SUNCOR ENERGY ADELAIDE WIND POWER PROJECT

WIND TURBINE SPECIFICATIONS REPORT

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Prepared for:

Suncor Energy Products Inc.
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Prepared by:

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1.0 Introduction

1.1 PROJECT OVERVIEW

Suncor Energy Products Inc. ("Suncor") is proposing to develop the Suncor Energy Adelaide Wind Power Project (the Project) within the Municipality of Adelaide Metcalfe, County of Middlesex, Ontario.

The Project will include 18 wind turbines (Siemens SWT-2.3-113 operated at a 2.221 MW rating) with an estimated total nameplate capacity of up to 40 MW. The proposed Project would also include access roads, meteorological tower (met tower), electrical collector lines, and a substation which would connect the Project with the provincial high voltage transmission system. Suncor has elected to assess and seek approval for some alternative wind turbine locations. The Renewable Energy Approval (REA) application will consider up to four alternative turbine locations. Final selection of the turbine sites will be determined prior to Project construction and will be based on consultation activities, potential effects assessments, and detailed design / engineering work. A full description of Project infrastructure is provided in the **Project Description Report**.

Suncor has retained Stantec Consulting Ltd. (Stantec) to prepare a Renewable Energy Approval (REA) Application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the Act of the Environmental Protection Act (O. Reg. 359/09). According to subsection 6.(3) of O.Reg.359/09, the Project is classified as a Class 4 Wind Facility and will follow the requirements identified in O.Reg.359/09 for such a facility.

1.2 REPORT REQUIREMENTS

This **Wind Turbine Specifications Report** is one component of the REA Application for the Project, and has been prepared in accordance with Item 14, Table 1 of O. Reg. 359/09 which sets out specific content requirements as provided in the following table (**Table 1.1**).

Table 1.1: Wind Turbine Specifications Report Requirements: O .Reg. 359/09

Requirements	Completed	Section Reference
Provide specifications of each wind turbine, including make, model, name plate capacity, hub height above grade, rotational speeds and acoustic emissions data, including the sound power level and frequency spectrum, in terms of octave-band power levels.	✓	2.1 and Appendix A

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2.0 Wind Turbines

2.1 SPECIFICATIONS

The Siemens SWT–2.3–113 wind turbine (operated at a rating of 2.221 MW and sound power level of 104 dBA) has been selected as the wind turbine for the Project and details are provided below in Table 2.1.

Table 2.1: Siemens SWT – 2.3 - 113 Turbine Description

Operating Data	Specification
General	
Rated Capacity (MW)	2.221
Cut-in wind speed (m/s)	3.0 (12.6 km/hr)
Cut-out wind speed (m/s)	25 (90 km/hr)
Rotor	
Number of rotor blades	3
Rotor diameter (m)	113
Swept Area (m^2)	10,000
Rotor Speed (rpm)	6 - 13
Blade length (m)	55
Tower	
Hub height (m)	99.5
Tip height (m)	154.5
Sound Power Level	
Maximum output (at a 2.221 MW rating)	104 dBA

Specifications of the turbine are provided in **Appendix A**. In addition, detailed noise characteristic data is provided within the Noise Assessment Report (included as an attachment to the **Design and Operations Report**).

3.0 Closure

The **Wind Turbines Specifications Report** for the Suncor Energy Adelaide Wind Power Project has been prepared by Stantec for Suncor in accordance with Item 14, Table 1 of Ontario Regulation 359/09 and the MOE's *Technical Guide to Renewable Energy Approvals*.

This report has been prepared by Stantec for the sole benefit of Suncor, and may not be used by any third party without the express written consent of Suncor. The data presented in this report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

STANTEC CONSULTING LTD.

