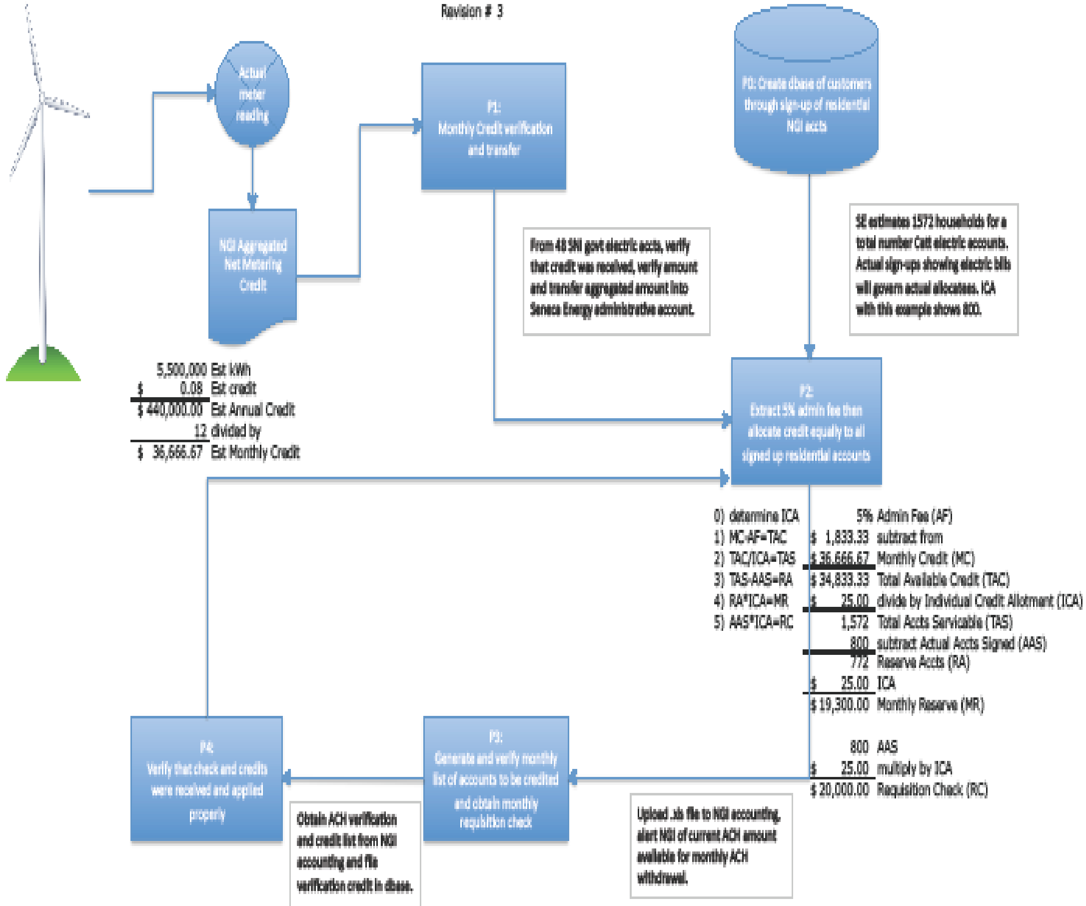
However, Seneca Energy is on pace to generate the expected amount of revenue during the first year of production. This is due to the amount of money earned per kWh ($.11-$.13/kWh) through our net-metering agreement with NGRID. The Nation has already realized ~$150,000 of savings to date. We have seen production numbers increase as Vensys adjusts the turbine for maximum production output.

In April 2017, the Seneca Nation paid its first $25 credit to residents enrolled in the "Seneca Electricity Credit Program". The $25 credit is applied directly to resident's utility invoices and will total $300 of savings every year and ~$8,000 of savings over the project lifecycle. The Seneca Nation has already paid $40,000 towards resident's electricity bills since the commissioning of the wind turbine in April 2017.

