Appendix A: Public Information Meeting Documentation

- Blank Copy of Sign-In Sheet
- Blank Copy of Comment Sheet
- Presentation Boards
  - SPower Seneca Wind Project Welcome
  - SPower Seneca Wind Project Summary
  - SPower Seneca Wind Project Proposed Location
- Letter to Home Owners from Seneca Wind
- Project Ads
  - The Truth About Wind Turbines and Noise
  - The Truth About Wind Farms and Property Value
  - The Truth About Shadow Flicker
  - The Truth About “Wind Turbine Syndrome”
  - The Truth About Wind Turbines and Low-frequency Sounds
  - The Truth About the Cost of Wind Energy Production
  - The Truth About Seneca Wind

Seneca Wind, LLC

S·POWER
An AES and AIMCo Company

Seneca Wind
Public Informational Meeting
April 17, 2018

Sign-in Sheet

Name	Address	Telephone Number	Email Address

Seneca Wind, LLC

S·POWER
An AES and AIMCo Company

Seneca Wind
Public Informational Meeting
April 17, 2018

Comment Sheet

Please summarize your comment/question in the space below:

Name: _____

Address: _____

_____

Phone Number: _____

Email Address: _____

Thank you for your comment.

Seneca Wind, LLC

S·POWER
An AES and AIMCo Company

Seneca Wind
Public Informational Meeting
April 17, 2018

Comment Sheet

Please summarize your comment/question in the space below:

Name: _____

Address: _____

_____

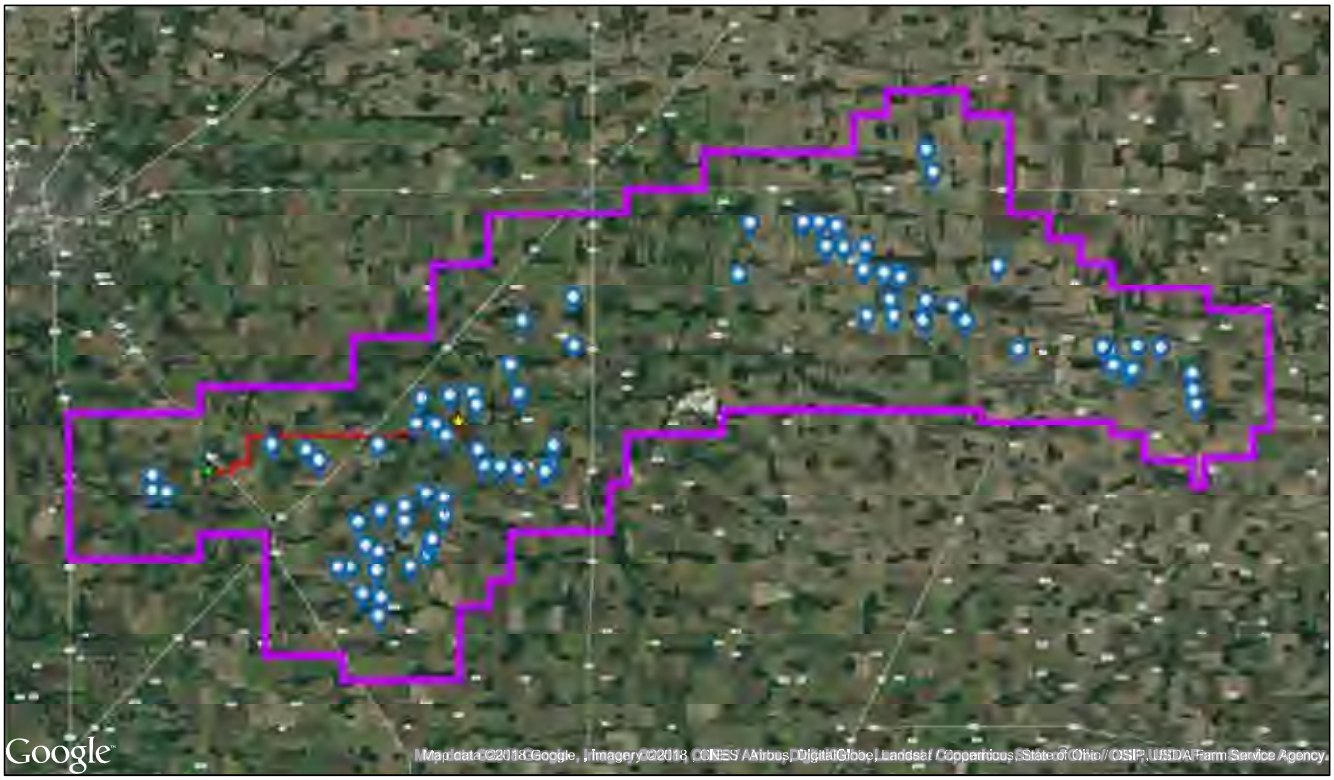
Phone Number: _____

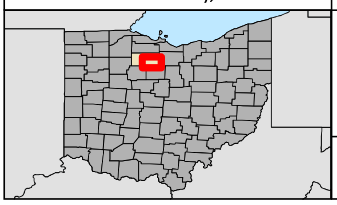
Email Address: _____

Thank you for your comment.

www.senecawind.com

WELCOME!



Seneca County, OH	Map Details	Map Description	
	N Proposed Location Collector Substation Melmore Substation Gen-tie Project Boundary 0 2.5 5 Mi	Seneca Wind will be located on private land in Seneca County, Ohio	Author: JL Date: 4/9/2018 Version: 1.0 Type: Exhibit
		S·POWER An AES and AIMCo Company	Seneca Wind

SENECA WIND

200 MW
Power Generation

715,000+
MWh Generated Per Year

57,000+
Homes Powered Per Year

S·POWER
An AES and AIMCo Company

www.senecawind.com

S·POWER
An AES and AIMCo Company

Project Summary

- **Project Name:** Seneca Wind LLC
- **Project Location:** Towns of Scipio, Reed, Venice, Eden & Bloom Townships in Seneca County, Ohio
- **Amount of MW Developed:** 200 MW
- **Project Footprint:** 25,000 acres

About sPower

sPower, an AES and AIMCo company, is a leading renewable energy Independent Power Producer (IPP).

150+ Projects Across the United States	1.1 GW Operating Assets	13.0 GW Operating | Construction | Pipeline	4 BILLION kWh and Counting

About Seneca Wind

Seneca Wind is a proposed 200 MW wind farm that will be built on approximately 25,000 acres of privately leased land and will utilize up to 60 turbines.

Project Timeline

2018 Permitting, Geotechnical Analysis, Public Outreach, Design

2019 Finish permitting, start construction, Commercial Operations

Commercial Operations Begin – **Q4 2019**

Electricity Generated

Enough electricity to meet the consumption of **57,500 Ohio Homes per year.**

Equivalent to avoiding **532,000 Metric Tons of CO_2 Emissions** Annually.

Annual greenhouse gas emissions over the course of one year from **114,000 Passenger Vehicles**.

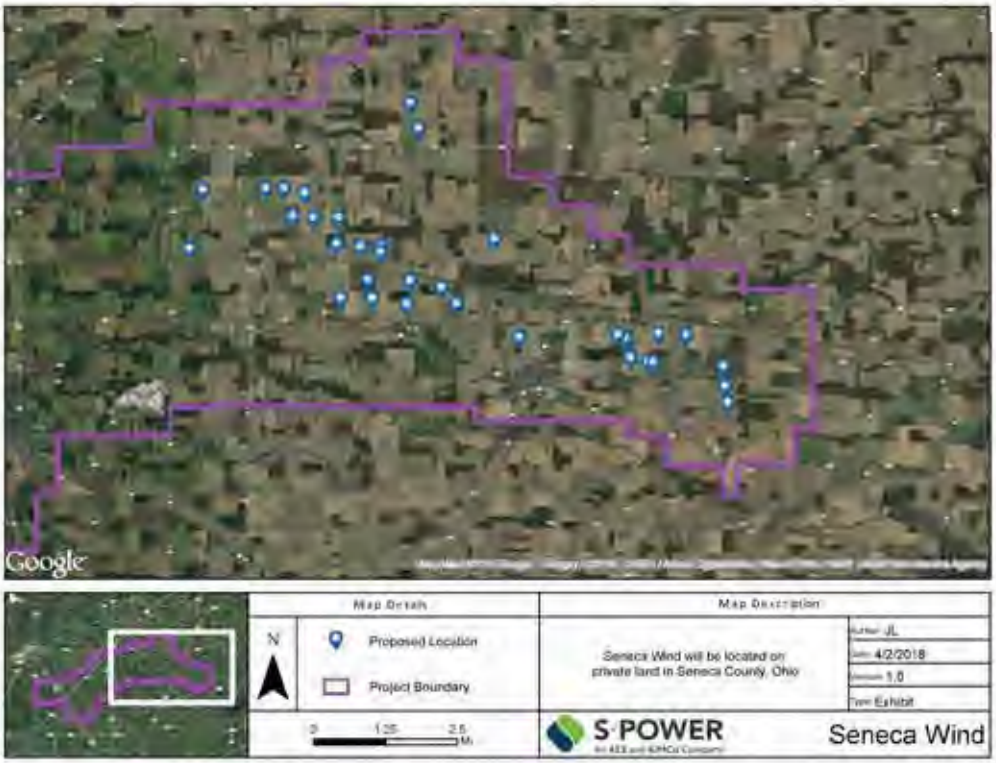
Project Benefits

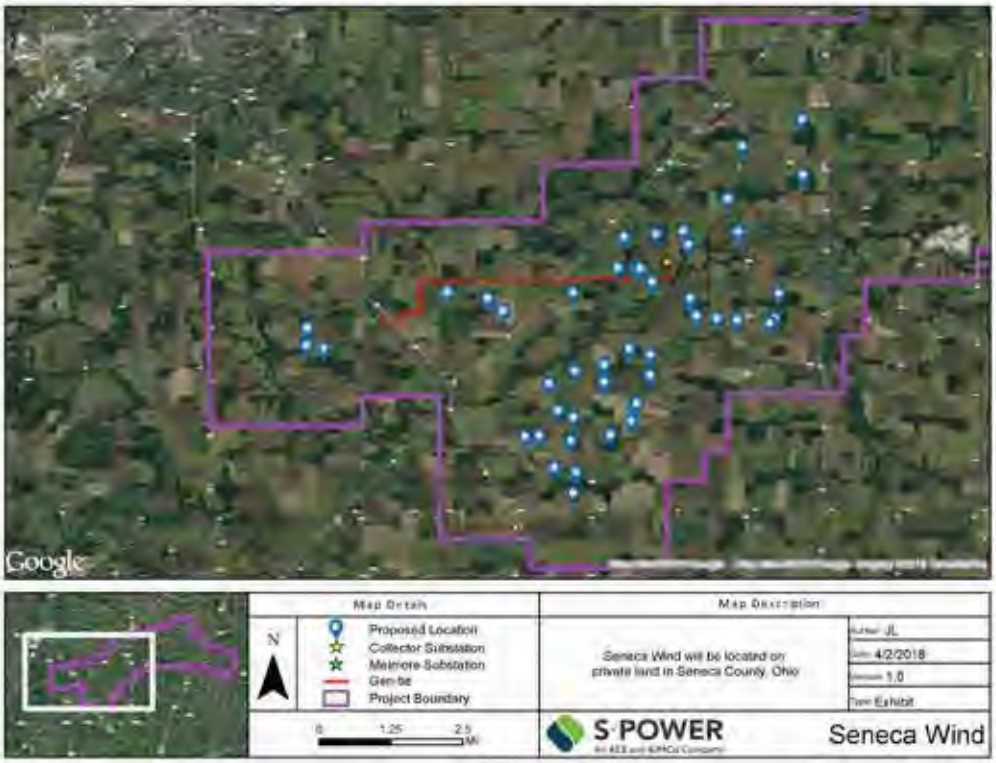
Economic Benefits

- New Income Source for Landowners
- Tax Revenue Generated: Over $56,000,000 Over the Life of the Project
- Shared Among: Schools | Counties | Townships | State

Local Jobs

- 200 Jobs During Peak Construction
- Approximately 8 to 10 Long-Term Operations & Management Positions


Google
Map Details
Map Description
N
Proposed Location
Project Boundary
Seneca Wind will be located on private land in Seneca County, Ohio
Author JL
Date 4/2/2018
Version 1.0
Type Exhibit
0
1.25
2.5
Mi
S·POWER
Seneca Wind


Google
Map Details
Map Description
N
Proposed Location
Collector Substation
Meimore Substation
Gen-tie
Project Boundary
Seneca Wind will be located on private land in Seneca County, Ohio
Author JL
Date 4/2/2018
Version 1.0
Type Exhibit
0
1.25
2.5
Mi
S·POWER
Seneca Wind

S·POWER
An AES and AIMCo Company

SENECA WIND

Seneca County, OH

April 26, 2018

Dear resident,

We were pleased by the number of people who took time out of their busy schedules last week to attend our public meeting for the proposed Seneca Wind project in Scipio, Reed, Venice, Eden and Bloom Townships. If you were among those who attended, thank you.

We also were pleased that so many people were willing to ask questions and to tell us what was on their minds. Based on that feedback, we know that people still have many questions about Seneca Wind.

While we're still early in the permitting process, we want to make sure you have as much information as possible. We'll be providing more information directly and through our website (**www.senecawind.com**), but in the meantime I hope you'll find the enclosed question-and-answer document helpful. Also enclosed is a new map that provides additional detail about where the proposed project boundaries lie.

We welcome other questions or comments that you may have, which you may submit by phone or email in the contact information section on our website.

Thanks again for your interest in the Seneca Wind project.

Sincerely,

John Moran
Seneca Wind Project Manager

S·POWER
An AES and AIMCo Company

SENECA WIND

Seneca County, OH

Some questions and answers about Seneca Wind

What is Seneca Wind, LLC?

Seneca Wind is a proposed wind project in Scipio, Reed, Venice, Eden and Bloom Townships in Seneca County.

Is Seneca Wind just a new name for an old project?

sPower acquired the project in fall of 2017 from Exelon, which previously purchased it from John Deere.

Is sPower handling the Republic Wind project?

No. Republic Wind, owned by Apex, is a separate wind farm that straddles Seneca and Sandusky counties. The projects and sponsoring companies are not related.

What's the size of this project and how does it compare to projects around the country?

As proposed, Seneca Wind is a 200 MW wind farm using up to 60 wind turbines and will be built on approximately 25,000 acres of privately leased land. Wind farms vary in sizes, with the largest wind farms in the United States producing thousands of megawatts with hundreds of turbines.

Where can I find a detailed map that shows where the project boundaries are in relation to common landmarks?

We have updated our maps to show clearer labels. We are providing a copy with this question-and-answer document and also will be putting it on our website.

How big are the turbines going to be?

Seneca Wind plans to install two types of GE turbine models: One type (GE 3.83 MW) will be 110 meters tall with a 137-meter rotor diameter, and the other (GE 2.3 MW) will be up to 94 meters tall with a 116-meter rotor diameter.

Can you explain how the setbacks work?

The state of Ohio established setbacks of 1,125 feet from the tip of the turbine blade to the property line of the nearest adjacent property. In practice, that will require setbacks of about 1,300 feet from each turbine's base. By comparison, the setback for drilling of an oil or gas well is only 100 to 200 feet from a habitable residence.

How will this affect the community?

It will provide income for participating landowners and provide $56 million in tax revenues during the life of the project. These revenues will be shared among schools, townships, the county and the state. In addition, construction and operation of the project will result in direct and indirect economic benefits throughout the surrounding community. It also will provide enough clean energy to power almost 60,000 homes each year. Because the project is privately funded, no cost to the community will result, including those necessary for upgrades or repairs to infrastructure.

Who has final approval of this project?

Final approval rests with the Ohio Power Siting Board, which reviews applications for construction of major utility facilities (such as the project) as part of a comprehensive process that includes public input. This review includes a comprehensive evaluation of the range of potential impact issues, including confirmation that appropriate setbacks and other standards are met that minimize impacts to the community and environment.

What is the approval process and timetable?

The meeting we held on April 17 began the public review process. At this meeting, Seneca Wind was required to inform the community about its plans to file an application with the Ohio Power Siting Board and gather input from the public. Comments received will be summarized in the application document. The next step is to finalize project details and conduct a range of studies that will be described in the formal application. Once this is filed with the Siting Board, the Siting Board staff will review the application to make sure it's complete. It usually takes about 60 days for this review to conclude.

Assuming the application is complete, the Siting Board will deem the application complete and copies of the application will be provided for local community review. The Siting Board then will begin its formal application review process, with the Siting Board staff's technical experts and other Ohio agencies contributing to the evaluation. Information from the applicant, the public and from a Siting Board staff site walk will be incorporated in this review process. The Siting Board staff then prepares its report, which will include its recommended decision and potential conditions, about two weeks before a public hearing is held at the project's location. This hearing, which will be scheduled and advertised in advance, provides an additional opportunity for community members to provide written or verbal input. It usually takes 60 to 90 days from the time the application is deemed complete until the public hearing is held.

After considering all of the information gathered during the investigation and at the public hearing, the Siting Board will hold an adjudicatory hearing to allow parties in the case to provide sworn testimony and cross-examine witnesses. Only after this is complete will the case be directed to the Ohio Power Siting Board for a formal decision.

What are Seneca Wind's next steps?

Following Seneca Wind's public meeting in Tiffin on April 17, we will continue to reach out to members of the local community while we refine our design and complete the studies necessary to support our Ohio Power Siting Board application. We plan to file our application in June. We hope to have a Siting Board decision by January 2019.

How can I make my opinions known to the Ohio Power Siting Board before a decision is made?

Interested parties can submit written comments during the application review process and testify in person at the public hearing. More information is available at the Siting Board website, by calling 1-866-270-6772 or through email using contactOPSB@puc.state.oh.us.

What will construction do to our roads?

The Ohio Power Siting Board application will include a preliminary assessment of the roads anticipated to be used for project construction, and a commitment that the project will enter into an agreement to ensure that roads are left in the same or better condition than before the project construction began.

What are you going to do to protect birds and other wildlife?

Wildlife studies have been conducted in the project area since 2009. Studies of bats, eagles, waterfowl and some other wildlife resources are ongoing. These studies have identified areas that will be avoided by turbines and other wind farm infrastructure, potential operational restrictions under certain conditions, and plans for ongoing monitoring. Seneca Wind is consulting with the Ohio Department of Natural Resources and the U.S. Fish and Wildlife Service to develop a Habitat Conservation Plan, an Eagle Conservation Plan, and a Bird and Bat Conservation Strategy that will avoid and minimize impacts to species that use the project area. These studies will be presented and reviewed by the Ohio Power Siting Board as well.

How deep are the Geotech borings?

The Geotech borings are 60 feet deep.

What if this project damages my tile drainage system?

Seneca Wind will work closely with individual landowners to identify existing drainage tiles to the extent possible. Where drainage tiles are unavoidably disrupted, Seneca Wind will make appropriate repairs at the project's expense. This is expected to be a condition of the Ohio Power Siting Board process.

What will this do to my drinking water?

No effect on water quality is expected as a result of the project. The project will not use water, other than drinking water, in its proposed operations and maintenance building. The setbacks in the project design will make sure that no turbines are located near the wells of non-participating landowners. In addition, materials such as lubricating oils will be stored in areas designed for containment, while rigid spill prevention practices and emergency procedures will be designed to prevent their release.

What are the health effects of turbines on people?

