



Appendix G
O & M Appendices



Appendix G-1

SCADA System DESCRIPTION

APPENDIX G-1: SCADA SYSTEM DESCRIPTION

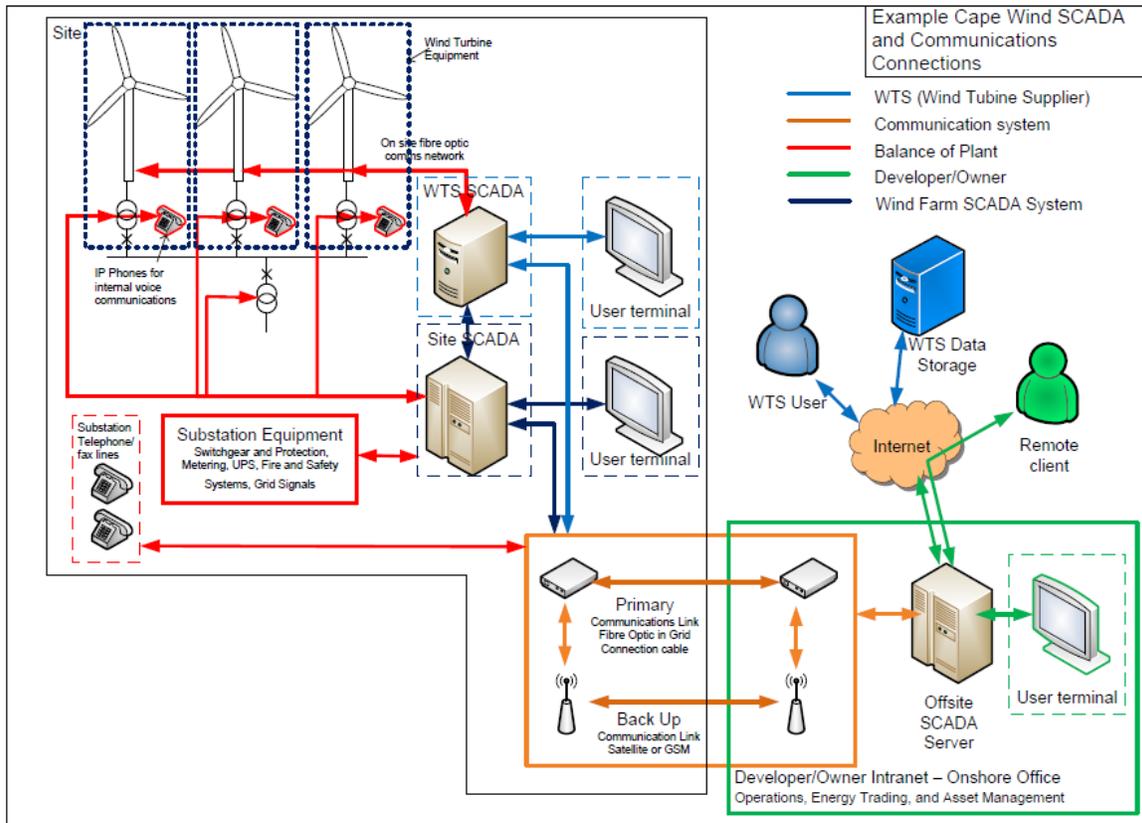
This is a representative SCADA system design. A detailed SCADA system design will be provided upon submittal of the FIR.

General Description

Use of two or more SCADA systems is established practice for wind farms. The overall SCADA system comprises:

- WTG SCADA system (WTSS) which is a proven proprietary system developed by the WTG manufacturers for monitoring and control of the WTGs. This communicates with the WTG suppliers' and Owners' base stations enabling either or both the WTG supplier or the Owner to monitor status and performance, and undertake supervisory controls in accordance with protocols which are defined for the project.
- Wind Farm SCADA system (WFSS) which is the parent system designed for the project to monitor and control the ESP and BoP. This will interface with the WTSS and may include the following sub-systems:
 - Grid monitoring or grid interface system if the ISO-NE & NSTAR requires the Project to provide real-time data on equipment status and power import / export to the ISO-NE & NSTARS' data systems.
- Owners' base station.
- Communications systems.

A typical schematic for a wind farm is provided below.



General Operation

The SCADA system shall allow individual and user defined groups of WTGs to be remotely stopped and started without compromising the operation of any of the other WTGs.