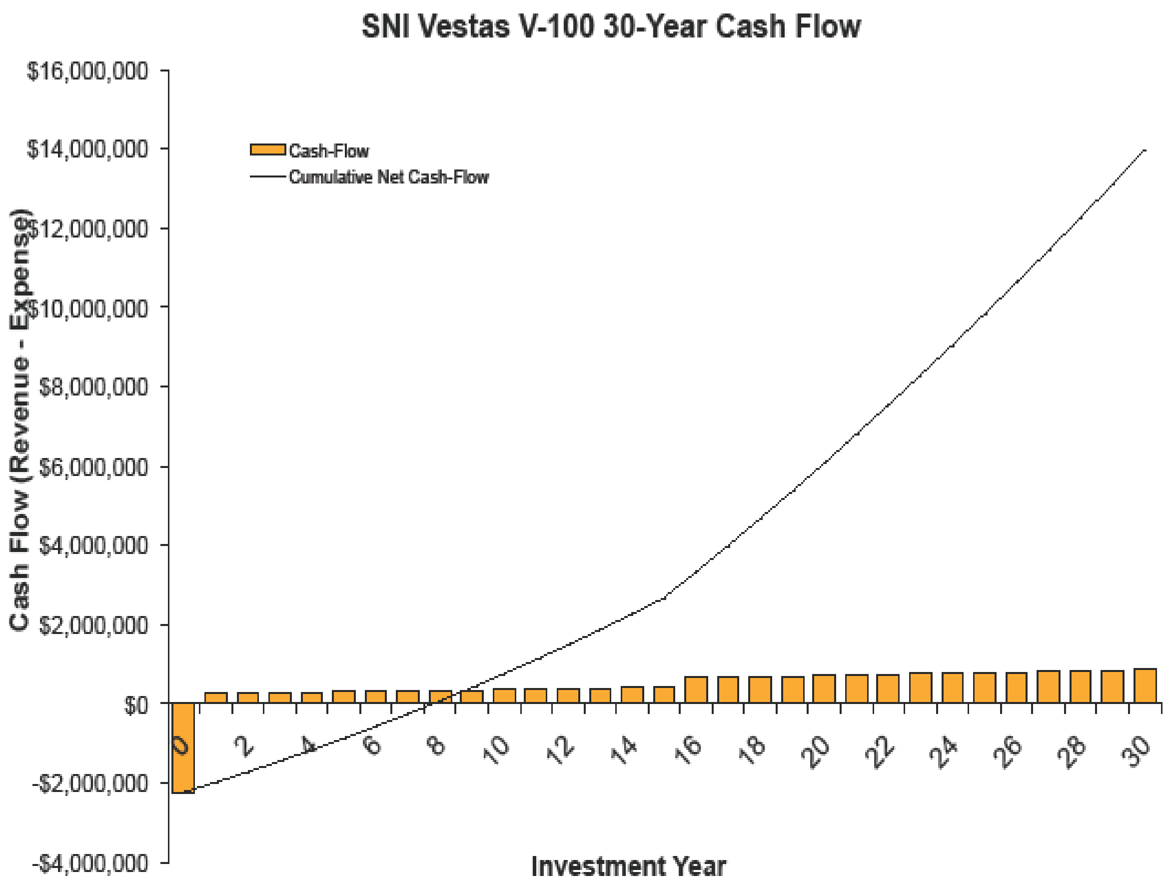
The Seneca Electricity Credit Program was one of the primary driving factors for the project and we continue to have additional residents enroll for the program each month. Our goal is to continue to add residents to our credit program and assist them in keeping electricity rates down, so that they can use their money for other necessary living expenses.

The Seneca Nation and Seneca Energy are extremely proud of the Cattaraugus wind turbine as well as all of the other exciting energy projects taking place on territory. We are continuing to follow our Strategic Energy Plan as we move forward towards achieving energy self-sufficiency.

Revision # 3



Actual meter reading
NGI Aggregated Net Metering Credit
P1: Monthly Credit verification and transfer
P0: Create dbase of customers through sign-up of residential NGI accts
From 48 SNI govt electric accts, verify that credit was received, verify amount and transfer aggregated amount into Seneca Energy administrative account.
SE estimates 1572 households for a total number Catt electric accounts. Actual sign-ups showing electric bills will govern actual allocates. ICA with this example shows 800.
5,500,000 Est kWh
$ 0.08 Est credit
$ 440,000.00 Est Annual Credit
12 divided by
$ 36,666.67 Est Monthly Credit
P2: Extract 5% admin fee then allocate credit equally to all signed up residential accounts
0) determine ICA
1) MC-AF=TAC
2) TAC/ICA=TAS
3) TAS-AAS=RA
4) RA*ICA=MR
5) AAS*ICA=RC
5% Admin Fee (AF)
$ 1,833.33 subtract from
$ 36,666.67 Monthly Credit (MC)
$ 34,833.33 Total Available Credit (TAC)
$ 25.00 divide by Individual Credit Allotment (ICA)
1,572 Total Accts Servicable (TAS)
800 subtract Actual Accts Signed (AAS)
772 Reserve Accts (RA)
$ 25.00 ICA
$ 19,300.00 Monthly Reserve (MR)
800 AAS
$ 25.00 multiply by ICA
$ 20,000.00 Requisition Check (RC)
P4: Verify that check and credits were received and applied properly
Obtain ACH verification and credit list from NGI accounting and file verification credit in dbase.
P3: Generate and verify monthly list of accounts to be credited and obtain monthly requisition check
Upload .xls file to NGI accounting, alert NGI of current ACH amount available for monthly ACH withdrawal.



SNI Vestas V-100 30-Year Cash Flow
Cash-Flow
Cumulative Net Cash-Flow
Cash Flow (Revenue - Expense)
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
-$2,000,000
-$4,000,000
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Investment Year