There's no direct evidence of adverse effects on human health when wind turbines are sited properly. At present, there are roughly 60 scientific peer-reviewed articles on this issue. The available scientific evidence suggests that shadow flicker, low-frequency noise, infrasound, and electromagnetic fields from wind turbines are not likely to affect human health. Because environmental noise above certain levels is a recognized factor in a number of health issues, siting restrictions have been implemented in many jurisdictions to limit noise, and we expect the Siting Board to restrict noise levels to certain limits. The required setbacks in Ohio (a minimum of 1,125 feet from property lines) also conservatively protect residents from the effects described above.

What government subsidies is sPower getting?

Seneca Power intends to apply for a Production Tax Credit from the Internal Revenue Service.

Are you going to use eminent domain to take my property?

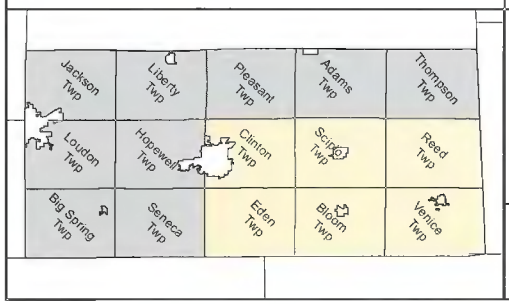
No. We will place turbines only on land where owners have voluntarily negotiated a lease agreement.

How are you going to keep the community informed?

We will remain engaged with local leaders and residents throughout the application and construction process. We will provide periodic updates to community members to let them know as milestones are approached or reached, and will work with the local media to keep them informed of our progress. We also will answer inquiries as quickly as possible as we receive them. For now, people can use the contact information listed on our website, **www.senecawind.com.**

How can I contact Seneca Wind with a question or concern?

Inquiries can be made by emailing us at **info@senecawind.com.**

Seneca County, OH	Map Details	Map Description	
	N Proposed Turbine Location (not to scale) Proposed Project Boundary 0 2.5 5 Mi	These maps show the Project Site's preliminary boundaries and turbine layout. The locations of wind turbines are subject to the results of ongoing environmental studies, lease agreements and final engineering designs.	Author: JL Date: 4/20/2018 Version: 1.0 Type: Exhibit
		S·POWER An AES and AIMCo Company	Seneca Wind

The Truth About
Wind Turbines and Noise

Modern turbine designs have **greatly reduced the mechanical sounds** to where the normal wind farm sound is a light whooshing as the blades pass through the air.

Other factors do play a part, such as distance from the turbine, height, topography, vegetation and wind conditions, but **overall wind farms are remarkably quiet.** In fact, because the wind is blowing whenever the turbines are spinning that the sound of the blades' movement is often lost in the sound of the wind itself.

Seneca Wind will comply with all applicable noise standards.

SENECA WIND
senecawind.com

The Truth About

Wind Farms and Property Value

In 2009, a Berkeley National Laboratory researcher published a study analyzing data from approximately 7,500 sales of single-family homes within 10 miles of 24 existing wind facilities in nine different states and found "***no evidence... that home prices surrounding wind facilities are consistently, measurably, and significantly affected by either the view of wind facilities or the distance of the home to those facilities***."

His second study in 2013 examined more than 50,000 home sales within 10 miles of 67 different wind facilities in 27 states, and found "***no statistical evidence that home prices near wind turbines were affected in either the post-construction or post-announcement/pre-construction periods.***"

SENECA WIND

senecawind.com

The Truth About
Shadow Flicker

Shadow flicker occurs when the blades of a turbine pass in front of the sun to create a recurring shadow on an object.

In 2009, the American Wind Energy Association and the Canadian Wind Energy Association established a multidisciplinary scientific advisory panel to review current literature on the perceived health effects of wind turbines and found that **shadow flicker is not harmful to persons with epilepsy**.

The **strobe rates generally necessary to cause seizures** in people with photosensitive epilepsy are **five to 30 flashes per second**. Large wind turbine blades **cannot rotate nearly that quickly**.

SENECA WIND
senecawind.com

The Truth About

"Wind Turbine Syndrome"

A self-published book by an anti-wind activist named Nina Pierpont coined the term "wind turbine syndrome" in 2009. However, Pierpont's conclusions have been debunked by independent scientific studies from government research bodies around the world.

A 2014 scientific review published in the peer-reviewed journal Frontiers in Public Health strongly refutes the existence of wind turbine syndrome, and numerous reviews of peer-reviewed scientific studies have concluded wind turbines do not cause health problems.

S·POWER
An AES and AIMCo Company

The Truth About
Wind Turbines and Low-frequency Sounds

One common question about wind turbines concerns the effects of infrasound – sound at frequencies outside the range of normal human hearing.

Infrasound comes from a number of sources, including wind, ocean waves, breathing and even your beating heart. Scientific studies have found **no causal link between sound patterns generated by wind turbines and health conditions.**

By contrast, Scientific American recently reported that particulate **pollution from fossil-fueled power plants caused more than 30,000 premature deaths, 600,000 asthma attacks and 5 million lost workdays.**

S·POWER
An AES and AIMCo Company

The Truth About the Cost of Wind Energy Production

A World Economic Forum white paper published in 2016 reported that the costs of wind and solar energy are lower than the costs of building new coal or other plants.

New technologies often take time to become competitive with more mature alternatives, but wind energy has developed to the point where it has become very competitive, and costs continue to decline.

The industry is expected to survive and even thrive after the federal Production Tax Credit phases out.

S·POWER
An AES and AIMCo Company

The Truth About
Seneca Wind

Seneca Wind is a wind project proposed for Scipio, Reed, Venice, Eden and Bloom townships. **We are committed to Seneca County and eager to make positive contributions as a long-term and active corporate citizen**.

Our project will result in direct and indirect economic benefits, including **$56 million in tax revenues to schools, townships, the county and the state**. And because the project is privately funded, there will be no cost to the community, including those necessary for upgrades or repairs to infrastructure.

We appreciate the support we have received so far and will continue to work hard to maintain the public's trust.

S·POWER
An AES and AIMCo Company

Appendix B: PJM Facilities Study

PJM Generator Interconnection Request
Queue #U4-028 & U4-029
Fostoria Central-Greenlawn-Howard (Seneca)
138kV
Facilities Study

U4-028 and U4-029 new AEP Melmore Station 138 kV (Fostoria Central – Greenlawn – Howard 138 kV circuit) Facilities Study Report

A. Facilities Study Summary

1. Project Description

Exelon Wind LLC proposes to install a 200 MW generating facility comprised of 88 Siemens SWT-22.3-93 2.3 MW wind turbine generators. Exelon is proposing a single connection for U4-028 and U4-029 to connect to the American Electric Power (AEP) Melmore Station on the Fostoria Central – Greenlawn - Howard 138 kV circuit. The Melmore Station, once proposed as part of the scope of this project, is now being developed by AEP under approved baseline project b1667. This revised report reflects the effects of the reduced scope of work and updates the proposed schedule.

*The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. The metering work above and cost indicated below does not include any potential work or cost to address metering requirements of the local service provider. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

2. Amendments/Changes to the Impact Study Report

- The commercial operation date has changed from October 1, 2012 to December 31, 2017.
- Exelon has requested a single point of connection for U4-028 and U4-029.

3. Interconnection Customer Schedule

Exelon has proposed the following schedule for their collector station:

- Ground Breaking: November 1, 2016
- Receive back feed from AEP: October 15, 2017
- Commercial Operation Date: December 31, 2017

4. Scope of Customer's Work

- Design and construct generation collector station including step up transformers.
- Design and construct 138 kV tie from generation collector station to interconnect station.
- Fiber optic tie between stations for relay communication.
- Right of way and land purchases for all facilities, including access road.

© PJM Interconnection 2016. All rights reserved

5. Description of Transmission Owner Facilities Included in the Facilities Study

Direct Connection Work

- Install two 138 kV circuit breakers configured in a breaker and a half arrangement at the AEP Melmore Station on the Fostoria Central – Greenlawn - Howard 138 kV circuit. (Work done by AEP)

Network Upgrade Work - First Energy (FE)

At West Fremont substation, relocate the 138-69 kV Transformer #2 to being tapped off the East 138kV bus. The position between West Fremont breakers B5 & B6 will be left open with future use to be determined. A new 138kV high-side circuit breaker is required to be added on the 138-69kV Transformer #2. (n3577).

The cost for this network upgrade is $550,900.

Network upgrade n3577 is no longer required. The baseline upgrades listed below mitigated the need for the network upgrade, but the Exelon Wind LLC still has a cost allocation of $550,900 towards the baseline upgrades listed below.

1. Build new Hayes 345/138 kV substation with new 138 kV lines to: Greenfield #1, Greenfield #2, and Avery (b1281)
2. Build Beaver - Hayes - Davis - Besse #2 345 kV line (b1282)

A separate network upgrade, n4797, was created to capture Exelon Wind LLC's cost responsibility towards the above referenced baseline upgrades.

6. Total Cost of Transmission Owner Facilities Included in the Facilities Study:

Direct Connection facilities	$1,108,304
Network Upgrade facilities	$550,900
Total Cost	$1,659,204

7. Summary of Schedule Milestones for Completion of Transmission Owner Work Included in Facilities Study:

Material ordered by September 15, 2016
Outage requests made by September 30, 2016
Construction Start (Below Grade) November 1, 2016
Outage (Test, Checkout & Commission) September 1, 2017 – October 15, 2017
Backfeed by October 15, 2017

© PJM Interconnection 2016. All rights reserved

Commercial Operation date of December 31, 2017

B. Transmission Owner Facilities Study Results

1. Transmission Lines – New

None required.

2. Transmission Lines – Upgrades

None required.

3. Substation Facilities – New

Install two 138 kV circuit breakers at the AEP Melmore station. (Work done by AEP)

4. Substation Facilities – Upgrades

None required.

5. Metering & Communications

Standard 138 kV metering will be installed at the Melmore station.
A standard station communication scheme will be used.

6. Environmental, Real Estate and Permitting Issues

None required.

7. Summary of Results of Study

Cost Estimates for AEP

	NUN#	Engineering	Material	Construction	Misc.	Total
Melmore Station	**n2115**	$155,631	$319,200	$183,615	$194,555	$853,001
Melmore Metering	**n2121**	$52,422	$108,959	$43,192	$50,730	$255,303
Contribution to baseline upgrades b1281 and b1282	**n4797**					$550,900
	Total	**$208,053**	**$428,159**	**$226,807**	**$245,285**	**$1,659,204**

© PJM Interconnection 2016. All rights reserved

Schedule

Material ordered by September 15, 2016
Outage requests made by September 30, 2016
Construction Start (Below Grade) November 1, 2016
Outage (Test, Checkout & Commission) September 1, 2017 – October 15, 2017
Backfeed by October 15, 2017
Commercial Operation date of December 31, 2017

Assumptions

Agreements executed by June 15, 2016.
Exelon will have their construction and required checkout completed prior to the start of the September 1, 2017 outage.
System conditions allow scheduled outages to occur.

8. Information Required for Interconnection Service Agreement

Direct Interconnection Cost Breakdown

Direct Material -	$640,982
Direct Labor -	$651,014
Indirect Material -	$48,888
Indirect Labor -	$318,320
Total	$1,659,204

Network Upgrade Cost Breakdown

N/A

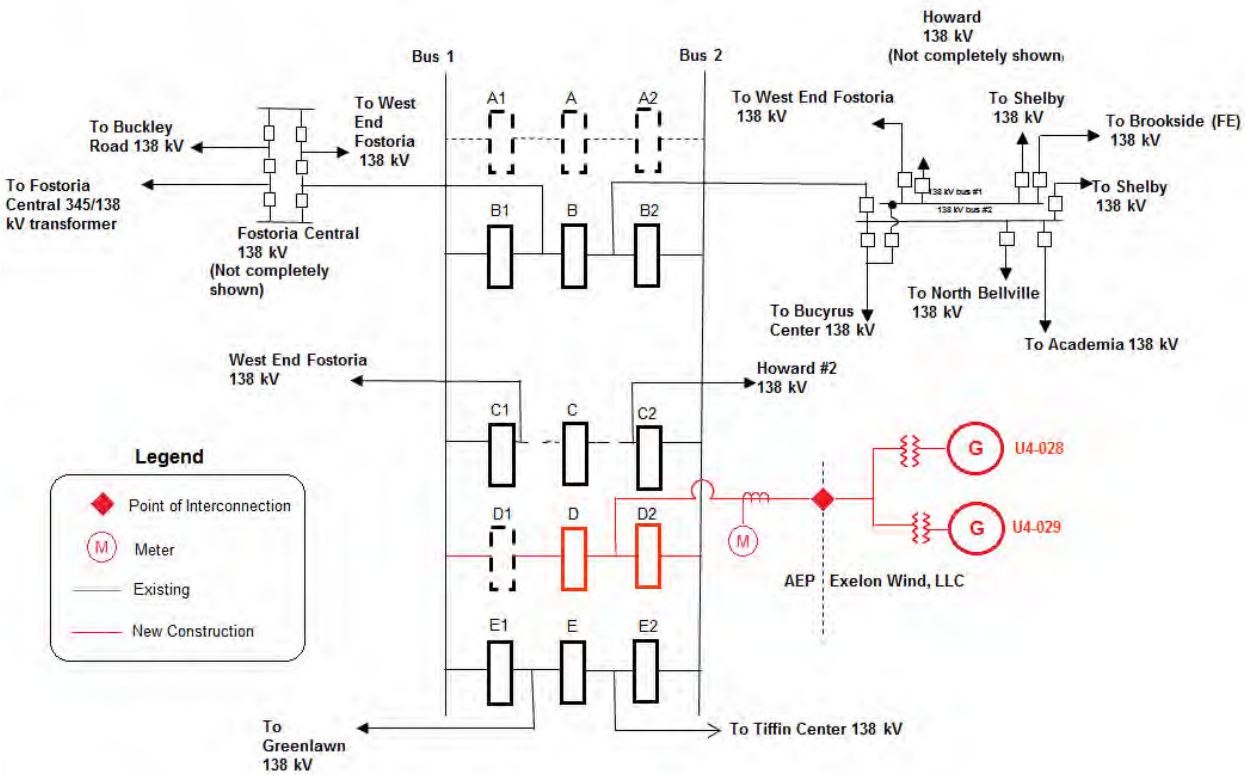
© PJM Interconnection 2016. All rights reserved

Figure 1

Approximate interconnection location of the proposed facilities

© PJM Interconnection 2016. All rights reserved

Figure 2



Simplified diagram of the proposed 138 kV interconnection on the AEP Melmore Station on the Fostoria Central – Greenlawn - Howard 138 kV circuit.

© PJM Interconnection 2016. All rights reserved

Appendix C: Economic and Fiscal Impact Study

Economic and Fiscal Impact of Seneca Wind

Seneca County, Ohio

July 2018

Prepared for

Seneca Wind LLC

Prepared by

TETRA TECH

Table of Contents

Introduction **1**

State and Local Context **1**

- Demographic Overview 1
- Employment and the Economy 2
- Tax Revenues 4

Methodology **4**

- Economic Impact Analysis 4
  - The JEDI Model 5
  - Impact Types 5
  - Impact Measures 6
- Impact Sources 7
  - Construction 7
  - Operation 7

Economic Impacts **7**

- Construction Phase Impacts in the State of Ohio 8
- Annual Operation Phase Impacts in the State of Ohio 9
- Construction Phase Impacts in Seneca County, Ohio 9
- Annual Operation Phase Impacts in Seneca County, Ohio 10

Tax Revenues **11**

Conclusion **12**

Qualifications of the Preparer **12**

References **13**

Introduction

Seneca Wind LLC (Seneca Wind) is proposing to develop the Seneca Wind project (the Project) in Seneca County, Ohio. The Project is a new 212-megawatt (MW)[1] wind-energy facility consisting of up to 85 wind turbine generators. The Project will be located on private lands within an area of approximately 56,900 acres in Seneca County (the Project Area). Land use within the Project Area is primarily agricultural. The Project will require significant capital investment, with construction expected to take place from the second quarter through the fourth quarter of 2019.

This report, prepared on behalf of Seneca Wind, assesses the economic and fiscal impact of the Project. Regional economic impacts are assessed using the National Renewable Energy Laboratory's (NREL's) Jobs and Economic Development Impact (JEDI) Land-based Wind Model (JEDI Wind Model) and presented in terms of employment, income, and economic output. Impacts are estimated separately at the state (Ohio) and local (Seneca County) levels. The fiscal impact analysis provides an estimate of tax revenues that would be expected to accrue as a result of Project construction and operation.

The results presented in this report are indicative, preliminary estimates based on a certain set of assumptions and estimated model inputs. These assumptions and inputs are based on the best data and information available at this stage in the Project development process. These assumptions and inputs could differ from actual conditions due to unexpected events or other Project-related developments, resulting in different economic and fiscal impacts. However, this analysis is anticipated to generally reflect the order of magnitude of expected impacts.

State and Local Context

Demographic Overview

Seneca County is located in north-central Ohio. The county encompasses 552 square miles, the majority of which (about 80 percent) is pasture land (WSOS Community Action Group 2011). With a total estimated population of 55,243 in 2017, Seneca County ranked 47 of 88 counties in Ohio in terms of population, with an average population density of 100.3 persons per square mile (persons/square mile) compared to a statewide average of 285.3 persons/square mile (U.S. Census Bureau 2018a, 2018b).

There are eight incorporated communities in Seneca County: the cities of Tiffin and Fostoria (part) and the villages of Attica, Bettsville, Bloomville, Green Springs (part), New Riegel, and Republic. These eight communities together account for about two-thirds of total county population. Tiffin, located west of the Project area is the county seat and the largest of the eight communities, with an estimated population of 17,701, followed by Fostoria (13,397) and Green Springs (1,637). The villages of Attica and Bloomville, with respective estimated populations of 1,018 and 915, are located within the boundaries of the Project Area (U.S. Census Bureau 2018c).[2]

Total population in Seneca County peaked in 1980 and has been declining since. The total population identified in the last decennial census (2010) was 56,745, roughly equal to the county's population in 1955. Total population dropped by 1,938 residents or 3.3 percent from 2000 to 2010, falling by a further 1,502 residents from 2010 to 2017, a 2.6 percent decrease (U.S. Census Bureau 2018b, WSOS Community Action Group 2011). The net loss of people from 2010 to 2017 was primarily the result of net out-migration

[1] The installed (nameplate) capacity would be 212 MW; however, a maximum of 200 MW would be generated per the interconnection agreement.

[2] The most recent population estimates for cities and towns with populations of less than 20,000 are 5-year estimates from the 2012-2016 American Community Survey (U.S. Census Bureau 2017c). Estimates are annual totals based on 5 years of data.

(more people left than moved to the county), with the county experiencing a very modest gain (20 people) through natural increase (more births than deaths) (U.S. Census Bureau 2018d).

The State of Ohio had a total estimated population of 11.66 million in 2017. Unlike Seneca County, the statewide population has been slowly growing, increasing by about 1.6 percent from 2000 to 2010, and by a further 1.1 percent from 2010 to 2017 (U.S. Census Bureau 2018a, 2018e).

Employment and the Economy

An estimated 27,294 people were employed in Seneca County in 2016 (Table 1). Employment was concentrated in the manufacturing sector, which accounted for 16 percent of total employment compared to just 10 percent statewide. Viewed in terms of number of establishments, fabricated metal products, machinery, and transportation equipment were the main clusters of manufacturing industries in 2009 (WSOS Community Action Group 2011). Employment in Seneca County is also relatively concentrated in education, which made up 6 percent of total employment in 2016, three times the state average (Table 1). The relative importance of education reflects the presence of two universities, a career/vocational school, and several school districts within the county. Employment in Seneca County in 2016 also included a total of 1,554 construction jobs (Table 1).