Mark Kozak
Project Manager

Rob Rowland
Senior Project Manager

Appendix A

Turbine Specifications from Manufacturer

SWT - 2.3 - 113

Turning moderate wind into maximum results

At the leading edge of evolution

The new Siemens SWT-2.3-113 wind turbine is the ultimate choice for low to moderate wind conditions. The revolutionary direct drive generator and the new, optimized Quantum Blade are paired to extract as much energy as possible from the wind.

Efficient. Quiet. Robust and reliable. The Siemens SWT-2.3-113 is the new benchmark wind turbine for low to medium wind speeds. As a result of more than 30 years of research and development, it is designed to harvest more energy out of moderate wind con ditions than anyone thought possible.

Proven design

The SWT-2.3-113 is built around the same revolutionizing direct drive generator as the SWT-3.0-101. The direct drive turbine offers exceptional reliability and efficiency – with only 50% of the parts normally required for a conventional wind turbine. By using the same proven design and sharing the majority of components with its larger sibling, production costs and lead times can be kept down.

Unique aerodynamics

The Quantum Blade combines excep tional aerodynamic performance with patented manufacturing technology. Based on innovative aerodynamic solutions in the root and tip sections, the Quantum Blade offers maximum efficiency at low to medium wind speeds.

Maximum availability

Simplicity is the ultimate sophistication. With the simple and robust direct drive concept with 50% fewer parts, the SWT-2.3-113 wind turbine is designed for maximum availability. Furthermore, the spacious nacelle and the ergonomic working conditions facilitate service ability and contribute to minimizing downtime for scheduled maintenance.


“You cannot change the wind.
It may be strong, it may be light.
This leaves it up to us to extract
as much energy as we can from it.
Anne Schannong Vinther, Quality Engineer

Innovation for efficiency

Siemens direct drive technology and the new Quantum Blade represent groundbreaking wind turbine design and technology. The result of these two key innovations is a turbine with maximum efficiency and reliability, which helps to enable a solid return on investment.

Maximized performance with 50% fewer parts

The Siemens direct drive design incorporates a permanent magnet generator with fewer moving parts than ever before.

The simple permanent magnet design offers increased efficiency directly by minimizing energy losses and indirectly by reducing maintenance needs. The outer rotor arrangement leads to a more compact and lightweight generator, making transportation and installation easier and faster.

The B55 Quantum Blade

The new generation of Siemens wind turbine blades is lighter than previous designs but retains the superior strength known from earlier generations of blades. Thanks to unique airfoils and redesigned tip and root sections, the blade offers superior performance at low to medium wind speeds. The root section uses Siemens "flatback" profiles to minimize root leakage and provide higher lift. The tip has also undergone a fine-tuning process to give enhanced lift and acoustic performance.

One-piece moulding

Like other Siemens blades, the new Quantum Blades are manufactured in Siemens proprietary IntegralBlade® process. Each blade is moulded in one single production step from fiberglass-reinforced epoxy resin, resulting in a stronger, lighter blade without any joints.

Technical specification

Rotor

- Type: 3-bladed, horizontal axis
- Position: Upwind
- Diameter: 113 m
- Swept area: 10,000 m²
- Speed range: 6–13 rpm
- Power regulation: Pitch regulation with variable speed
- Rotor tilt: 6 degrees

Blade

- Type: Self-supporting
- Blade length: 55 m
- Tip chord: 0.63 m
- Root chord: 4.2 m
- Aerodynamic profile: NB 1-7, SWPNA1_XX12, FFAxxx
- Material: GRE
- Surface gloss: Semi-mat, <30 / ISO2813
- Surface colour: Light grey, RAL 7035