Table 1. Employment by Economic Sector, 2016

	Seneca County		State of Ohio	
Economic Sector	**Number of Jobs[1]**	**Percent of Total**	**Number of Jobs[1]**	**Percent of Total**
Agriculture	1,120	4	87,949	1
Forestry, Fishing, and Related	(D)	na	14,314	0
Mining	176	1	34,124	0
Utilities	115	0	20,576	0
Construction	1,554	6	326,254	5
Manufacturing	4,392	16	714,829	10
Wholesale Trade	971	4	269,484	4
Retail Trade	2,929	11	698,917	10
Transportation and Warehousing	1,141	4	258,303	4
Information	280	1	86,785	1
Finance and Insurance	863	3	334,294	5
Real Estate	1,061	4	274,701	4
Professional, Scientific, and Technical Services	(D)	na	394,559	6
Management of Companies	(D)	na	145,440	2
Administrative, Waste Management, Remediation	728	3	418,477	6
Arts, Entertainment, and Recreation	295	1	137,780	2
Accommodation and Food Services	2,075	8	505,339	7
Education	1,650	6	156,783	2

Table 1. Employment by Economic Sector, 2016

Economic Sector	Seneca County		State of Ohio	
	Number of Jobs[1]	Percent of Total	Number of Jobs[1]	Percent of Total
Health Care and Social Assistance	2,639	10	898,978	13
Other Services	1,619	6	377,953	5
Government	2,754	10	801,699	12
Total Employment	**27,294**	**100**	**6,957,538**	**100**

Notes:
na – not applicable
(D) Not shown to avoid disclosure of confidential information; estimates for this item are, however, included in the totals.
[1] Employment estimates include self-employed individuals. Employment data are by place of work, not place of residence, and, therefore, include people who work in the area but do not live there. Employment is measured as the average annual number of jobs, both full- and part-time, with each job counted at full weight.

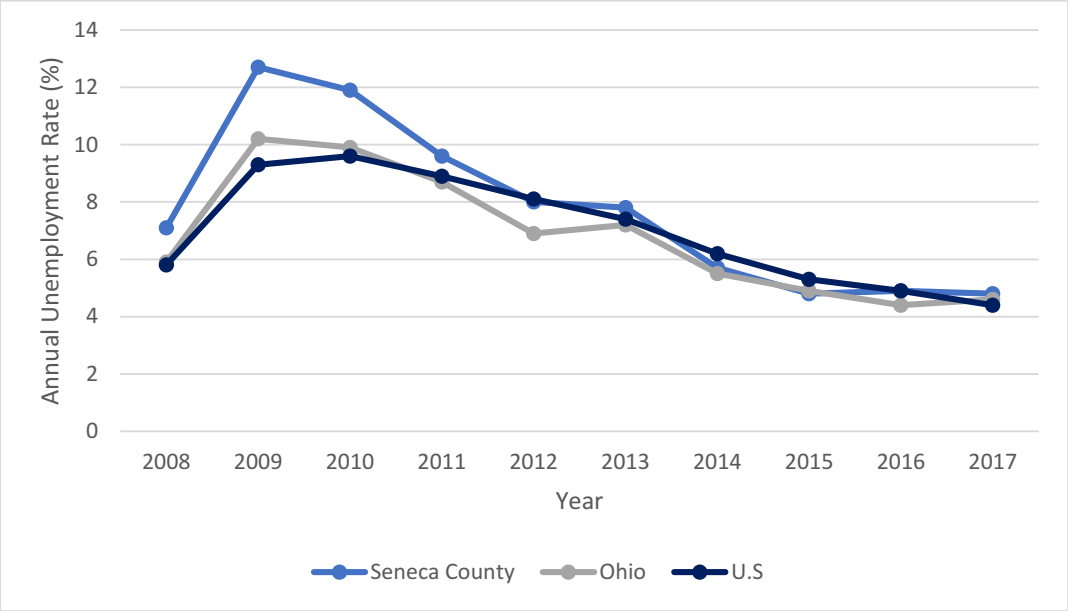
Source: U.S. Bureau of Economic Analysis 2018

The largest private employers in the county include Mercy Tiffin Hospital and Ameriwood Industries, each with more than 500 employees. A number of other businesses employ between 200 and 499 workers, including Church & Dwight, Mennel Milling, and National Machinery, among other manufacturing companies, and Heidelberg University and Tiffin University in the education sector (Seneca Industrial and Economic Development Corp 2018).

Almost 7 million people were employed in the state of Ohio in 2016. Health care and social assistance was the largest economic sector based on employment, accounting for 13 percent of total employment, followed by the government (12 percent), manufacturing (10 percent), and retail trade (10 percent) sectors (Table 1).

Annual unemployment rates for Seneca County, the State of Ohio, and the United States are presented in Figure 1. Unemployment in Seneca County peaked at the height of the recession in 2009, with an annual unemployment rate of 12.7 percent, substantially higher than the corresponding statewide (10.2 percent) and national averages (9.3 percent). Unemployment rates have declined in all three areas since 2010, with annual rates ranging from 4.4 percent (U.S.) to 4.8 percent (Seneca County) in 2017 (Figure 1). The drop in the annual unemployment rate in Seneca County has been accompanied by a drop in the number of workers in the labor force, with fewer people employed in the county in 2017 than 8 years earlier in 2009 (26,000 jobs in 2017 compared to 26,600 jobs in 2009) (Ohio Department of Job and Family Services 2018).

Figure 1. Annual Unemployment Rates, 2008 to 2017



Source: Ohio Department of Job and Family Services 2018

Tax Revenues

In Ohio, local government entities are allowed to levy *ad valorem* property taxes on real and personal property within their jurisdictions. Real property tax rates are levied locally and vary by taxing authority. The total tax rate for a parcel includes all applicable levies for the taxing jurisdictions that the parcel falls within. Taxing jurisdictions include school districts, counties, municipalities, townships, and special service districts, with each unique combination of these jurisdictions creating a separate taxing district. Assessed values are established by the County Auditor at 35 percent of appraised market value, with all property required to be reevaluated every 6 years. Seneca County is a primarily rural county with a significant agricultural and durable goods manufacturing base. The 2016 Annual Financial Report for Seneca County noted that the county's $1.19 billion assessed real property tax base for that year increased by 27 percent over the preceding 6 years, mainly due to residential real estate construction and reevaluations of property within Seneca County (Auditor of State 2017). A total of $58.4 million was collected in property tax revenues in Seneca County in 2017 (Ohio Department of Taxation 2017). This total includes revenues for all taxing jurisdictions within the county, including school districts, municipalities, townships, and special service districts, as well as the county itself.

Methodology

Economic Impact Analysis

The economic impact of the Project will occur in two phases: 1) the initial construction phase; and 2) following construction, the operations and maintenance (O&M) phase. This report assesses both phases using the JEDI Wind Model, with a separate analysis prepared for each phase. Impacts are assessed at the state (Ohio) and county (Seneca County) levels, resulting in four separate analyses. Construction and operation of the Project will generate economic benefits in local economies through direct expenditures for materials and services in the local area, and new payroll income. Benefits will also result from payments to landowners.

Wind energy projects in the State of Ohio can be exempted from tangible personal property and real property tax payments if they meet certain conditions. The following analysis assumes that Seneca Wind

will meet these conditions and will instead make annual payments in lieu of taxes (PILOT) payments to the Seneca County Treasurer. These payments will also result in economic benefits.

The JEDI Model

The JEDI Wind model is a spreadsheet tool that applies standard input–output multipliers and consumption patterns using multiplier data derived from the IMPLAN (**IM**pact Analysis for **PLAN**ning) model. IMPLAN is a commercially available economic modeling package widely used to assess the economic impacts of renewable energy and many other types of projects.

The IMPLAN model divides the economy into 536 sectors including government, households, farms, and various industries, and models the linkages between the various sectors. The linkages are modeled through input-output tables that account for all dollar flows between different sectors of the economy. Using national industry and county-level economic data derived from the U.S. Bureau of Economic Analysis, U.S. Census, and other government sources, IMPLAN models how spending in one sector of the economy is spent and re-spent in other sectors of the economy. By tracing these linkages, the model approximates the flows of initial project spending through the local economy based on the supply lines connecting the various economic sectors. These linkages vary by sector and also through regional differences in spending and employment patterns. The amount spent locally decreases with each successive transaction away from the initial expenditure due to the effects of savings, taxes, or other activities that happen outside the local economy, known as leakages.

The economic relationships modeled by IMPLAN are embedded in the multipliers used by the JEDI Wind Model, which allows the user to estimate the overall change in the economy that would result from construction and operation of a wind generating facility. The dollars spent on a project's construction and operation within a state or county are analyzed to determine the total economic impact within the local area. The direct investments in project construction and operation trigger successive rounds of spending that result in an overall increase in employment, income, and output in the local economy. Construction-related impacts are assessed as one-time impacts; O&M-related impacts are modeled as annual impacts.

The JEDI Wind Model combines user inputs and industry-average values to develop overall project costs and allocate expenditures among different sectors of the economy. NREL developed the industry average values used in the model from extensive interviews with power generation project developers, state tax representatives, and others in the appropriate industries. The model allows the user to modify the default average values to incorporate project-specific data, including construction material and labor costs, estimated payments to landowners, and local tax payments, as well as the shares of specific expenditures expected to occur within the analysis area.

The standard JEDI model assesses potential impacts at the state level, using corresponding state-level multipliers derived from IMPLAN. Using Project-specific inputs, this version of the model was used to estimate impacts at the state level for Ohio. In addition, a county-specific version of the model was developed using 2016 IMPLAN data for Seneca County and the JEDI Wind Model's User Add-in Location feature. This model was used to assess economic impacts at the county level for Seneca County.

Impact Types

Total economic impacts reported by the JEDI Wind Model consist of three components.[3] These components are reported separately for the construction and operation phases of the Project.

---

[3] These categories were re-labeled in more recent versions of the JEDI Wind model "to reflect a more accurate description of these impacts and facilitate user interpretation of model results" (NREL 2017). Project Development and On-Site Labor Impacts were previously labeled Direct Impacts. Turbine/Local Revenue and Supply Chain Impacts were identified as Indirect Impacts. The original naming conventions are more consistent with IMPLAN and other input-

Construction Impact Types:

- ***Project Development and On-Site Labor Impacts:*** This component consists of expenditures on labor (wages and salaries and associated impacts) for workers engaged in on-site construction and people providing professional services in support of the Project. Typical on-site workers include road builders, concrete-pouring companies, construction companies, tower erection crews, and crane operators. Typical professional services include Project developers, and environmental and permitting consultants.
- ***Turbine and Supply Chain Impacts:*** This component includes the materials and equipment necessary for the Project (e.g., turbines, blades, and towers), and the smaller components that make up the balance of the system (e.g., wiring, inverters, mountings, and transformers), as well as the supply chain of inputs required to produce these materials.
- ***Induced Impacts:*** These impacts result from the spending of households associated either directly or indirectly with the Project. Workers employed during construction, for example, will use their income to purchase groceries and other household goods and services. Workers at businesses that supply the Project during construction will do the same. Induced effects are sometimes referred to as "consumption-driven" impacts.

Operation Impact Types:

- ***On-Site Labor Impacts:*** This component consists of expenditures on labor (wages and salaries and associated impacts) for workers engaged in on-site operation of the Project, including site technicians, administration, and management.
- ***Local Revenue and Supply Chain Impacts:*** This component includes expenditures on goods and services by suppliers who provide goods and services to the Project, as well as payments related to landowner leases and property tax or PILOT contributions.
- ***Induced Impacts:*** These impacts result from the spending of households associated either directly or indirectly with the Project.

Impact Measures

Impacts are assessed using the following measures as reported by the JEDI Wind Model:

- ***Employment****:* Jobs are expressed in the JEDI Wind Model as FTEs, or 2,080-hour units of labor (one job equates to one full-time job for one year). Part-time or temporary jobs constitute a fraction of a job. For example, if an engineer works just 3 months on a wind project, that would be considered one-quarter of a job by the JEDI Wind Model.
- ***Earnings (or labor income):*** Earnings are expressed as the sum of employee compensation and proprietary income.
- ***Output***: Output represents the total value of goods and services produced as a result of the Project, and serves as a broad measure of economic activity.

---

output models. The first category presented here does, however, differ from the typical Direct Impacts reported by IMPLAN and other input-output models because it is based on labor expenditures only and does not include direct expenditures on materials, which are included as part of the second category reported by the JEDI Wind Model.

Impact Sources

Construction

Project construction is expected to take place in 2019, with construction activities expected to extend from the second quarter through the fourth quarter. Based on similar project experience, Seneca Wind estimates that Project construction will directly employ from 175 to 250 workers on-site, including construction workers, engineers, electricians, equipment operators, and a number of other contractors and service providers.

Construction costs for this analysis were provided by Seneca Wind. These cost estimates were used in conjunction with more detailed industry-average values provided by the JEDI Wind Model to adjust the average model input values to more accurately reflect the proposed Project. The largest share of the overall construction cost is the purchase and transportation of the equipment (turbines, blades, and towers) to the Project site. The JEDI Wind Model default settings assume that this component accounts for approximately 75 percent of the total construction costs. The Project-specific estimates developed by Seneca Wind indicated that this component would comprise a smaller, but still substantial share of the total Project costs. Expenditures related to this construction component are expected to occur outside the State of Ohio.

Balance-of-plant activities make up a second broad category of costs. Balance-of-plant activities assessed in the model include materials, labor, and development and other costs. The materials portion includes concrete, rebar and other construction materials as well as the electrical components and cabling required to prepare the site and connect the turbines. The labor component includes the site work, foundations, electrical, erection, and other associated labor needed to construct the Project. Development and other costs include legal fees, engineering, site certificates, and other miscellaneous expenditures. The shares of these expenditures expected to be made locally (either in-state or in Seneca County) are estimated by the JEDI Wind Model. These estimates were reviewed with adjustments made to reflect local conditions and Project-specific information.

Operation

Once the construction phase is complete, O&M of the Project will continue to contribute to the local economy. The Project will provide direct O&M-related employment, and Project-related O&M expenditures will generate economic benefits in the local economy. Typical local O&M-related expenditures include vehicle-related expenditures, such as fuel costs, site maintenance, replacement parts and equipment, and miscellaneous supplies. Project-specific O&M costs developed by Seneca Wind were used for this analysis.

Lease payments to landowners will also generate annual benefits to the local economy over the life of the Project. In most cases these payments represent a net increase in income for the landowner. Each turbine occupies a relatively small footprint when compared to the site as a whole and landowners can usually continue farming and livestock operations on their property. Seneca Wind estimates that landowner payments will total more than $20 million over the life of the Project. These estimated payments were used to modify the default values estimated by the JEDI Wind Model. The impact of these payments is assessed by the model as an increase in household income.

Wind energy projects in the State of Ohio may be exempted from tangible personal property and real property tax payments if they meet certain conditions. This analysis assumes that Seneca Wind will meet these conditions and will instead make an annual PILOT payment of $9,000 per MW (as discussed below).

Economic Impacts

Construction and operation related impacts are presented below for Ohio and Seneca County in turn. It should be noted that impacts estimated for Seneca County are substantially lower than those modeled for the state as a whole because there are greater leakages of expenditures at the county level, resulting in

larger benefits at the state level. Further, the state-level evaluation also captures Project-related spending elsewhere in Ohio (i.e., outside Seneca County).

Construction Phase Impacts in the State of Ohio

Estimated construction phase impacts for the State of Ohio are summarized in Table 2. These estimates are one-time impacts developed using the JEDI Wind Model for Ohio. Job estimates are presented in FTEs, with each identified job representing 12 months (2,080 hours) of employment. Construction of the Project is expected to involve 99 on-site FTE jobs that would be filled by Ohio residents. Additional on-site positions that would be filled by out-of-state workers are not included in these estimates. Spending by out-of-state workers is, however, captured in the induced impact estimates. On-site jobs expected to be filled by Ohio workers include those associated with site work, foundations, electrical work, tower erection, and other associated labor needed to construct the plant. In addition, an estimated 22 construction-related service positions would be filled by Ohio workers. Jobs falling under the category of construction-related services include civil and electrical engineers, attorneys, and permitting specialists. Workers with more specialized skills, such as turbine assemblers, crane operators, and high voltage electrical workers are expected to come from outside the state, remaining only for the duration of their employment.

Table 2. Construction Phase Impacts in Ohio

Impact Type/Measure	Jobs[1]	Earnings ($ million)[2]	Output ($ million)[2]
Project Development and Onsite Labor Impacts	121	$8.89	$10.72
Construction and Interconnection Labor	99	$7.74	--
Construction Related Services	22	$1.15	--
Turbine and Supply Chain Impacts	479	$27.23	$90.75
Induced Impacts	195	$10.59	$31.15
Total Impacts	**795**	**$46.71**	**$132.62**

Notes:

[1] Jobs are FTE for a period of one year (1 FTE = 2,080 hours). Project development and onsite labor jobs and earnings include only those positions that would be filled by Ohio residents. Positions filled by out-of-state workers are not included in these estimates. Spending by out-of-state workers is, however, captured in the induced impact estimates.

[2] Earnings and output are expressed in millions of dollars in Year 2018 dollars.

Construction of the Project would also support employment, income, and output elsewhere in the state, with turbine and supply chain impacts expected to support 479 jobs in Ohio and induced impacts expected to support 195 jobs (Table 2). A majority of the estimated 479 turbine and supply chain jobs are expected to occur in the construction sector as a result of in-state expenditures on materials, specifically concrete and rebar, equipment, roads, and site preparation. The total also includes jobs in the retail, professional services, and manufacturing sectors, based on expenditures on materials, as well as estimated in-state expenditures on balance-of-plant labor (for example, foundation and electrical work, hauling, and tractor operation). Overall, construction of the Project is expected to support 795 total jobs in Ohio and approximately $46.7 million in earnings, with total output of approximately $132.6 million.

Annual Operation Phase Impacts in the State of Ohio

Estimated operation phase impacts for the State of Ohio are summarized in Table 3. These estimates are annual average impacts developed using the JEDI Wind Model for Ohio. Operation of the Project is expected to provide direct employment for 11 workers, all of whom would reside in Ohio. Operation and maintenance of the Project would also support employment, earnings, and output elsewhere in the state, with local revenue and supply chain impacts expected to support 14 jobs in Ohio and induced impacts expected to support an additional 14 jobs (Table 3). Overall, operation of the Project is expected to support 39 total jobs in Ohio and approximately $2.4 million in earnings, with total output of approximately $7.8 million. These annual average impacts are expected to occur over the life of Project operation.

Table 3. Annual Operation Phase Impacts in Ohio

Impact Type/Measure	Jobs[1]	Earnings ($ million)[2]	Output ($ million)[2]
Onsite Labor Impacts	11	$0.60	$0.60
Local Revenue and Supply Chain Impacts	14	$0.94	$4.73
Induced Impacts	14	$0.82	$2.42
Total Impacts	**39**	**$2.36**	**$7.75**

Notes:
[1] Jobs are FTE for a period of one year (1 FTE = 2,080 hours).
[2] Earnings and output are expressed in millions of dollars in Year 2018 dollars.

Construction Phase Impacts in Seneca County, Ohio

The Project's estimated construction phase impacts for Seneca County are summarized in Table 4. These estimates are one-time impacts estimated using a county-specific version of the JEDI Wind Model that was developed using 2016 IMPLAN data for Seneca County and the JEDI Wind Model's User Add-in Location feature. Construction of the Project is expected to directly employ approximately 10 workers from Seneca County on-site during the construction period. Positions filled by workers from elsewhere in Ohio and out-of-state are not included in these estimates. Spending by non-resident workers in Seneca County is, however, captured in the induced impact estimates.

The construction and interconnection labor estimates presented in Table 4 are conservative estimates and assume that only a small share of the construction workers estimated to be hired in-state (i.e., workers normally resident in Ohio) would be hired from within Seneca County. These estimates are likely conservative because an estimated annual average of 1,554 construction job were identified in Seneca County in 2016 (Table 1), which suggests that a sizeable construction workforce exists within the county. These workers likely have the necessary skills to fill on-site jobs associated with tasks, such as site work, foundations, and general electrical work. In addition, data from the IMPLAN model indicates that an estimated 141 workers were employed in the Construction of new power and communication structures sector (the IMPLAN sector that includes construction of power plants and electric and communication transmission lines) in Seneca County in 2016. This suggests that more specialized workers may also be available for hire within the county.

Construction of the Project would also support employment, income, and output elsewhere in the county, with turbine and supply chain impacts expected to support 31 jobs in Seneca County and induced impacts expected to support an additional 9 jobs (Table 4). Similar to the construction and interconnection labor estimates, the turbine and supply chain impacts in Table 4 are likely conservative estimates because they assume that only a small share of the expenditures on materials estimated to occur in-state would occur in

Seneca County. Materials estimated to be purchased in-state include concrete and rebar, and equipment, as well as materials related to roads and site preparation. Overall, construction of the Project is expected to support 49 total jobs in Seneca County and approximately $2.4 million in earnings, with total output of approximately $7.6 million.

Table 4. Construction Phase Impacts in Seneca County, Ohio

Impact Type/Measure	Jobs[1]	Earnings ($ million)[2]	Output ($ million)[2]
Project Development and Onsite Labor	10	$0.77	$0.77
Construction and Interconnection Labor	10	$0.77	--
Construction Related Services	0	$0.00	--
Turbine and Supply Chain Impacts	31	$1.31	$5.69
Induced Impacts	9	$0.29	$1.08
Total Impacts	**49**	**$2.36**	**$7.54**

Notes:
[1] Jobs are FTE for a period of one year (1 FTE = 2,080 hours). Project development and onsite labor jobs and earnings include only those positions that would be filled by Ohio residents. Positions filled by workers from elsewhere in Ohio and out-of-state are not included in these estimates. Spending by non-resident workers in Seneca County is, however, captured in the induced impact estimates.
[2] Earnings and output are expressed in millions of dollars in Year 2018 dollars.

Annual Operation Phase Impacts in Seneca County, Ohio

Estimated operation phase impacts for Seneca County are summarized in Table 5. These estimates are annual average impacts developed using the JEDI Wind Model for Seneca County. Operation of the Project is expected to provide direct employment for 11 workers, all of whom would reside in Seneca County. Project O&M would also support employment, earnings, and output elsewhere in the county, with local revenue and supply chain impacts expected to support 13 jobs in Seneca County and induced impacts expected to support an additional 4 jobs (Table 5). Estimated annual impacts include the effects of lease payments to landowners, which Seneca Wind estimates will total more than $20 million over the life of the Project. Overall, operation of the Project is expected to support 27 total jobs in Seneca County and approximately $1.2 million in earnings, with total output of approximately $4.6 million. These annual average impacts are expected to occur over the life of Project operation.

Table 5. Annual Operation Phase Impacts in Seneca County, Ohio

Impact Type/Measure	Jobs[1]	Earnings ($ million)[2]	Output ($ million)[2]
Onsite Labor Impacts	11	$0.59	$0.59
Local Revenue and Supply Chain Impacts	13	$0.45	$3.60
Induced Impacts	4	$0.11	$0.43
Total Impacts	**27**	**$1.16**	**$4.63**

Notes:
[1] Jobs are FTE for a period of one year (1 FTE = 2,080 hours).
[2] Earnings and output are expressed in millions of dollars in Year 2018 dollars.

Tax Revenues

Wind energy projects in the State of Ohio may be exempted from tangible personal property and real property tax payments if they meet certain conditions as provided in Ohio Revised Code (ORC) Section 5727.75. Qualified energy projects that receive this exemption are instead required to make annual PILOT payments. Annual PILOT payments are determined based on the size of the Project and the share of the construction workforce normally resident in the State of Ohio.

According to ORC 5727.75, tangible personal property of a qualified energy project using renewable energy resources is exempt from taxation for tax years 2011 through 2021 if all of the following conditions are satisfied:

- An application is filed for certification of the energy project as a qualified energy project with the director of the Ohio Development Services Agency on or before December 31, 2020.
- An application is filed with the Ohio Power Siting Board (OPSB) for a certificate under ORC section 4906.20.
- The county commissioners of a county in which the energy project is located either adopt a resolution approving the application submitted to the Ohio Development Services Agency or pass a resolution declaring the county an alternative energy zone (AEZ).
- Construction is initiated by January 1, 2021, with construction defined as either the date the application is filed with the OPSB or the date the contract for construction or installation is entered into, whichever is earlier.

If the applicant is granted an exemption from taxation from any of the tax years 2011 through 2021, the qualified energy project is also exempt from taxation for tax year 2022 and all following years.

Estimated PILOT "base" payments range from $6,000 per MW of nameplate capacity for projects where the majority (75 percent or more) of total construction jobs (measured in FTEs) are filled by workers normally resident in Ohio to $8,000 per MW for projects where Ohio residents account for a smaller share (50 to 60 percent) of total employment. PILOT payments are $7,000 per MW of nameplate capacity for projects where 60 to 75 percent of the construction workforce consists of Ohio residents. Under ORC 5727.75, county commissioners may also require an additional service payment, with a combined service and PILOT ("base") payment not to exceed $9,000 per MW.

The Board of Seneca County Commissioners adopted a resolution designating Seneca County as an AEZ in October 2011, with an annual service payment required in addition to the annual "base" payment of $6,000 to $8,000 per MW (Seneca County Commissioners' Office 2011). The amount of each service payment shall be the difference between $9,000 and the "base" payment per MW required under ORC 5727.75. The funds derived from the "base" payment will be distributed to taxing districts in accordance with the applicable millage in the respective taxing districts, with the additional service payments dispersed as decided by the Board of County Commissioners (Seneca County Commissioners' Office 2011).

Seneca Wind anticipates that it will make payments in lieu of real and personal property taxes in accordance with the applicable statute (ORC 5727.75) and the Board of Seneca County Commissioners' 2011 resolution (Seneca County Commissioners' Office 2011). For the Project, with a nameplate capacity of 212 MW, the combined "base" and service payment of $9,000 per MW will result in annual payments of $1.91 million during its first year of operation, and each year thereafter. This estimated total of $1.91 million is equivalent to 3.3 percent of total property tax revenues for all taxing jurisdictions in Seneca County, which were 58.4 million in 2017 (Ohio Department of Taxation 2017).

Conclusion

The preceding analysis estimates the economic and fiscal impacts associated with construction and operation of the proposed Project at the local (Seneca County) and state levels. Impacts were estimated for each geographic area, state and county, using separate JEDI Wind Models. The results of this analysis indicate that construction and operation of the Project would provide direct employment for residents in Seneca County and elsewhere in-state, as well as support economic activity elsewhere in the local and state economies.

Overall, construction of the Project is estimated to support 795 total (Project Development and On-Site, Turbine and Supply Chain, and Induced) jobs in the State of Ohio, and approximately $46.7 million in labor income, with total economic output of approximately $132.6 million. In Seneca County, Project construction is estimated to support approximately 49 total jobs and approximately $2.4 million in labor income, with total economic output of approximately $7.6 million. Construction impacts would be one-time impacts that would occur only during construction.

Operation of the Project is estimated to support approximately 39 total (direct, indirect, and induced) jobs in the State of Ohio and approximately $2.4 million in labor income, with total economic output of approximately $7.8 million. In Seneca County, Project operation is estimated to support approximately 27 full-time jobs and approximately $1.2 million in labor income, with total economic output of approximately $4.6 million. These annual average impacts are expected to occur over the life of Project operation.

Seneca Wind anticipates that it will make payments in lieu of real and personal property taxes in accordance with the applicable statute (ORC 5727.75) and the Board of Seneca County Commissioners' 2011 resolution (Seneca County Commissioners' Office 2011), with the Project estimated to generate $1.91 million in PILOT payments during its first year of operation, and each year thereafter. Seneca Wind also estimates that lease payments to landowners will total more than $20 million over the life of the Project.

Qualifications of the Preparer

This report was prepared by Matt Dadswell of Tetra Tech, with inputs provided by Seneca Wind LLC, as referenced in the report. Mr. Dadswell has a first class, joint honors, bachelor's degree in Economics and Geography from Portsmouth Polytechnic in England; a master's degree in Geography from the University of Cincinnati; and completed two years of doctoral study in Geography at the University of Washington. Mr. Dadswell has 24 years of experience preparing economic and social analyses for energy projects throughout the United States.

References

Auditor of State. 2017. Seneca County Single Audit for the Year Ended December 31, 2016. September. Available online at: http://www.senecacountyauditor.org/

NREL (National Renewable Energy Laboratory). 2017. Jobs and Economic Development Impact (JEDI) Models. About JEDI Wind Model. Available online at: http://www.nrel.gov/analysis/jedi/about_jedi_wind.html

Ohio Department of Job and Family Services. 2018. Ohio Labor Market Information. Labor Force, Employment & Unemployment. Available online at: http://ohiolmi.com/laus/laus.htm

Ohio Department of Taxation. 2017. Real Estate And Public Utility Tangible Personal Property, Assessed Value And Taxes Charged Including Special Assessments For Taxes Payable In Calendar Year 2017 (A), By County. August 31. Available online at: https://www.tax.ohio.gov/tax_analysis/tax_data_series/publications_tds_property.aspx

Seneca County Commissioners' Office. 2011. In the Matter of: Designating Seneca County as an Alternative Energy Zone; Approving all Applications Submitted by the Depart of Development; Requiring Annual Service Payments and Additional Service Payments; and Specifying the Time and Manner of Such Payments. October 17.

Seneca Industrial and Economic Development Corp. 2018. Largest Private Employers in Seneca County. Available online at: https://senecasuccess.wordpress.com/2015/08/28/largest-private-employers-in-seneca-county/

US. Census Bureau. 2018a. QuickFacts. Available online at: https://www.census.gov/quickfacts/table/PST045215/00

US. Census Bureau. 2018b. PEPANNRES: Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2016. Available online at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

US. Census Bureau. 2018c. B01003. Total Population. 2012-2016 American Community Survey Selected Population Tables. Available online at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. 2018d. PEPTCOMP: Estimates of the Components of Resident Population Change: April 1, 2010 to July 1, 2016. Available online at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

US. Census Bureau. 2018e. P001. Total Population. Census 2000 Summary File 1 (SF 1) 100-Percent Data. Available online at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

WSOS Community Action Group, Inc. 2011. Seneca County Comprehensive Economic Development Strategy. December.

Appendix D: Complaint Resolution Program

Seneca Wind
Complaint Resolution Program

1. INTRODUCTION

Seneca Wind LLC (Seneca Wind) has developed a complaint resolution program for implementation during the construction of the Seneca Wind project (the Project) to provide an effective process for identification and resolution of concerns voiced by members of the community.

Seneca Wind is committed to complying with requirements established through the Ohio Power Siting Board (OPSB) and other regulatory processes, and to establishing an accessible process for community members to voice concerns and for those concerns to be addressed as quickly and effectively as possible. Maintaining detailed records of all complaints and resulting actions is an important aspect of the complaint resolution program.

Seneca Wind's policy is to take all reasonable necessary actions to rectify legitimate interference or disturbances that are a direct result of the Project.

2. COMPLAINT RESOLUTION PROCEDURE

2.1 Seneca Wind Contacts

Seneca Wind will establish a toll-free telephone number prior to the Project being commercially operational and will provide that number to the county commissioners, township trustees, emergency responders, schools, and public libraries within the Project Area; that number will also be posted on the Project website. To register a complaint, individuals may either call the telephone number and leave a message or go to the local construction office during regular business hours.

2.2 Notification

In addition to providing the contact information and procedure to the officials and public locations noted above, Seneca Wind will maintain a Project contact list for residents and will provide notification to residences located within 1 mile of construction activities that construction is about to commence.

2.3 Complaint Documentation and Follow-Up

Seneca Wind will keep a logbook to register every complaint received. The logbook will include pertinent information about the person making the complaint, the issues surrounding the complaint, and the date the complaint was received; an example of a complaint resolution form is attached.

The logbook will also document Seneca Wind's recommended resolution, the date agreement was reached on a proposed resolution, and the date when the proposed resolution was implemented. Seneca Wind personnel will generate a quarterly report based on the information recorded in the log book about the nature and resolution of all complaints received in that quarter, and file the report with the OPSB on January 31, April 30, July 31, and October 31 of each calendar year or portion thereof during construction.

Individuals who register a complaint with Seneca Wind will receive correspondence from Seneca Wind no later than 2 business days after registering the complaint. The intent of the initial correspondence is to gather more information to better understand the complaint. Within 30 days of the complaint being logged, Seneca Wind will initiate reasonable action to resolve the legitimate interference or disturbance that is a direct result of the Project.

If Seneca Wind and the complaining individual cannot agree to a resolution, Seneca Wind will provide a summary of the complaint and proposed resolution to the complaining individual so the complaint can be brought to the OPSB.

Seneca Wind
Complaint Resolution Form

Complaint Log Number: _____ Complainant's name and address: Phone number/email:
Date complaint received: _____ Time complaint received: _____ Date complainant first contacted: _____
Nature of complaint:
Definition of problem after investigation:
Description of corrective measures taken: Complainant's signature: _____ Date: _____
This information is certified to be correct: Site Manager's Signature: _____ Date: _____

(Attach additional pages and supporting documentation, as required.)

Appendix E: Transportation Management Plan

Pending Filing

Appendix F: FAA Filings

Federal Aviation Administration

« OE/AAA

Project Submission Success
Project Name: S POW-000474618-18

Project S POW-000474618-18 has been submitted successfully to the FAA.

Your filing is assigned Aeronautical Study Number (ASN):

2018-WTE-5597-OE
2018-WTE-5598-OE
2018-WTE-5599-OE
2018-WTE-5600-OE
2018-WTE-5601-OE
2018-WTE-5602-OE
2018-WTE-5603-OE
2018-WTE-5604-OE
2018-WTE-5605-OE
2018-WTE-5606-OE
2018-WTE-5607-OE
2018-WTE-5608-OE
2018-WTE-5609-OE
2018-WTE-5610-OE
2018-WTE-5611-OE
2018-WTE-5612-OE
2018-WTE-5613-OE
2018-WTE-5614-OE
2018-WTE-5615-OE
2018-WTE-5616-OE
2018-WTE-5617-OE
2018-WTE-5618-OE
2018-WTE-5619-OE
2018-WTE-5620-OE
2018-WTE-5621-OE
2018-WTE-5622-OE
2018-WTE-5623-OE
2018-WTE-5624-OE
2018-WTE-5625-OE
2018-WTE-5626-OE
2018-WTE-5627-OE
2018-WTE-5628-OE
2018-WTE-5629-OE
2018-WTE-5630-OE
2018-WTE-5631-OE
2018-WTE-5632-OE
2018-WTE-5633-OE
2018-WTE-5634-OE
2018-WTE-5635-OE
2018-WTE-5636-OE
2018-WTE-5637-OE
2018-WTE-5638-OE
2018-WTE-5639-OE
2018-WTE-5640-OE
2018-WTE-5641-OE
2018-WTE-5642-OE
2018-WTE-5643-OE
2018-WTE-5644-OE
2018-WTE-5645-OE
2018-WTE-5646-OE
2018-WTE-5647-OE
2018-WTE-5648-OE
2018-WTE-5649-OE
2018-WTE-5650-OE
2018-WTE-5651-OE
2018-WTE-5652-OE
2018-WTE-5653-OE
2018-WTE-5654-OE
2018-WTE-5655-OE
2018-WTE-5656-OE
2018-WTE-5657-OE
2018-WTE-5658-OE
2018-WTE-5659-OE
2018-WTE-5660-OE
2018-WTE-5661-OE
2018-WTE-5662-OE
2018-WTE-5663-OE
2018-WTE-5664-OE
2018-WTE-5665-OE
2018-WTE-5666-OE
2018-WTE-5667-OE
2018-WTE-5668-OE
2018-WTE-5669-OE

2018-WTE-5670-OE
2018-WTE-5671-OE
2018-WTE-5672-OE
2018-WTE-5673-OE
2018-WTE-5674-OE
2018-WTE-5675-OE
2018-WTE-5676-OE
2018-WTE-5677-OE
2018-WTE-5678-OE
2018-WTE-5679-OE
2018-WTE-5680-OE
2018-WTE-5681-OE
2018-WTE-5682-OE
2018-WTE-5683-OE
2018-WTE-5684-OE
2018-WTE-5685-OE
2018-WTE-5686-OE
2018-WTE-5687-OE
2018-WTE-5688-OE
2018-WTE-5689-OE
2018-WTE-5690-OE
2018-WTE-5691-OE
2018-WTE-5692-OE
2018-WTE-5693-OE
2018-WTE-5694-OE
2018-WTE-5695-OE
2018-WTE-5696-OE

Please refer to the assigned ASN on all future inquiries regarding this filing.

Please return to the system at a later date for status updates.

It is the responsibility of each e-filer to exercise due diligence to determine if coordination of the proposed construction or alteration is necessary with their state aviation department. Please use the link below to contact your state aviation department to determine their requirements:
State Aviation Contacts

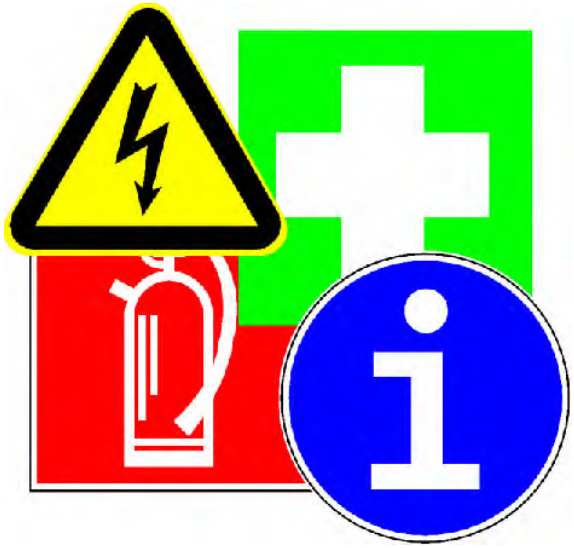
To ensure e-mail notifications are delivered to your inbox please add noreply@faa.gov to your address book. Notifications sent from this address are system generated FAA e-mails and replies to this address will NOT be read or forwarded for review. Each system generated e-mail will contain specific FAA contact information in the text of the message.

Appendix G: Turbine Safety Manual

GE Power and Water

– Original –

Technical Documentation
Wind Turbine Generator Systems
1&2MW Platform



Safety Manual

-Please read first-

imagination at work

© 2015 General Electric Company. All rights reserved

Gepower.com

Visit us at
www.gewindenergy.com

All technical data is subject to change in line with ongoing technical development!

Copyright and patent rights

This document is to be treated confidentially. It may only be made accessible to authorized persons. It may only be made available to third parties with the expressed written consent of General Electric Company.