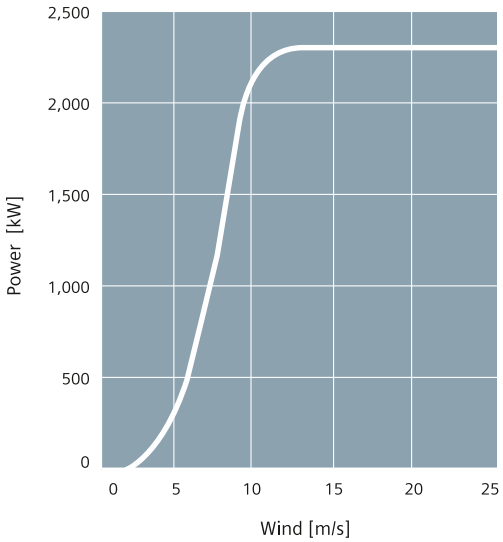
Aerodynamic brake

- Type: Full span pitching
- Activation: Active, hydraulic

Load-supporting parts

- Hub: Nodular cast iron
- Main shaft: Cast
- Nacelle bed plate: Cast

Sales power curve



Mechanical brake

- Type: Hydraulic disc brake
- Position: Generator rear end
- Number of callipers: 3

Canopy

- Type: Totally enclosed
- Surface gloss: Silk mat, 30–40 / ISO2813
- Colour: Light grey, RAL 7035

Generator

- Type: Synchronous, PMG
- Nominal power: 2,300 kW

Grid terminals (LV)

- Nominal power: 2,300 kW
- Voltage: 690 V
- Frequency: 50 Hz or 60 Hz

Yaw system

- Type: Active
- Yaw bearing: Externally geared
- Yaw drive: 8 (optional 10) electric gear motors
- Yaw brake: Passive friction brake

Controller

- Type: Microprocessor
- SCADA system: WPS
- Controller designation: SWTC, STC-1, SCS-1

Tower

- Type: Cylindrical and/or tapered tubular
- Hub height: 99.5 m or site-specific
- Corrosion protection: Painted
- Surface gloss: Silk mat, 30–40 / ISO2813
- Colour: Light grey, RAL 7035

Operational data

- Cut-in wind speed: 3 m/s
- Nominal power at: 12–13 m/s
- Cut-out wind speed: 25 m/s
- Maximum 3 s gust: 59.5 m/s (IEC version)

Weights (approximately)

- Rotor: 66,700 kg
- Nacelle: 73,000 kg
- Tower: Site-specific

1 Quantum Blade

- Unique design and manufacturing process
- IntegralBlade® one-piece moulding for maximum strength
- Optimized aerodynamics for low to medium wind conditions
- Increased length for higher energy yield
- Blade root – designed for minimized root leakage and increased lift

2 Direct drive generator

- Permanent magnet design
- Totally enclosed, easy to handle and lightweight design
- Optimum reliability and efficiency

3 Nacelle

- Solid, compact and lightweight structure
- Spacious, ergonomic design – maximum serviceability
- 50% fewer parts compared to geared turbines

4 Cooling

- Simple and robust LiquidLink® water cooling system
- Top-mounted passive cooling radiators
- High-efficient two-stage cooling as function of power

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SIEMENS

January 18, 2013

To Whom It May Concern

Re. Adelaide Wind Project

Dear Sir/Madam,

In respect of the Adelaide Wind Project, Siemens will be providing the SWT 2.3-113 direct drive (DD) wind turbine generators that have been de-rated to the following nameplate: SWT 2.221-113. Siemens guarantees the values shown in the table below are the maximum power levels and maximum broadband sound power levels respectively.

Official Nameplate	Maximum Rated Power	Maximum Broadband Sound Power Level
SWT 2.300-113	2.300 MW	105 dBA
SWT 2.221-113	2.221 MW	104 dBA

Siemens confirms the attached acoustic emissions data sheets correspond to each of the nameplate wind turbines listed above. The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 99.5m.

Siemens can also confirm that the sound from the Siemens turbines to be supplied for the Adelaide Wind Project is not tonal since all of these turbines have tonal audibility less than 3 dB as stated in our acoustic emission documents, and as determined in accordance with IEC61400-11:2002.

Regards,

John D. Amos
Head of Engineering
Siemens Energy, Inc.
Wind Power Americas

Enclosures (2)

Siemens Energy, Inc.

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