All documents are copyrighted within the meaning of the Copyright Act. The transmission and reproduction of the documents, also in extracts, as well as the exploitation and communication of the contents are not allowed without express written consent. Contraventions are liable to prosecution and compensation for damage. We reserve all rights for the exercise of commercial patent rights.

© 2015 General Electric Company. All rights reserved.

GE and ■ are trademarks and service marks of General Electric Company.

Other company or product names mentioned in this document may be trademarks or registered trademarks of their respective companies.

imagination at work

Table of Contents

1 Basic Information on the Technical Documentation for GE Energy Wind Turbine Generator Systems 5
Explanation of Abbreviations 5
2 General Safety Principles 6
2.1 Personnel Groups 6
2.1.1 Qualified Persons 6
2.1.2 Technically Competent Persons 7
2.1.3 Experienced Persons 7
2.1.4 Experts 7
2.2 Proper Use 7
2.3 General Information 8
3 Marks, Signs and Symbols 9
3.1 Danger Classifications and Symbols 9
3.2 Marks and Signs attached by GE Energy 10
3.2.1 Tower 11
3.2.2 Nacelle 16
3.2.3 Hub 22
4 Information for the Operator/Owner of the Wind Turbine Generator System 24
5 Signs to be attached by the Operator/Owner 25
6 Safety Equipment 26
6.1 Personal Protective Equipment 26
6.2 Safety Harness 27
6.2.1 Example of Putting on a Standard Safety Harness 28
6.2.2 Cable or Rail Grab Device/Fall Arrestor 31
Using the Cable or Rail Grab Device 32
Rail Grab Device 32
Cable Grab Device 32
6.3 Protective Equipment for Measurements on Live Components 32
6.4 Hooking Points 33
6.5 Abseiling Device 33
6.5.1 Abseiling from the Roof of the Nacelle 34
6.5.2 Care and Maintenance of the Abseiling Device 35
6.6 Fire Extinguishers (optional feature) 36
6.6.1 Operating principle of the optional fire extinguisher – An example 37
6.6.2 Types of Fire Extinguisher 37
6.7 First Aid 38
First Aid Box (Optional) 38
7 Safety Devices 39
7.1 Emergency Stop Pushbuttons 39
7.2 Rotor Lock 40
7.2.1 Rotor Lock on the High-speed Shaft (HSS) 40
Engaging the Rotor Lock on the High-Speed Shaft 40
7.2.2 Rotor Lock on the Low-Speed Shaft (LSS) 40
Engaging the Rotor Lock on the Low-speed Shaft 40
8 Residual Risks 42
8.1 Special Dangers – Electric Power 43
8.2 Special Dangers – Hydraulic System 44
8.3 Special Dangers - Noise 44
8.4 Special Dangers - Icing 44

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

8.4.1 Ice Build-up on the Rotor Blades 44
8.4.2 Icy Condition of the Access Route 45
8.4.3 Icy Condition of the Tread of the Steps outside the Nacelle 45
8.5 Exceptional Dangers – Earthquakes 45
9 Safety Information for Individual Plant Components 46
9.1 Down Tower Assembly 46
9.2 Anemometer and Wind Vane 46
9.3 Top Box 47
9.4 Pitch Electrical Control Cabinets Inside the Hub - Axis and Battery 47
10 Conduct in Emergency Situations 48
10.1 Conduct in Case of Fire 48
10.1.1 Fire-Fighting 48
10.1.2 Fire in the Tower - Person in the Nacelle 49
10.1.3 Fire in the Nacelle - Person in the Nacelle 49
10.1.4 Fire in the Transformer 49
10.2 Escape Routes 50
10.2.1 First Escape Route 50
10.2.2 Second Escape Route 50
10.3 Information for Rescue and Emergency Personnel 50
10.4 Oil Spill – Immediate Measures 51
Measures 51
11 Remaining in and on the Wind Turbine Generator System 52
11.1 Approaching and Entering Frosted Wind Turbine Generator Systems 53
11.2 Shut-down of the Wind Turbine Generator System 53
11.3 Climbing the Tower 54
11.4 Deactivation of the Yaw Drive 55
11.5 Entering the Nacelle 55
11.6 Walking on the Roof of the Nacelle/Entering the Rotor Hub 56
Walking on the Roof with Ice and Snow 57
11.7 Activation of the Wind Turbine Generator System 58
12 Information on Maintenance and Troubleshooting 58
13 Power Disconnection and Isolation Procedures (Lock-out/Tag-out Instructions) 60
13.1 Identification of Installations, Processes, Circuits 60
13.2 Preparation for Shutdown / Notification of Affected Employees 60
13.3 Identification of Energy Sources and Strengths 60
13.4 Deactivation of Energy Sources and the Mounting of Energy Control Devices 60
13.5 Control of Stored Energy 61
13.6 Verification of Isolation 61
13.7 Reconnection of the Installation to the Supply 61
ANNEX: Items and Installations which are subject to Inspection pursuant to the Accident Prevention Regulations 63

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

1 Basic Information on the Technical Documentation for GE Energy Wind Turbine Generator Systems

This "Safety Manual" is a constituent part of the technical documentation for GE Energy wind turbine generator systems. In the case of offshore plants, the supplementary safety information for offshore plants is also to be considered.

The safety manual must be read and understood by the operating and maintenance personnel and the owner, in order to guarantee safety in and on the wind turbine generator system and to prevent accidents and personal injuries.

In addition to the safety manual, the respective specific safety information in the technical documentation, in which e.g. installation or maintenance is described, must always be read.

The basic rules of conduct for safe working in and on the WTG are described in this safety manual.

Any unclear points in the technical documentation, which may jeopardize the correct performance of work in or on the WTGS, must first of all be clarified. Contact GE Energy for advice if necessary.

In addition to the safety manual, the local safety and accident prevention regulations must be complied with to ensure the safety of personnel.

Explanation of Abbreviations

WTGS	Wind Turbine Generator System
PPE	Personal Protective Equipment
EHS	Environment, Health & Safety

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

2 General Safety Principles

The GE Wind Energy 1&2MW Platform Wind Turbine Generator System (WTGS) has been built according to recognized safety rules.

Hazards for the user or third parties and impairment of the wind turbine generator system and other property may nevertheless arise during the use of this facility if it is

- operated by untrained or uninstructed staff
- not used properly
- improperly maintained or serviced

The owner / operator responsible for the WTG must ensure that

- The safety manual and the operating manual are available and are complied with
- The service conditions and technical data are complied with
- The protective devices are used
- The prescribed maintenance work is carried out
- The maintenance personnel are immediately informed or the plant immediately shut down if higher temperatures, noise, vibration, etc. compared to operation at normal rating should occur.

The operating manual contains the information required for operation of the WTG by qualified personnel.

The warranty of the manufacturer is only provided if the currently valid operating manual is observed and complied with.

NOTE

Take precautions against malfunctions and thereby prevent personal injury or death and material damage!

2.1 Personnel Groups

Different personnel groups are specified for carrying out the various tasks in and on the WTG. Before work is started, it must be ensured that the personnel in question have the requisite qualifications to carry out the respective tasks. If necessary, suitable training or qualification measures are required, or the work is carried out by other personnel with a suitable qualification.

2.1.1 Qualified Persons

Work on electrical equipment and machinery may only be carried out by qualified persons who are familiar with the currently applicable safety and installation regulations. The qualified persons must be authorized to carry out the requisite tasks by the person responsible for safety in the WTG under the health and safety regulations. A qualified person is a person who

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

- has appropriate training and experience
- is familiar with the currently applicable standards, regulations and accident prevention regulations and generally recognized code of practice
- has been instructed in the operating principle and service conditions of electrical and mechanical drive systems and
- can recognize and avoid dangers

Unqualified persons may not be deployed.

2.1.2 Technically Competent Persons

Technically competent persons are persons who have the requisite technical knowledge for the inspection of work equipment as a result of their professional training, their professional experience and their current professional activity.

2.1.3 Experienced Persons

An experienced person is someone who, on the basis of his technical training and experience, has gained adequate knowledge in the particular field of the equipment/device to be tested and who is acquainted with the pertinent national industrial safety legislation, the regulations for the prevention of accidents, directives and generally accepted engineering standards (DIN standards, VDE regulations, technical rules of other member states of the European Union or other contracting states of the agreement concerning the European Economic Area as well as OSHA/ANSI/NFPA/CSA and other standards and regulations for the Americas) to the extent that he is able to assess the safe working order of the equipment/device concerned.

2.1.4 Experts

Experts are persons who are familiar with the relevant industrial safety regulations, directives and generally recognized code of practice and can verify and authoritatively assess the presence of threats and dangers.

2.2 Proper Use

The GE Energy 1&2MW Platform Wind Turbine Generator Systems are intended solely for the generation of electrical power by means of wind energy.

Any other use or use extending beyond this is deemed to be improper. The operator / owner of the WTG bears the sole responsibility for any damage resulting there from.

The same also applies to any unauthorized modifications made to the WTG. As a general principle, modifications to the WTG may be carried out only after consultation with GE Energy, in order to guarantee the safety and the correct functioning of the WTGS.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Proper use also includes compliance with the information on

- Safety
- Operation
- Service and maintenance

provided in the technical documentation of the WTGS.

2.3 General Information

The wind turbine generator system may only be used in a technically perfect condition in line with the technical documentation. In addition, it must be used as intended, as well as with safety in mind and with an awareness of the dangers. Any malfunctions, particularly those which could impair safety, must be reported and remedied immediately.

Anybody who has been authorized to carry out erection, commissioning, operation or maintenance work must have read and understood the complete operating manual, in particular the safety manual.

It is too late to read the manual while carrying out the work. This applies especially to personnel who are only occasionally deployed on the wind turbine generator system.

The operating manual must be readily available at the site of operation of the wind turbine generator system at all times. It is kept in the main cabinet of the WTG.

The relevant regulations for the prevention of accidents (see "Information for the Operator" in "Basic information regarding the operating instructions manual") and any other generally recognized safety and industrial health regulations must also be complied with.

We cannot be held liable for any damage or accidents as a result of non-compliance with the operating instructions, the relevant regulations for the prevention of accidents and any other generally recognized safety and industrial health regulations.

Responsibilities for the different activities within the framework of operation, service and maintenance of the WTG must be clearly defined and complied with. This is the only way to prevent mistakes, particularly in dangerous situations.

The instructions for

- Shutting down the WTG
- Maintenance work
- Handling the rotor lock
- Entering the rotor hub

must be followed during the inspection, maintenance and repair of the wind turbine generator system and the safety devices.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

3 Marks, Signs and Symbols

3.1 Danger Classifications and Symbols

The following danger classifications and symbols are used in the technical documentation for the GE Energy 1&2MW Platform wind turbine generator systems:

NOTE

Notes include user tips and useful information.
All notes should be implemented in the interest of a proper use of the wind turbine generator system.

ATTENTION

Exact description of danger!

Indicates a potentially hazardous situation that may result in damage to the WTGS or surrounding area if the dangerous situation is not avoided.

Gives are clear instruction on how to avoid damage to the WTGS.

CAUTION

Exact description of danger!

Indicates a potentially hazardous situation which may result in slight or minor injury if the dangerous situation is not avoided.

Gives a clear instruction on how to avoid the dangerous situation.

WARNING

Exact description of danger!

Indicates a potentially hazardous situation that may result in death or serious injury if the dangerous situation is not avoided.

Gives a clear instruction on how to avoid the dangerous situation.

DANGER

Exact description of danger!

Indicates an imminent threatening danger resulting in death or serious injury.

Gives a clear instruction on how to avoid injury.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

All notices and symbols directly attached to the WTG, such as safety signs, operating notices, rotation arrows, component identification markings, etc., must be observed without fail. They may not be removed and must be maintained in a fully legible condition.

3.2 Marks and Signs attached by GE Energy

The personnel in the WTG must be able to check certain data at all times, in order to ensure safe operation of the WTG. The following information must therefore be clearly visible and permanently attached:

1. Marks for identification of the device
2. Characteristic values by means of which the permissible limits for safe use are specified, e.g. permissible load, rotational speed, pressure.

In addition, information about the prescribed use and about possible dangers which could arise when handling a device must be provided.

Safety marks could be texts, signs, signals, pictographs and colors. All texts are to be in two languages, i.e. English and the respective national language. Pictographs must be easy to understand and self-explanatory.

The signs are made of durable materials with stable colors.

The instructions on the safety signs and marks must be followed.

The presence and legibility of the safety signs must be checked as part of the regular maintenance work. Any missing or illegible safety signs must be replaced immediately.

The signs in the wind turbine generator systems may differ as a result of country-specific differences in the environmental and safety regulations.

All possible signs attached by GE Energy are listed in the following:

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

3.2.1 Tower

Keep escape and rescue routes clear! This sign is attached in the entrance area of the turbine. Not for USA/Canada!	
It is strictly forbidden to leave the WTGS with rotor lock applied! This sign is attached in the tower at the bottom of the ladder.	
Falling hazard warning on trap doors and floor openings! This sign is attached to each platform.	
Falling objects hazard warning! This sign is attached to each hatch.	
Admissible maximum loading of the platform! This sign is attached to each platform.	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Always close hatch after climbing through! This sign is attached to each platform.	
Climbing the WTG - Things to do! This sign is attached in the tower near the ladder.	
Danger: Electricity! This sign is attached to the outside of the door..	
Dangerous batteries! This sign is attached to the emergency power supply unit and to the main cabinet.	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Attention, confined space! This sign is attached to the underside of the access hatch leading to the transformer section.	
No access for persons with pacemakers!	
Fire extinguisher! This sign is attached in the tower near the fire extinguisher. Not for USA/Canada!	
ONLY WITH TRANSFORMER IN TOWER: **Attention! High voltage!** This sign is attached to the outside of the door, the switch gear, the transformer cage and the hatch to the tower base.	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Access forbidden! This sign is attached to the outside of the door.	
First Aid! This sign is attached at the bottom of the tower. Not for USA/Canada!	
First Aid! This sign is attached at the bottom of the tower. Not for USA/Canada!	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Climbing the WTG - Things not to do! This sign is attached in the tower at the bottom of the ladder.	
Tie off point Only for USA/Canada!	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

3.2.2 Nacelle

Description	Sign
Pinch Point (ANSI) This sign is attached in the nacelle during the assembly. Only for USA/Canada!	
Pinch Point (ISO) This sign is attached in the nacelle during the assembly. Only for USA/Canada!	
Instructions for working in the nacelle! This sign is attached in the nacelle.	
Instruction for the rotor lock on the high-speed shaft! This sign is attached to the cover beside the rotor lock on the high-speed shaft (sample: actual wind speed limits may vary by WTG model in accordance with the Assembly and Maintenance Wind Speed Limitations document).	

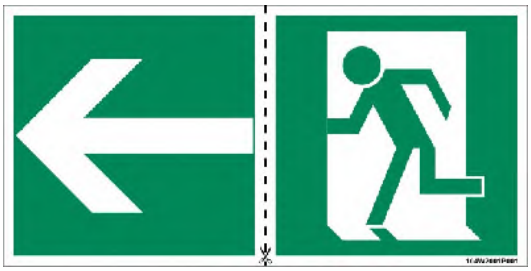
CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
Allowable Loading rotor lock - low-speed shaft! This sign is attached to the rotor lock of the low-speed shaft. This sign shown here is a representative example; versions with the updated wind speeds for newer models may be applied.	
It is forbidden to leave the WTGS with rotor lock applied! This sign is attached in the nacelle above the passage to the tower.	
Standing on the starter terminal box prohibited – NOT A STEP! This sign is attached to all surfaces which may not be used as a step.	
Warning: strong wind currents! This sign is attached to the hatch leading to the roof of the nacelle (exit to the hub).	
Falling Hazard Warning! This sign is attached to the hatch leading to the roof of the nacelle (exit to the hub).	
Caution! Hot surface. This sign is attached to the generator.	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
ONLY FOR PLANTS WITH COLD WEATHER EQUIPMENT! **Caution! Hot surface.** This sign is attached to the anemometer on the roof of the nacelle.	
Instructions for entering the rotor hub! This sign is attached to the hatch leading to the roof of the nacelle (exit to the hub).	
Instructions for yaw stop! This sign is attached beside the yaw stop switch on the uppermost tower platform.	
ONLY FOR PLANTS WITH AN "EMERGENCY DESCENT HATCH": **Falling hazard at hatches!** This sign is attached to the optional emergency descent hatch.	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
Maximum load on the bottom surface in the nacelle enclosure! This sign is attached in the nacelle enclosure near the generator.	
Warning! Must be tied off at all times! This sign is attached to the hatch leading to the roof of the nacelle (exit to the hub). Only for USA/Canada!	
Attention! Danger from rotating parts! This sign is attached to the yaw and the low-speed and the high-speed shaft.	
Fire extinguisher! This sign is attached in the nacelle near the fire extinguisher. Not for USA/Canada!	
ONLY FOR PLANTS WITH AN "EMERGENCY DESCENT HATCH": **Emergency exit!** This sign is attached above the emergency descent hatch!	
First Aid! This sign is attached near the First Aid box. Not for USA/Canada!	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
First Aid! This sign is attached near the First Aid box. Not for USA/Canada!	
First Aid! This sign is attached near the First Aid box. Not for USA/Canada!	
Use the railing for hooking! This sign is attached beside the roof hatch in the nacelle enclosure. Not for USA/Canada!	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
Attention! Use the railing for hooking! This sign is attached beside the roof hatch in the nacelle enclosure. Only for USA/Canada	
Hook onto Spinner! This sign is attached to the hatch leading to the nose cone. Not for USA/Canada!	
Hook onto Spinner! This sign is attached to the hatch leading to the nose cone. Only for USA/Canada	
Lift point (ANSI) This sign is attached to the lifting lugs of the main frame. Only for USA/Canada	
Lift point (ISO) This sign is attached to the lifting lugs of the main frame. Only for USA/Canada	
Lift point for top cover only (ANSI) This sign is attached to the tie-off points of the top cover. Only for USA/Canada	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
Lift point for top cover only (ISO) This sign is attached to the tie-off points of the top cover. Only for USA/Canada	

3.2.3 Hub

Description	Sign
Dangerous batteries! This sign is attached to the battery cabinet in the hub.	
Attention! Danger from rotating parts! This sign is attached to the pitch drive mechanisms.	
Danger: Electricity! This sign is attached to the axis cabinets in the rotor hub.	
Falling Hazard Warning! This sign is attached to the hatches of the hub.	
Maximum load on the blade root bulkhead This sign is attached above and below each rotor blade connection, so that the signs are exposed to view on entering the rotor blade.	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Description	Sign
Attention! Confined space This sign is attached to the access hatch leading the hub.	
Caution! May energize without warning (ANSI) This sign is attached to the pitch drive mechanisms. Only for USA/Canada	
Caution! May energize without warning (ISO) This sign is attached to the pitch drive mechanisms. Only for USA/Canada	
Secure hatch (ANSI) This sign is attached to the access hatch to the hub Only for USA/Canada	
Secure hatch (ISO) This sign is attached to the access hatch to the hub Only for USA/Canada	
Caution! Handle or Step only (ANSI) This sign is attached to the handles in the entrance to the hub. Only for USA/Canada	
Caution! Handle or Step only (ISO) This sign is attached to the handles in the entrance to the hub. Only for USA/Canada	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

4 Information for the Operator/Owner of the Wind Turbine Generator System

The operator of the WTG is responsible for ensuring that no unauthorized persons remain inside or on the WTG. The WTG must be kept locked to prevent this.

The wind turbine generator system may only be started up if it has been completely assembled and is in working order.

The wind turbine generator system may only be operated if all safety equipment and safety-relevant devices, e.g. detachable protective equipment, are in place and operational.

If any malfunctions occur or if ice builds up on the rotor blades, the wind turbine generator system must be shut down immediately and secured. Malfunctions are to be remedied without delay by trained technical personnel.

In the case of malfunctions which are not automatically reset by the control system of the WTG, GE Energy must be contacted before a restart is carried out, in order to confirm that the WTG may be placed in the automatic operating mode (i.e. whether the WTG may be restarted).

Follow the switch-on and shut-down procedures and take note of the visual and monitoring displays in accordance with the operating manual!

In addition to this, the operator/owner of the WTG must comply with the following additional safety instructions (if maintenance is not carried out by GE Energy employees):

- If the WTG is not directly connected to the public telephone system, the maintenance personnel must have a cell phone or radio with them when ascending the tower.
- The personnel must be informed about who to contact in an emergency. (Telephone numbers of a rescue center, police, fire department...)
- For safety reasons, the personnel must be instructed that the WTG may only be entered by a minimum of two persons.
- Special authorization from GE Energy is required to carry out inspection and maintenance work inside a WTG while it is in operation.
- The personnel must be instructed to keep the WTG escape routes clear at all times when carrying out work as a part of maintenance or operation.
- In the case of work involving a fire hazard, the personnel must have a fire extinguisher ready at hand, in order to be able to immediately extinguish any fire that may start.
- Personnel are not permitted to remain at a higher level in the WTG while work involving a fire hazard is being carried out.
- Personnel instructed to carry out work in or on the WTG must be provided with instructions and the appropriate personal protective equipment (PPE).
- The WTGS must only be entered when a second person is available to provide assistance or call for help in case of accident.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

- If the WTG is part of a wind farm and connected to a wind power plant, this safety manual must be supplemented in cooperation with the local power supply company, so that it also:
  - describes the safety aspects relevant to the wind farm
  - describes the exchange of information and names the persons who are to be contacted
  - describes access to basic first aid facilities

5 Signs to be attached by the Operator/Owner

The operator/owner of the WTG is obliged to attach additional warning signs to the WTG. These are intended to cover safety aspects which are not related to the scope of supply of the manufacturer of the WTG.

The warning signs must state that

- It is dangerous and prohibited for unauthorized persons to enter or climb the WTG
- It is prohibited to remain in the vicinity of the WTG while work is being carried out outside the nacelle
- Deposits of ice which have formed on the rotor blades (depending on the location of the WTG) could drop off

The operator/owner is responsible for seeing that any components or plant components which he has supplied are properly equipped with signs.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

6 Safety Equipment

The safety equipment serves to reduce risks and dangers. You will find further information on equipment and items which are subject to inspection in the annex of this safety manual.

6.1 Personal Protective Equipment

Everybody must wear Personal Protective Equipment (PPE) when working on or in the WTG to protect themselves from injury.

DANGER

Danger of accident!

Never enter or climb the WTG without the personal protective equipment. Otherwise there is danger of injury and falling.

The PPE is especially required for climbing the tower. It comprises:

- Safety harness
- Cable or rail grab device/fall arrestor
- Double lanyard with shock absorber
- Hard hat
- Safety boots
- Gloves
- Safety glasses
- Hearing protection (if required)
- Respirator (if required)
- Thermal clothing (if required
- Suspension trauma straps

The PPE must be of an approved type; must be compliant with the applicable local regulators; and must bear marks of conformity stating that it is suitable for the work and protection involved and that it is also suitable for the climatic conditions at the site of the WTGS.

NOTE

The extent and the equipment of the personal protective equipment may vary in some countries. Please comply with the local regulations!

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Optionally, safety harness and travelling safety hooks may be supplied by GE Energy. The remaining constituents of the PPE are not part of the scope of supply of the wind turbine generator system. If supplied the safety harnesses and travelling safety hooks must be properly stored in the WTG and must be accessible.

If several persons ascend the tower simultaneously, personal protective equipment must be available for the respective number of persons.

NOTE

Check the completeness, the condition and the function of your personal protective equipment in good time before entering the WTG. If a piece of the equipment is missing, it must be replaced before starting work.

The safety harness and the entire safety equipment must be checked before use. Damaged equipment must never be used.

The PPE must be inspected and tested by a technically competent person after any fall, or at the intervals recommended by the manufacturer at least.

NOTE

Follow the manufacturer's directions for use for all component parts of the personal protective equipment!

6.2 Safety Harness

ATTENTION

Danger of equipment failure.

The Safety harness and all safety equipment should never be exposed to acids/caustic chemicals. If this is unavoidable, follow manufacturer instructions for treatment.

Protect from sharp edges and sharp-edged objects.

Wash and dry according to manufacturer’s instructions.

Store in a well-aired place out of direct sunlight.

The safety harness is used to protect personnel during the ascent to the nacelle of the WTG, during the descent from the nacelle of the WTGS and, in combination with a lanyard and a shock absorber, when carrying out work in areas where there is a danger of falling.

Optionally, safety harness and travelling safety hooks may be supplied by GE Energy.

The safety harnesses and the entire safety equipment must be cleaned, cared for, maintained and stored in accordance with the manufacturer's instructions.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Follow the manufacturer's instructions when putting on the safety harness.

6.2.1 Example of Putting on a Standard Safety Harness

As previously mentioned, the manufacturer's instructions should always be followed when putting on a safety harness. An example of how to wear a safety harness is included below.

1. **Hold the safety harness in such a way that you can see in which way it is going to be put on at a later stage.**
   (Fig. 1)
   Ensure that the loops are not twisted.

Fig. 1: Preparing the safety harness

2. **Insert your arms through the yellow shoulder straps and place the safety harness on your shoulders like a rucksack.**
   (Fig. 2 and Fig. 3)

Fig. 2: Insert your arms through the shoulder straps

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Fig. 3: Safety harness on the shoulders

3. **Closing the stomach strap**

   Take the two loops positioned at stomach height.

   Pull the right-hand loop (1) through the eyelet (2) and guide the end of the loop through the rectangular frame (3). (Fig. 4)

   Adjust the strap to ensure a close fit.

Fig. 4: Closing the stomach strap

4. **Closing the chest strap**

   Take the two straps positioned at chest height. (Fig. 5)

   Pull right-hand strap (1) through the eyelet (2) and insert its end through the rectangular frame (3) also located on the right-hand strap.

   Adjust the strap to ensure a close fit. (Fig. 6)

Fig. 5: Closing the chest strap

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Fig. 6: Closed chest strap

5. **Closing the leg loops**

   Push both loose leg loops from behind through the legs and to the front.

   Pull the leg loops through the strap closure and pull the leg loops tight. (Fig. 7)

Fig. 7: Closing the leg loops

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

6. **Check that all straps are straight and close fitting and that the buckles are closed correctly.**
   (Fig. 8)

Fig. 8: Safety harness correctly fitted

6.2.2 Cable or Rail Grab Device/Fall Arrestor

The manufacturer's instructions for use of cable or rail grab device are to be followed.

In combination with the safety harness, the cable or rail grab device is a safety device for ascending/descending the tower via the ladder. Should somebody slip off the ladder, the cable or rail grab device clamps on tightly to the safety rail and prevents a fall. The system consists of a fixed guide, fastening elements, and a travelling arrestor device. A steady straight-line ascent and descent of the ladder without the user leaning back in the harness is best way to ensure that the travelling safety hook runs freely.

WARNING

Beware of hand injuries!

A free running travelling safety hook can crush your hands if you grasp the device or the safety rail or cable.

Keep your hands on the sides of the ladder during the ascent/descent.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Using the Cable or Rail Grab Device

Rail Grab Device

1. Insert the travelling safety hook into the retaining eyes of the safety harness.
2. Push the travelling safety hook into the guide rail mounted on the ladder.
3. Ascend and descend the ladder slowly and carefully.

Fig. 9

Cable Grab Device

1. Insert the cable grab fall arrestor and the shock pack assembly into the D-ring (or retaining eyes) of the safety harness.
2. Push the cable grab fall arrestor into the wire rope attached to the ladder.
3. Ascend and descend the ladder slowly and carefully.
4. Ensure to be in contact with the ladder on at least 3 points at all times.

Fig. 10

6.3 Protective Equipment for Measurements on Live Components

DANGER

Danger! Electricity!

Contact can cause extremely serious injuries and even death.

Life-threatening hazard!

Special PPE is required for measurements on live components. This provides protection against electricity flowing through the body, e.g. as a result of touching live components in operation. Furthermore, it provides protection against accidental arcs caused by insulation breakdowns e.g. as a result of switching operations under load.

Refer to NFPA 70E document (GE Standard) for further guidance on PPE requirements for electrical work.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

6.4 Hooking Points

As a rule, the hooking points are marked in yellow and are designated with a statement of the permissible safe work load. These hooking points are to be used with a safety harness and lanyard with a shock absorber to provide protection in areas where there is a danger of falling.

ATTENTION

Exchange of the rail

The nose cone rail and nacelle rail must be exchanged after any fall!

6.5 Abseiling Device

Not all wind turbine generator systems are supplied with an abseiling device. There is sometimes only a certain number of devices, especially in larger wind farms.

The abseiling device (e.g. abseiling device AG 10 K – RK Sicherheitstechnik) has a rope which is long enough for the respective height of the tower of the WTG.

The abseiling device is stored in a lead-sealed equipment bag, which is located in a net beside the hatchway to the roof of the nacelle.

Fig. 11: Equipment bag in the net

The abseiling device is used by the personnel to abseil from high workplaces. It is not a fall arresting device, instead it is used primarily for the evacuation of personnel in the event of an accident or fire. In case of fire, it can be used to abseil from the roof of the nacelle of the WTG as a 2nd escape route.

As a rule, the hooking points for the abseiling device are marked in yellow and are designated with a statement of the permissible safe work load. The abseiling device is attached to the hooking point by means of a snap hook or to the roof rail by means of a sling rope and a snap hook.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

ATTENTION

Danger of accident with a defective abseiling device!

In an emergency, your life could depend on the abseiling device working properly!

As a result, check the integrity of the seal of the equipment bag on each visit to the nacelle. The abseiling device is pre-assembled and is ready for use immediately after it has been removed from the equipment bag.

Carry out an additional visual inspection of the abseiling device immediately before use.

NOTE

It is easy to operate the abseiling device incorrectly in emergency situations. As a result, ensure that you know how to operate the device and are familiar with the abseiling operation. Please also read the operating manual.

This is the only way to ensure that the correct maneuvers are carried out in an emergency.

6.5.1 Abseiling from the Roof of the Nacelle

Abseiling can take place individually or in pairs. The abseiling device may be loaded with a maximum of 225 kg up to a rope pitch of 100 m. Abseiling takes place at a speed of 0.7 m/s. The abseiling speed is regulated by means of a centrifugal brake.

A typical abseiling operation is described in the following. The procedure described may vary depending on the abseiling device. As a general principle, always follow the instructions of the manufacturer of the respective abseiling device!

1. **Make sure that your safety harness is put on correctly.**
2. **Secure yourself against falling by means of the lanyard. Attach the lanyard to tie-off points or nacelle rail. Step out on the roof of the nacelle.**
3. **Close the roof hatch.**
4. **Break the lead seal on the equipment bag.**
5. **Remove the abseiling device from the equipment bag.**
   Leave the rope in the equipment bag.
6. **Attach the abseiling device to the roof rail of the nacelle by means of the sling rope and the snap hook.**
7. **Secure the snap hook with the clamping nut.**
8. **Throw down the equipment bag with the rope.**
9. **Check the condition and the correct functioning of the device.**
10. **Check the rope for loops and knots.**

Fig. 12: Abseiling device

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

DANGER

Interruption of abseiling through loops or knots!

Loops or knots in the rope prevent abseiling, since the rope cannot run through the abseiling device if it has a knot. As a result, always check the rope carefully!

REMOVE ALL LOOPS AND KNOTS FROM THE ROPE BEFORE YOU START ABSEILING!

11. **Hook the snap hook on the short end of the rope into the two chest rings of your safety harness.**
12. **Sit in front of the roof rail on the edge of the nacelle.**
13. **Ensure that the length of rope between the chest rings of your safety harness and the abseiling device is pulled taut.**
14. **Release the lanyard attached for your safety.**
15. **Slowly put your weight on the rope of the abseiling equipment.**
    After you have let go of the nacelle and the roof rail, you will abseil at a speed of 0.7 m/s.
16. **After you have reached the ground, immediately release the snap hook from the chest rings of your safety harness.**
17. **A second person waiting on the roof can then hook in the snap hook of the end of the rope which is now at the top and abseil as described.**
    The rope may have to be pulled through until the snap hook arrives at the top.
18. **The device must be inspected by a technically competent person after a rescue or an abseiling exercise.**

6.5.2 Care and Maintenance of the Abseiling Device

The textile components of the abseiling equipment may only be cleaned by the manufacturer.

If damage to the rope, snap hook or abseiling device is discovered, the escape equipment must be withdrawn from use and inspected by the manufacturer.

Under normal service conditions, a service period of 4-6 years can be assumed for the textile ropes.

The abseiling device must be inspected by a technically competent person or by the manufacturer after a rescue or an abseiling exercise or at the intervals recommended by the manufacturer at the latest.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

6.6 Fire Extinguishers (optional feature)

Fire extinguishers are optional in the wind turbine generator systems (WTG). If fire extinguishers are supplied, the WTG is normally provided with a fire extinguisher in the tower and in the nacelle.

The locations of the fire extinguishers are identified by this sign.

DANGER

Danger: Electricity!

De-energize the installation before using the fire extinguisher.

After actuation of the medium-voltage circuit-breaker, keep a safe distance of at least one meter from the fire when extinguishing!

The fire extinguisher may only be used on electrical installations up to 1000V!

NOTE

Ensure that you are familiar with the function and the operation of the fire extinguisher. Only thus can you act quickly and purposefully in emergency situations.

The use of fire extinguishers must be practiced. The personnel deployed in the WTG must therefore be trained in fire-fighting at regular intervals.

The fire extinguishers must be regularly inspected by a technically competent person in accordance with the national regulations. A record of the check with the date must be permanently affixed to the appliance in an easily visible location. The directions for use (on the fire extinguisher) must be followed before fire-fighting.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

6.6.1 Operating principle of the optional fire extinguisher – An example

As a general principle, always follow the instructions of the manufacturer of the respective fire extinguisher.

1. **Remove the safety tab (1).**
2. **Press down the fire-extinguishing button (2).**
3. **The perforating disk of the CO_2 cylinder (3) is opened and the CO_2 released for charging the tank. The appliance is ready for use.**
4. **The extinguishing agent, which is under pressure, flows through the riser pipe (4) to the valve armature.**
5. **After the fire-extinguishing button has been pressed, the extinguishing agent flows through the hose line to the spray fog nozzle (5).**
6. **The jet of extinguishing agent can be interrupted at any time by releasing the fire-extinguishing button.**
   (Contents of the fire extinguisher: 5 kg)

Fig. 13: Fire extinguisher - An example

6.6.2 Types of Fire Extinguisher

		Substances to be extinguished			
		Solid, glowing substances	Liquid substances or substances becoming liquid	Gaseous substances, also under pressure	Flammable metals (use only with a powder nozzle)
Types of Fire Extinguisher	Dry powder extinguisher with ABC dry powder	+	+	+	-
	Dry powder extinguisher with BC dry powder	-	+	+	-
	Dry powder extinguisher with metal fire powder	-	-	-	+
	Carbon dioxide fire extinguisher	-	+	-	-
	Water extinguishers (also with additives, e. g. wetting agent, antifreeze or corrosion inhibitor)	+	-	-	-
	Water extinguishers with additives which also extinguish liquid substances or substances becoming liquid in combination with water	+	+	-	-
	Foam extinguisher	+	+	-	-

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

6.7 First Aid

First aid is used for the initial treatment of an accident victim until the arrival of a doctor or until transport to a hospital, in order to avert a life-threatening situation or to prevent secondary injury.

NOTE

There is a legal obligation to carry out rescue measures provided that this is possible without considerable self-endangerment.

The plant may never be entered alone, so that a second person can send an emergency call. If the interphone has a landline connection, the emergency call can be made via the interphone. An operational cellphone is to be carried at all times, in order to be able to ensure rapid assistance in an emergency.

Proceed as follows in the case of an accident:

1. **Keep CALM!**
2. **In the case of serious accidents and injuries, notify a rescue center by interphone, cell phone or radio.**
3. **Render first aid immediately.**
4. **Secure the scene of the accident.**
5. **Report all accidents (near-accidents, minor accidents, serious accidents) to your immediate supervisor. Also notify the EHS department of GE Energy.**

ATTENTION

Keep access to the WTG clear!

The access roads to the plant must be kept clear at all times and be negotiable by car, in order to guarantee rapid and problem-free first aid in an emergency.

First Aid Box (Optional)

The provision of wind turbine generator systems (WTGS) with first aid boxes is optional.

If provided a first aid box is located in the nacelle of the wind turbine generator system for the treatment of minor injuries. Any material removed is to be replaced immediately after use.

This sign identifies the location of the first aid box in the nacelle.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

7 Safety Devices

The safety devices of the WTG comply with the requirements of the following standards:

- DIN EN ISO 13857: 2008 - 06 – Safety distances to prevent danger zones from being reached by the upper limbs and lower limbs.

The unauthorized removal or the overriding (by-passing) of safety devices is a punishable offence. Any liability claim is invalid in the case of damage.

Any point at which danger can arise and all drive units are provided with protective covers, which can only be undone and removed by means of tools. These protective covers may only be removed by qualified staff and only for the performance of service and maintenance or repair work. The protective covers are to be refitted immediately after completion of the work.

The owner / user of the WTG and the personnel deployed by him for operation, maintenance and repairs bear the responsibility for an accident-free work process.

7.1 Emergency Stop Pushbuttons

Any power-operated work equipment with dangerous movements must have one or - if necessary - several emergency control units for the prevention or reduction of an imminent or arisen danger, by means of which the dangerous movements can be stopped or rendered ineffective in another manner.

The emergency stop pushbuttons are not dependent on electronic logic.

Emergency stop pushbuttons (red mushroom pushbutton on a yellow base) are located on the control cabinet, the top box in the nacelle and the control cabinet in the hub.

Fig. 14: Emergency stop pushbutton

NOTE

The EMERGENCY STOP pushbutton may only be pressed in situations, in which the safety of personnel or the WTGS and its components is threatened.

Pressing the emergency stop pushbutton causes the safety chain to open, and the rotor of the WTG is brought to a standstill via emergency braking. Initiation of the safety chain causes the rotor blades to travel to the feathering position in the [emergency] battery mode! In addition to this, the WTG is de-energized except for the control voltage.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

7.2 Rotor Lock

The GE 1&2MW Platform plants are equipped with two rotor locks. Depending on the model of turbine being serviced and weather conditions, the permissible wind speed to engage each lock will vary. Reference the ”Assembly & Maintenance Wind Speed Limitations” (General_Description_1-2MW-xxHz_WindSpeedLimitations) document for the specific wind speed limits for each wind turbine model type.

The current wind speed can be read on the SCADA display.

7.2.1 Rotor Lock on the High-speed Shaft (HSS)

The rotor lock on the high-speed shaft is located on the brake disk of the outgoing shaft of the gearbox. It must be engaged during all regular maintenance work on the drive train and for the physical inspection of the rotor hub.

Maintenance work in the rotor hub or on the drive train may only be carried out with the high-speed shaft engaged. The rotor lock on the low-speed shaft must not be engaged.

If the turbine is unable to idle after a malfunction, the lock on the high-speed shaft must be engaged. It must be ensured that all three rotor blades are in the feathering position.

Engaging the Rotor Lock on the High-Speed Shaft

1. Manual stop and pitch blades to 85° (feathered)
2. Pull out the spring loaded locking pin of the rotor lock to enable the crank mechanism and advance the rotor lock as far as possible
3. If necessary, briefly actuate/release the "rotor brake" by the switch on the top box, in order to disengage the brake for a short time, thereby placing the brake disk in a better position.
4. Fully engage the rotor lock until the locking pin locks home again at the lower position.

7.2.2 Rotor Lock on the Low-Speed Shaft (LSS)

A lock is located on the rotor shaft flange of the low-speed shaft. This is only used for carrying out special work on the drive train as defined in the maintenance manual or specific work procedure. A sliding block or a sliding bolt which is guided in a fixture on the base frame is pushed onto the shaft flange in grooves or holes. The limit switch in the safety loop is opened as a result.

Engaging the Rotor Lock on the Low-speed Shaft

1. Manual stop and pitch blades to 85° (feathered)
2. Position the rotor to align the locking bolt with flange hole
3. Engage the rotor lock on the high-speed shaft
4. Actuate the service switch to disconnect the battery in the rotor hub
5. Engage the rotor lock on the low-speed shaft
6. If necessary, release the lock on the high-speed shaft after leaving the hub.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

If the wind speed unexpectedly increases beyond the allowable limits the rotor lock must be disengaged except in the event that the hub adapter joint is inadequate. If the hub adapter joint is not fully tightened to the seating torque (for torque and angle joints) or to the final torque (for torque only joints) the rotor lock must remain engaged. In this event the turbine and surrounding area must be evacuated until wind speeds return to allowable limits.

ATTENTION

Leaving the WTG with the rotor lock applied is strictly prohibited!

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

8 Residual Risks

Even if all the safety requirements are complied with, a residual risk remains during operation of the GE Energy 1&2MW Platform wind turbine generator systems.

Anyone who works on and with the WTG must be aware of these residual risks and follow the instructions which prevent these residual risks from resulting in accidents or damage.

DANGER

Danger of injury during ascent!

A full-body safety harness must be worn and attached to the fall arrest system during the ascent of the turbine, in order to prevent the person from falling. Any oil or grease deposits on the ladder must be removed immediately to prevent anyone from slipping while using the ladder.

Ensure that your footwear is clean!

Life-threatening hazard - working under suspended loads!

Never stand under suspended loads.

Danger of falling from the nacelle!

The nacelle has a roof hatch for accessing the hub. You may be exposed to strong winds when climbing out through the hatch. Attach your lanyard to the outside rail from inside the nacelle. Climbing out is only allowed at wind speeds up to 15 m/s.

WARNING

Falling objects hazard warning!

An object may be unknowingly and unintentionally dropped and hit and cause injury to somebody.

For this reason, only one person at a time may climb a section of the ladder between two platforms. The hatch covers must be closed again immediately after they have been passed through.

Tools and equipment must be secured while climbing and transitioning to the nacelle roof or the hub.

NOTE

As a general principle, there is a falling hazard at all higher locations / workplaces.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

8.1 Special Dangers – Electric Power

Note the following rules when carrying out any work on the electrical components of the plant, e.g. assembly, connection, opening of a device, maintenance:

1. DISCONNECTION
2. SECURE against re-connection, following proper Lock Out/Tag Out (LOTO) procedures
3. Ascertain safe isolation from supply
4. Ground and short-circuit
5. Cover up adjacent live components or provide them with barriers

In addition, ensure that all drives are at standstill.

DANGER

Caution! Danger from electrical voltage!

When switched on, electrical installations and machinery have live exposed conductors or rotating parts. They could therefore cause personal injury or death and material damage if the cover and the prescribed safety devices are removed, or in the event of incorrect handling and maintenance and in the case of improper use. The above stated safety regulations must therefore be complied with, particularly when removing a cover.

In addition to this, electrical energy is still present in devices with power electronics even after the supply voltage to the device has been switched off. These devices are secured against unauthorized access. After waiting an appropriate time for the device to discharge (e.g. capacitors), always check for residual voltage before starting work.

FOLLOW THE RESPECTIVE LOCKOUT/TAGOUT INSTRUCTIONS! (cf. Chapter 13).

In the case of malfunctions of the energy supply of the wind turbine generator system, actuate the EMERGENCY STOP button immediately if the plant has not already been switched off by the automatic control system.

Only use original fuses with the prescribed amperage!

In the case of repairs, care should be taken that design features are not modified, so that safety is compromised (e.g. leakage distances and sparking distances in air) and that distances are not reduced by insulation materials.

As a general principle, maintenance work may only be carried out by two persons, so that the second person can actuate the EMERGENCY STOP button in an emergency.

Only use insulated and approved tools.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

The control system and interlocking as well as the monitoring and protective functions (thermal motor protection, speed monitoring, over current, fault to ground, etc.) may not be set out of function, even during a test run.

8.2 Special Dangers – Hydraulic System

For maintenance work on the hydraulic system, maintenance staff must be completely acquainted with the hydraulic circuit diagram and must have been instructed about its function and the possible consequences of an operating error.

Prior to any work on the hydraulic accumulators, it must be ensured that the accumulator circuits have been depressurized. The shut-down device is clearly marked and independent of the system management.

DANGER

Danger through stored residual hydraulic energy!

FOLLOW THE RESPECTIVE LOCKOUT/TAGOUT INSTRUCTIONS! (cf. Chapter 13)

8.3 Special Dangers - Noise

The A-weighted equivalent continuous sound intensity level in the tower and the nacelle exceeds the permissible 70 dB(A) (per European Standard EN 50308) or the permissible 85 dBA TWA (per OSHA 29 CFR 1910.95) during operation. For some work, it may be necessary to place the WTG in operation or carry out a test run while personnel are in the nacelle.

Anybody carrying out work in the tower or the nacelle when the WTG is in operation must wear hearing protection with an appropriate level of noise protection as part of their personal protective equipment.

8.4 Special Dangers - Icing

8.4.1 Ice Build-up on the Rotor Blades

Ice build-up on wind turbine generator systems (WTG) and, in particular, the shedding of ice from rotor blades can lead to problems if wind turbine generator systems are planned in the vicinity of roads, car parks or buildings at locations with an increased risk of freezing conditions, unless suitable safety measures are taken.

If people or objects near the wind turbine generator system (within the distance **R***) could be endangered by pieces of ice thrown off during operation, GE Energy always recommends the use of an ice detector.

The ice detector is installed on the nacelle. It is possible to detect the build-up of a small amount of ice by means of the ice detector. If this is the case, the ice detector sends a signal to the turbine controller.
The turbine controller disconnects the wind turbine generator system from the grid and the rotor is brought to a standstill or rotates at a very low speed. A message about the icy condition is displayed on the monitor in the

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

turbine, In addition, a message is sent to the service station and the operator via modem. The turbine does not restart until the detector is free of ice or the operator has satisfied himself of the ice-free condition of the rotor blades, has acknowledged the ice alarm message and restarts the plant.

However, ice may form on the rotor blades considerably more quickly than on the ice sensor on the nacelle. As a result, there is a residual risk for the reliable detection of ice build-up on the rotor blades.

The detector on the nacelle must be set relatively sensitively, in order to ensure that the time from when ice starts to build up on the rotor blades until the detector sends a message about the build-up of ice is as short as possible. As a consequence, a certain number of spurious trippings cannot be excluded. Loss of energy yield may occur as a result of the spurious trippings.

If an ice detector is not used, it is advisable to cordon off an area around the wind turbine generator system with the radius **R*** during freezing weather conditions, in order to ensure that individuals are not endangered by pieces of ice thrown off during operation (cf. also section 11.1).

> ***R** = 1.5 x (hub height [m] + rotor diameter [m])
> (Recommendation of the German Wind Energy Institute DEWI 11/1999)

8.4.2 Icy Condition of the Access Route

During the winter months, access to the plants may be very slippery due to ice or hard-packed snow. There is an increased danger of slipping.

cf. section 11.1 on approaching and entering WTGs which may be frosted.

8.4.3 Icy Condition of the Tread of the Steps outside the Nacelle

In the winter months, the tread of the steps outside the nacelle can be icy as a result of ice and hard-packed snow.

8.5 Exceptional Dangers – Earthquakes

In the case of an earthquake, the operator must inspect the WTG for damage. The following procedure is recommended:

- Determination of the acceleration values in the tower top which arose during the earthquake (PCH BOX).
- Contact GE Energy, in order to agree on the further procedure and possible inspection schedules.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

9 Safety Information for Individual Plant Components

9.1 Down Tower Assembly

The down tower assembly is the electrical cabinet lineup consisting of:

- Power distribution cabinet (PDC)
- Converter filter cabinet (CFC)
- Converter bridge cabinet (CBC)
- Main control cabinet (MCC)

DANGER

Caution! Danger from electrical current!

All personnel remaining in the WTG must be located between the person carrying out the measurements and the tower entrance during voltage measurements on the low voltage main distribution or on the low voltage main control panel.

Attention! Check the work area / control cabinet before completion of the work!

Remove all loose parts, tools and materials from the control cabinets. Tools and materials left in the control cabinets lead to unsafe working conditions for the service technicians when the plant is put into operation again.

Close and lock the control cabinets before returning to service.

ATTENTION

Please follow respective Lock Out/Tag Out (LOTO) instructions.

9.2 Anemometer and Wind Vane

The anemometer and the wind vane are intensely heated in WTGs with cold weather equipment!

ATTENTION

Hot surface!

Disconnect the anemometer and the wind vane from the supply and allow both to cool down prior to maintenance.

Physical contact may cause burns.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

9.3 Top Box

The top box is the electrical cabinet that resides in the nacelle. The main purpose of the top box is to distribute power to the up-tower wind turbine components.

DANGER

Caution! Danger from electrical current!

All personnel remaining in the WTG must be located between the person carrying out the troubleshooting and the nacelle exit during voltage measurements.

Attention! Check the work area / control cabinet before completion of the work!

Remove all loose parts, tools and materials from the cabinet. Tools and materials left in the control cabinets lead to unsafe working conditions for the service technicians when the plant is put into operation again.

Close and lock the control cabinets before returning to service.

ATTENTION

Please follow respective Lock Out/Tag Out (LOTO) instructions.

9.4 Pitch Electrical Control Cabinets Inside the Hub - Axis and Battery

DANGER

Danger from electrical current!

Before beginning any maintenance work, ensure that the control cabinets have been disconnected from all the energy sources in accordance with the currently applicable Lock out/Tag out instructions.

In addition to the main circuits, take any supplementary or auxiliary circuits into account. Wear appropriate electrical PPE for entrance into energized cabinets.

Check the work area/control cabinet before completion of the work!

Remove all loose parts, tools and materials from the cabinet.

Tools and materials left in the control cabinets lead to unsafe working conditions for the service technicians when the plant is put to operation again.

Danger from electrical current!

All axis and battery cabinet doors must be securely latched in place before the system is reenergized to avoid exposure to the potentially hazardous transient voltages that are present during start-up.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

10 Conduct in Emergency Situations

10.1 Conduct in Case of Fire

In principle the WTGS consists of fire-resistant materials. However

Fire, open flames and smoking are prohibited!

If a fire does occur, however, **call the fire department immediately!**

State the following information:

- Name of the person calling
- What is on fire
- Where the fire is located (seat of the fire/location of the plant)
  (You will find the site coordinates on the nameplate)
- Wind direction and wind strength

Note the following information in the case of fire:

- Saving lives has priority over fire-fighting
- Alarm all personnel who are in the WTG
- Use the escape routes described in chapter 10.2 – ensure that you are familiar with the various escape routes.
- Do not use the service lift.
- Burning debris can be expected to fall down if there is a fire in the nacelle or the upper part of the tower.
- If the wind turbine generator system is still in operation, it must be stopped and a large area around the plant cordoned off.
- Close the door of the plant.

10.1.1 Fire-Fighting

Fire-fighting may only be carried out by immediately fighting an initial fire using the fire extinguishers that may be available in the plant. The locations of the firefighting equipment (if available) in the tower and the nacelle are marked.

If the initial fire cannot be extinguished within a short time, abandon any further attempts to extinguish the fire and call the fire department immediately.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

In addition to the direct danger from the fire, a combustion toxicity hazard and the danger of asphyxia could also arise. As a result, move in a crouched position if smoke develops and also crouch down when attempting to extinguish the fire.

DANGER

Attempts to extinguish a fire may lead to very serious burns!

Do not make any attempts to extinguish the fire beyond the initial attempt. Due to confined space limitations, since the required minimum distance cannot be maintained while attempting to extinguish the fire.

10.1.2 Fire in the Tower - Person in the Nacelle

- Leave the WTG immediately via the second escape route (cf. chapter 10.2).
- Abseiling device in the nacelle - emergency exit using the abseiling device

10.1.3 Fire in the Nacelle - Person in the Nacelle

- Attempt to extinguish the fire.

If unsuccessful:

- Leave the danger area immediately via the first escape route (cf. chapter 10.2).
- Do **not** use the service lift.
- Do **not** use the abseiling device.

10.1.4 Fire in the Transformer

DANGER

Do not make any attempts to extinguish the fire – High voltage! Conventional fire extinguishers are not suitable.

- Leave the WTG immediately.

In the case of transformers in the tower:

- Leave the WTG via the second escape route

In the case of transformers in the transformer station:

- Leave the WTG via the first escape route

Fire-fighting may only be carried out by trained personnel.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

10.2 Escape Routes

ATTENTION

Keep escape routes clear!

The escape and rescue routes must be free of obstructions (tools, equipment, rubbish, etc.), in order to ensure that the turbine can be evacuated as quickly as possible in an emergency.

10.2.1 First Escape Route

In case of fire, leave the plant immediately. The first escape route from the nacelle is down the ladder in the tower. The descent is facilitated and made safer by resting platforms every 6 m. Do not use the hoisting passenger suspension device.

10.2.2 Second Escape Route

If the descent through the tower is no longer possible, use the second escape route. (Abseiling with the abseiling device). This either leads over the roof of the nacelle (hooking point on roof rail) or through the emergency descent hatch which may be present (hooking point directly beside the winch in the nacelle, which is also present in this case).

Correct use of the abseiling device:

- Make sure your safety harness if on correctly.
- Attach lanyard to approved tie-off point or nacelle rail.

DANGER

Use of the abseiling device!

Your life could depend on the correct use of the abseiling device.

The abseiling device can also be used by two people to abseil.

Read the instructions before beginning the abseiling operation!

10.3 Information for Rescue and Emergency Personnel

The rescue services and the emergency personnel must be equipped with their own personal protective equipment (safety harness, etc.). The rescue/emergency personnel must bring with them all the equipment required for rescuing personnel from the hub, nacelle or tower.

The information stated in this safety manual must also be read by the rescue / emergency personnel.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

10.4 Oil Spill – Immediate Measures

The objective of the immediate measures is to prevent or at least to contain a further uncontrolled escape of water-endangering substances and keep the areas of threatened or contaminated soil as small as possible, under consideration of safety engineering requirements.

NOTE

Inform yourself about the oils used beforehand. The safety data sheets provide details of Water Hazard Classes and suitable measures for combating oil pollution.

Measures

1. Decide and act quickly, so that the amount of oil reaching the environment is kept as small as possible.
2. Prevent further discharge (closure of valves, temporary sealing of cracks and holes, e.g. by means of sealing rags, sealing bags, sealing wedges, collection in containers, pumping out, transfer, etc.)
3. Bind the discharged oil – use approved oil binding agents and oil binder mats if the oil could not be pumped out or skimmed off in time. The damage can be limited by means of collecting containers, rolled foils and a shovel.
4. Prevent the oil from getting into the soil or bodies of water.
5. Remove contaminated soil.
6. Take the contaminated oil-absorbing materials to a local specialist waste disposal company for material recovery/conversion to energy or disposal. The national regulations are to be complied with.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

11 Remaining in and on the Wind Turbine Generator System

ATTENTION

Fire Hazard!

The storage of combustible or highly inflammable materials in the wind turbine generator system **is not allowed**.

Personnel may not remain inside the WTG, and maintenance or repair work may not be carried out in or on the WTG under power supply. There is a danger of accident and a danger to life and limb. In order to prevent accidents, the following actions are to be carried out in the following order before and on entering the wind turbine generator system:

1. Shut down the WTG and secure against an unauthorized return to service
2. Put on the personal protective equipment
3. Disable the power supply for the work to be carried out – carry out corresponding Lockout/Tagout instructions (cf. chapter 13)

Staying in the WTGS while it is in operation is unavoidable in the case of certain maintenance and repair work. In such cases a risk assessment should be developed for the task. Particular care is called for and hearing protection must be worn.

In addition, the following safety regulations are to be complied with without fail:

- As a general principle, no person may stay in the WTG during a gale or a thunderstorm! If a thunderstorm comes up, the WTG must be left immediately.
- The WTG may only be entered in the company of a second person who can provide assistance or call for help in the case of an accident.
- The entrance door to the tower must be kept closed or if it is kept open, it must be properly secured to prevent it from flying open and getting warped.
- Long open hair, loose clothing (e.g. flapping coats, tops with wide sleeves or trousers with wide legs) and scarves, ribbons, headscarves or jewelry may not be worn in the WTG! There is a fundamental danger of injury as a result of getting caught, trapped or drawn in by rotating elements! Clothing must always be tailored to suit the respective work and the weather conditions.
- Switch-on and shut-down procedures in accordance with the operating manual are to be complied with for all work which concerns the operation and adjustment of the WTG and its safety equipment.
- If any changes in the operating characteristics which are relevant to safety or any faults arise in the WTG, it must be shut down immediately and the event reported to GE Energy or the customer (if a maintenance contract has not been concluded with GE Energy).

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

11.1 Approaching and Entering Frosted Wind Turbine Generator Systems

Before parking near the turbine, stop approx. 350 m from the turbine and check the rotor blades for ice by means of binoculars and the sound of the rotation of the blades. If the turbine is running and ice is present on the rotor blades, call for a remote stop.
Once the blades have come to a complete standstill, verify that none of the blades is located over the entrance door of the turbine. If this is the case, call for a remote traverse of the yaw drive in any direction, so that the rotor is positioned on the side of the turbine opposing the door. As soon as the rotor is correctly positioned, call for a remote stop of the yaw drive and ask for confirmation of this operation.

Once the above conditions have been complied with, park your vehicle at a safe distance from the WTGS (at least 100 m). Watch out for falling ice as you approach the tower. If the wind is blowing against the opposite side of the door (or into the rotor at this point), you must proceed with extreme caution, since falling ice could be blown in your direction.

WARNING

Danger of slipping as a result of icy conditions!

There is danger of slipping as a result of the frozen ground and ice on the foundation and the stairs.

Sprinkle de-icing salt or sand over the foundation.

Use the handrail when going up the stairs.

Leave the immediate vicinity of the WTG after completing your work. Watch out for falling ice. Get into your vehicle. Do not call for a remote re-activation of the yaw drive and restart of the turbine until you are approximately 350 m away from the WTG.

11.2 Shut-down of the Wind Turbine Generator System

Before starting any service work, the wind turbine generator system must be deactivated. Proceed as follows:

1. Contact any remote monitoring groups that are supervising the site (before entering the wind turbine)
2. Contact any site operators or maintenance people (before entering the wind turbine)
3. Temporarily disconnect the Mark VIe controller from the site SCADA network:
   - Locate the SCADA network switch in the down tower assembly that houses the SCADA network switch
   - Disconnect the two fiber pairs (RX-TX and RX-TX) from the switch, taking the turbine off the site network
4. Press the "Stop-Reset" button to shut-down the plant manually.
5. Set the key-operated switch to "Repair".

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

NOTE

Follow lock-out-tag-out procedures to de-energize, lock-out and tag-out equipment to ensure that unit equipment is always put in a safe condition. Wind conditions must be continuously monitored manually if LOTO procedures used mean that the unit is not capable of moving to minimum load condition.

DANGER

Danger of accident!

The WTG must remain shut down as long as personnel are in the plant. Before it is returned to service by authorized personnel, check without fail that nobody is in the plant. Otherwise there is the danger of an accident!

11.3 Climbing the Tower

- Only persons who are physically fit, are wearing appropriate PPE and are capable of coping with the ascent may climb the WTGS.
- The WTGS must be shut down and secured against unauthorized start-up before the tower is ascended. The WTGS must remain shut down as long as anybody is climbing the tower or is on the tower platform.
- In order to avoid accidents caused by falling objects, nobody may stand under the ladder while somebody is ascending the tower. Even a small screwdriver can cause very serious injuries if it drops from a great height.

DANGER

Danger through falling objects!

Falling objects can cause very serious injuries irrespective of their size and weight!

Never stay in the vicinity of the ladder while somebody is ascending or descending. The ladder may only be used by one person at a time. Only after this person has reached an intermediate platform and has closed the tower hatch or has reached the ground in the tower base and stepped back from the ladder may the next person approach the ladder. Tools and equipment must be secured while climbing.

- Fall protection PPE must always be put on correctly before ascending the tower.
- Always check the safety harness and the entire safety equipment prior to use. Damaged PPE may never be used.
- Safety boots and a hardhat must be worn when ascending the tower. Gloves must be worn while climbing.
- The maximum possible fall path must be kept to a minimum by means of rope-shortening devices or similar.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

- Only use marked hooking points with an adequate load-bearing capacity.
- The tower may only be ascended by means of the ladder installed inside the tower or (if the person is properly trained) the hoisting passenger suspension devices/service platform which may be installed. (Follow the operating instructions of the manufacturer).
- The rail or cable grab must run freely in the rail while ascending and descending the tower. Never touch the travelling safety hook, otherwise there is a danger of injury!
- Both hands must be kept free during the ascent or descent. Tools, lubricants and other material may only be transported in a suitable bag. Permanent "3-point contact" with the ladder is only guaranteed by this means.
- Greater care needs to be exercised when climbing the ladder experiencing wet conditions or if the tower is covered in ice.
- Only unhook the lanyard after you have reached the tower platform and the access hatch has been closed.
- Ensure that you are always protected by at least one lanyard with a fall arrest block.
- The rest platforms in the tower are fitted with hatches that must be kept closed at all times. The platform hatches must therefore be opened on reaching a platform and closed again immediately after crossing to the next section of the tower. Tie off to anchor points while on platforms when hatches are open.

11.4 Deactivation of the Yaw Drive

Yaw stop switches are located in the tower base, below the nacelle and on the top box in the nacelle. The yaw drive and the automatic nacelle adjustment are disabled in the "Off" switch position, so that the nacelle is technically prevented from moving if there is a change in wind direction.

11.5 Entering the Nacelle

The yaw stop switch on the uppermost tower platform must be placed in the "Off" position before crossing from the tower to the nacelle. The yaw drive and the automatic nacelle adjustment are thereby disabled.

Depending on the position of the nacelle, the available simple ladder is hooked into one of the holders to prevent the ladder from slipping. Some of the WTGs are provided with a permanently installed extension ladder.

Hooking points are available in the vicinity of every platform.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

11.6 Walking on the Roof of the Nacelle/Entering the Rotor Hub

The roof of the nacelle may only be accessed for entering the rotor hub and for carrying out work on the wind vane, the anemometer and the obstruction light.

Only trained or instructed staff are permitted to enter the hub or walk on the roof of the nacelle. The rotor lock on the high-speed shaft (brake disk on the coupling) must be engaged before the rotor hub is entered. Reference section 7.2 for specific wind restrictions.

1. **Place the yaw stop switch on the top box in the "Off" position.**
2. **Turn the rotor to the "Y" position, so that the rotor hub can be entered.**
3. **Engage the rotor lock on the high-speed shaft.**
4. **Turn the rotor blades to the 85° feathering position.**

Fig. 15: Rotor in the "Y" position

DANGER

Life-threatening hazard through sudden start-up of the rotor if the rotor lock (brake disk on the coupling) on the high-speed shaft has not been engaged!

Always engage the rotor lock on the high-speed shaft before entering the rotor hub.

FOLLOW THE RESPECTIVE LOCKOUT/TAGOUT INSTRUCTIONS! (cf. section 13).

Falling Hazard! Warning: strong wind currents!

Before climbing out of the nacelle enclosure through the roof hatch above the gearbox, the lanyard must be hooked on to the rail on the nacelle, then transfer to the spinner if transitioning to the hub.

The roof rail is to be selected as a hooking point for all other work on the roof of the nacelle. Follow the hub access and rotor Lock Out/Tag Out (LOTO) procedures, in addition to proper JSA/EHS procedures.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

WARNING

Maintenance work inside the hub may only be carried out at maximum wind speeds from 11 - 15 m/s! Reference section 7.2 for specific wind restrictions.

Always engage the rotor lock on the high-speed shaft. Use of the rotor lock on the low-speed shaft only for this purpose is prohibited.

5. **In the hub, place the battery maintenance switch and the pitch maintenance switch on all three axis cabinets in the "Off" position.**

Fig. 16: Battery maintenance switch

6. **Switch the pitch controller on the control cabinet to "Manual".**

Fig. 17: Pitch controller

Walking on the Roof with Ice and Snow

If you have to walk on the roof of the nacelle or climb into the hub, first of all ensure that the rotor blades are in the Y position before you open the hatch. Otherwise there is danger of injury from falling pieces of ice.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

DANGER

Danger of Slipping and Falling Hazard as a result of icy conditions!

There is a high risk of slipping and falling if the roof of the nacelle and the spinner are covered by snow and ice.

Completely remove any snow and ice from the roof before walking on it. Sprinkle sand on the cleared areas

Do not walk on the roof/spinner if the snow and ice cannot be removed completely and the danger of slipping cannot be excluded. Proper JSA/EHS procedures should be followed at all times.

11.7 Activation of the Wind Turbine Generator System

DANGER

Danger of accident!

The WTG must remain shut down as long as personnel are in the turbine. Before it is returned to service by authorized personnel, check without fail that nobody is in the turbine. Otherwise the danger of an accident arises!

Proceed as follows to return the WTG to service:

1. Make an entry in the service life card of the WTG.
2. Connect the Mark VIe controller to the site SCADA network:
   - Locate the SCADA network switch in the down tower assembly that houses the SCADA network switch
   - Reconnect the two fiber pairs (RX-TX and RX-TX) from the switch, putting the turbine on the site network
3. Set the key-operated switch to "Operation".
4. Check the alarm message panel in home web page for error messages
5. Press the "Stop-Reset" button and then the "Start" button.
6. Inform the remote monitoring division that wind turbine is back in operation.
7. Inform the operator / customer that wind turbine is back in operation.

12 Information on Maintenance and Troubleshooting

Only trained or instructed staff may be deployed!

Trainee personnel or personnel undergoing orientation or general training may only carry out work on the wind turbine generator system under the constant supervision of an experienced person.

Personnel must familiarize themselves with the work environment around the wind turbine generator system before starting work!

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

As it is possible to start the plant by means of the remote monitoring system, the WTG must be shut down for maintenance work as described in Chapter 11.2. In addition, the service switch on the control cabinet must be placed in the "Maintenance" or "Repair" position. Once the maintenance or repair work has been completed, the service switch must be returned to the "Automatic" position.

Maintenance/inspection of the cable winch in the tower is the responsibility of the operator and must be carried out in accordance with the operating and maintenance instructions of the supplier of the cable winch.

Time limits for recurring tests/inspections prescribed or stated in the operating manual must be adhered to.

Suitable workshop equipment is essential for carrying out maintenance measures.

Work on electric equipment of the WTGS may only be carried out by a skilled electrician, equipment specific trained technician or by instructed persons under the guidance and supervision of a skilled electrician in accordance with the electrical engineering regulations.

Any safety equipment which has to be dismantled to carry out maintenance and repair work must be re-installed and checked immediately after the maintenance and repair work has been completed!

The wind turbine generator system, in particular the connections and bolted connections, must be cleaned of any oil, consumables and process materials, dirt or old preservative agents at the beginning of any maintenance/ repair / conservation work.

Only entrust experienced persons with the fastening of loads.

Individual components and larger modules which need to be exchanged must be carefully attached and secured to lifting gear, in order to minimize the danger that emanates from them. Only use suitable lifting gear and load suspension devices which are in a technically perfect condition and have an adequate load bearing capacity!

Follow the operating instructions of the winch manufacturer.

Never stand or work below suspended loads.

Use the specified or other safe ascent equipment and working platforms to carry out installation work above head height. Wear fall protection equipment when carrying out maintenance work at great heights. Keep all handles, steps, safety rails, platforms, stages and ladders free of dirt.

Ensure that consumables and process materials and replacement parts are disposed of safely and in an environmentally-friendly manner!

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

13 Power Disconnection and Isolation Procedures (Lock-out/Tag-out Instructions)

Pursuant to EN 50308 and OSHA standard 29 CFR 1910.147, wind turbine generator systems must be equipped with devices to disconnect and isolate them from all their energy sources during inspection and maintenance work.

These disconnecting/energy-isolating devices are prescribed for all mechanical, electrical and hydraulic energy sources.

GE Energy advises the plant operator/owner to develop specific procedures for the power disconnection and isolation of every individual subsystem.

Local and national regulations must be taken into account when developing workplace-specific Lockout/Tagout instructions.

The disconnection/isolation points are marked in the plant-specific circuit diagrams and hydraulic schematics supplied with the respective WTG.

Procedures for the Lock-out/Tag-out of power disconnection and isolation devices must consider the following aspects:

13.1 Identification of Installations, Processes, Circuits

(Individual mechanical, electrical or hydraulic subsystems)

13.2 Preparation for Shutdown / Notification of Affected Employees

- All personnel who may be affected must be notified before Lock-out/Tag-out devices are installed and after they have been removed. In addition to this procedure, authorized employees must be aware of any additional safety requirements prescribed for working on this type of equipment.
- Affected employees who work on or near an installation which is about to be disconnected and on which Lock-out/Tag-out devices are to be mounted must be notified thereof.

13.3 Identification of Energy Sources and Strengths

13.4 Deactivation of Energy Sources and the Mounting of Energy Control Devices

- The power disconnection and isolation devices (e.g. disconnecting switches or load interrupter switches, valves etc.) must be positioned in such a way that they interrupt the energy flow to installations, processes or circuits. The authorized employees are obliged to mount and secure Lock-out/Tag-out devices to these. They must hereby ensure that the power disconnection and isolation devices are "locked out" until further notice and remain in their safety or "Off" position.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

13.5 Control of Stored Energy

ATTENTION

Residual risks from stored energy!

PLEASE OBSERVE THE RESPECTIVE LOCKOUT / TAGOUT INSTRUCTIONS!

- The authorized employee must ensure that all potentially hazardous energy in any form (stored, residual, chemical or potential energy) is relieved, dissipated, contained, discharged or otherwise controlled. Additional measures may be necessary to prevent the re-accumulation or re-storage of energy, in order to protect personnel. Stored energy can form e.g. in batteries, capacitors, through gravity or in chemical lines.

13.6 Verification of Isolation

- The authorized employee must verify that the isolation and de-energization of the respective installation, process or circuit has actually been carried out before maintenance work may be started. The check must confirm that the installation, process or circuit has achieved a "zero" energy state. (Test equipment, circuit activation attempts, measuring devices, visual inspections, etc. can be used to verify the zero energy state.)

13.7 Reconnection of the Installation to the Supply

The authorized employee must carry out the following measures before returning the installation to service:

- Inspection of the work area to ensure that all items which are not required for the operation of the installation have been removed and that all the guards have been replaced, that the machine/installation, process or circuit is operational and that all personnel are in a safe location.
- Removal of all locks, tags and other Lock-out/Tag-out devices from all power disconnection and isolation devices by the authorized employee who previously attached these LOTO devices.
- Notification of affected personnel that the energy supply is about to be restored to the machine/installation, process or circuit.
- Visual inspection and/or cycle test to verify that the service or maintenance work has been successfully completed. Provided that the work has been completed, the machine/installation, process or circuit may be returned to service. Otherwise, the requisite procedural steps must be repeated.
- Correct sequential run-up of the installation, process or circuit.

WTG operators must ensure that suitable disconnection regulations are available for their plants and construction sites and those they are implemented. GE Energy has developed installation-specific Lock-out/Tag-out procedures for the activities listed below. This list does not claim to be complete, however. It may be advisable to develop additional procedures as a result of changes to installations or to comply with construction site-specific disconnection regulations.

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Service Jobs / Subsystems	Installations, Processes, Circuits
Gear box / gearing lubricant	Nacelle – protection of the gear lubricant flow
Work in the converter cabinet / on the generator	Isolation of converter cabinet from dangerous energy / isolation of generator from dangerous energy
Surge protector / medium voltage	De-energize power distribution cabinet (PDC) at MV transformer.
Surge protector / high voltage	De-energize power distribution cabinet (PDC) at MV transformer.
Work on the synchronization switch	Isolation of the synchronization switch. De-energize power distribution cabinet (PDC) at MV transformer.
Work on the safety isolated WTG	Disconnection of the power distribution cabinet.
Disconnection of the 400 V power supply	Disconnection of the 400 V power supply to the power distribution cabinet in the tower base and to the top control cabinet in the nacelle and to the hub.
Disconnection of the 690 V power supply	Disconnection of the 690 V power supply to the power distribution cabinet in the tower base and to the top control cabinet in the nacelle.
Work on the transformer in the DTA converter filter cabinet	Disconnection of the transformer in the DTA converter filter cabinet
Work on the UPS voltage output	Disconnection of the 230 V UPS voltage output in the main cabinet and the control cabinet, the nacelle and the hub
Disconnection of the 24 V power supply unit in the main cabinet	Disconnection of the 24 V power supply unit in the main cabinet
Isolation of the 400 V power supply from the nacelle to the hub	Isolation of the 400 V power supply from the nacelle (top control cabinet) to the hub
Nacelle hydraulics	24 V transformer / interruption of the hydraulic supply
24 V transformer in the nacelle	24 V transformer in the top control cabinet (e.g. for exchanging the transformer)
Battery charging voltage nacelle / hub	Disconnection of the battery charging voltage to the hub
230 V power supply to the nacelle	Disconnection of the battery charger, interruption of the 230 V power supply
Nacelle / motors	Disconnection of the motor
400 V motor circuit breaker in the nacelle	Disconnection of the 400 V motor circuit breaker
Work in the hub	Disconnection of the motor (hub)
Work in the hub	Back-up battery pack in the hub
Locking the high-speed shaft	Nacelle / high-speed shaft (gear box)
Locking the low-speed shaft	Nacelle / low-speed shaft (gear box)
Work on the transformer	Isolation of the transformer in WTGS with a transformer in the tower

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

ANNEX: Items and Installations which are subject to Inspection pursuant to the Accident Prevention Regulations

Article to be tested	Test before the initial operation	Exceptional tests	Regular tests	Proof of test	Regulations
Winches	To be checked by a technically competent person		Regular check by a technically competent person in accordance with the manufacturer's instructions and operational conditions.	Inspect and test log book and inspection sticker	Manufacturer's instructions
Doors Emergency exits	To be checked by a technically competent person. Doors must be executed so that they are self-closing, open in the direction of escape and can be easily opened from the inside at all times without auxiliary means.		Regular check by the operator. Once a year by a technically competent person.	Documentary evidence	Manufacturer's instructions
Escape routes			In case of danger, the work areas must be able to evacuated via escape routes or escape equipment. It must be ensured that at least one escape route can also be used in the case of a power failure. Escape routes or escape equipment are: routes via ladders and abseiling devices.		
Service lift	To be checked by an expert. In addition to the experts of the Technical Inspection Association (TÜV), only experts for the inspection of hoisting passenger suspension devices who are authorized by the trade association are considered to be experts for the purposes of this safety regulation. The operator must ensure that a test run is carried out at the installation location in all directions of movement with the working load of the passenger suspension device in the presence of the supervisor before the initial operation.	The operator must ensure that hoisting passenger suspension devices are subjected to an exceptional test by a qualified person after cases of damage or particular events which could affect the carrying capacity, as well as after any repair work.	All components of the hoisting passenger suspension device must be inspected for operational safety by a technically competent person at least once a year. Shorter test intervals may arise as a result of the service conditions. The manufacturer's instructions are to be followed.	Documentary evidence	Manufacturer's instructions
Fire extinguishers (optional feature)			Regular check by a technically competent person or expert in accordance with the national regulations.	Inspection sticker or test report	

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

Article to be tested	Test before the initial operation	Exceptional tests	Regular tests	Proof of test	Regulations
Personal protective equipment against falling (safety harness)	Check of the fall protection rail by an experienced person.		Users must check the PPE for its orderly condition and correct function before it is used. An experienced person must check the PPE for perfect condition at regular intervals. The manufacturer's instructions are to be followed.	Inspect and test log book, inspection sticker	Manufacturer's instructions
Abseiling device	To be checked by an experienced person.	To be checked by an experienced person after use.	Users must check the abseiling device for its orderly condition and correct function before it is used. An experienced person must check the abseiling device for perfect condition at regular intervals. The manufacturer's instructions are to be followed.	Inspect and test log book, inspection sticker	Manufacturer's instructions
Ladder		A technically competent person checks the orderly condition of mechanical ladders after any alterations or repairs.	A technically competent person checks the orderly condition of the ladders and steps once a year. Irrespective of this, the user must check the suitability and condition of the ladders before use. The manufacturer's instructions are to be followed.	Inspect and test log book, inspection sticker	Manufacturer's instructions
Electrical equipment	Check by a qualified electrician or under the supervision of a qualified electrician. (Also after alteration or repair) The test before the initial operation in accordance with Section 1 is not necessary if the manufacturer or installer confirms that the electrical installations and equipment are designed to comply with the provisions of this accident prevention regulation.		At specified intervals: The intervals are to be calculated in such a way that any defects which can be expected to arise are found in due time. The relevant electro-technical regulations are to be complied with for the check. At the request of the trade association, an inspection and test log book with specified entries is to be kept. The manufacturer's instructions are to be followed.	Inspect and test log book	Manufacturer's instructions
First aid box (optional feature)	Pursuant to the Law on Medical Devices, which has been in force since 1st January 1995*, bandaging materials must have a CE-marking but do not have to have a use-by date. If a use-by date is stated, however, the Law on Medical Devices prohibits further use after expiry of the use-by date under penalty of a fine. First aid material without a use-by date must only be replaced in the event of soiling or damage. With the exception of plaster material, it remains usable over a long period, provided that it is stored in a clean and dry place.				

CONFIDENTIAL - Proprietary Information. DO NOT COPY without written consent from General Electric Company.
UNCONTROLLED when printed or transmitted electronically.
© 2015 General Electric Company. All rights reserved

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

7/16/2018 11:06:40 AM

in

Case No(s). 18-0488-EL-BGN

Summary: Application Appendices A through G electronically filed by Teresa Orahood on behalf of Dylan F. Borchers