Each WTG shall be capable of operating independently of the other WTGs and of the SCADA system. Should the SCADA system fail, the individual WTGs shall continue to operate without compromising the safety of the equipment or breaching any technical conditions of the grid requirements or system design,

Should any part of the WFSS or WTSS fail, the individual WTGs, the meteorological station and electrical systems shall continue in operation unless such operation compromises the safety of the equipment or breach any technical conditions of the grid or system design,

The SCADA system shall be traceable and transparent in operation. It shall be structured in such a way as to provide maximum data integrity

The SCADA system shall be able to facilitate interfacing to a maintenance management system and to forecasting tools.

Wind Turbine SCADA System (WTSS)

The SWT-3.6-1 07 wind turbine is equipped with the Siemens WebWPS SCADA system. This system offers remote control and a variety of status views and useful reports from a standard internet web browser. The status views present information such as electrical and mechanical data, operation and fault status, meteorological data and grid station data. In addition to the Siemens WebWPS SCADA system, the SWT-3.6-107 wind turbine is equipped with the unique Siemens TCM condition monitoring system. This system monitors the vibration level of the main components and compares the actual vibration spectra with a set of established reference spectra. Result review, detailed analysis and reprogramming can all be carried out using a standard web browser.

Wind Farm SCADA System (WFSS)

The CWA WFSS remote station will be situated in the ESP and provide an interface with the WTSS.

The WFSS system shall provide alarms, indication and control for the complete wind farm including but not limited to the following subsystems and components:

- a. WTGs
- b. Meteorological masts.
- c. Navigation lights and systems.
- d. Fog sounding system.
- e. WTG MV switchgear sequenced control and interlocking and protection.
- f. Fire and safety system, WTG and substation.
- g. Wind farm substation (ESP) HV switchgear control and protection.
- h. Wind farm substation (ESP) MV switchgear control and protection.
- i. Wind farm grid connection cable (115kV) protection and monitoring.
- j. MV and HV transformers.
- k. CCTV monitoring system.
- l. WTG condition monitoring system.
- m. Telecoms and broadband communications.
- n. UPS's (Uninterruptable Power Supply).Utility and Utility substation
- o. Environmental Monitoring devices (bird cameras, etc)

As a subset the WTSS will supply the following signals to the WFSS

- a. WTGs
- b. Meteorological masts.
- c. Navigation lights and systems.
- d. Fog sounding system.
- e. WTG condition monitoring system.
- f. WTG transformer and switchgear

Details of the WFSS are to be confirmed through the detailed design of the ESP and BoP.

Communication Systems

This shall comprise four fiber optic cables from the wind farm with the export cables to the onshore connection vaults (two operating redundant cables and two spare). The two operating redundant fiber optic cables will be routed with the onshore cables to the Utility Substation at the grid interconnection point. From this point, the two redundant fiber optic cables will be routed via either local utility distribution or telephone poles to the Control Room. The fiber optic communication for the SCADA system shall be backed-up by radio or satellite communication.

Details of communication systems are to be confirmed through the detailed design of the ESP and BoP.

WTG Maintenance Schedule

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Confidential business information.
Not for public disclosure.

Appendix G-3

**ESP and BOP Maintenance
Schedule**

APPENDIX G-3: ESP AND BOP MAINTENANCE SCHEDULE

An indicative maintenance schedule is provided below for the ESP and also covering the BoP. A detailed maintenance schedule will be provided upon submittal of the FIR.

Project Name: Cape Wind Project Asset Type	Frequency of Preventative Maintenance									
	6M	12M	18M	24M	30M	36M	42M	48M	54M	60M
Wind Turbine 33 kV cable/Fiber Optic cable terminations		EI & TI		EI & TI		EI & TI		EI & TI		EI & TI
33kV Intra Array Cables/Fiber Optic Cable						DEI&T				
Cathodic Protection System (Turbine Platform)		EI		DEI&T		EI		DEI&T		EI
Cathodic Protection System (ESP)		EI		DEI&T		EI		DEI&T		EI
Cable Protection System and Protection (Turbine Platform)						DEI&T				
Cable Protection System and Protection (ESP)						DEI&T				
Mechanical / Civil Structure (Turbine Platform)								EI		
Mechanical / Civil Structure (ESP)								EI		
Earthing and Lightning Conductor (Turbine Platform)						DEI&T		EI		
Earthing and Lightning Conductor (ESP)						DEI&T		EI		
SCADA Component (Turbine Platform)										
SCADA Component (ESP)		EI		EI		EI		DEI&T		EI
SCADA Power Performance and Meteorological Masts		DEI&T		DEI&T		DEI&T		DEI&T		DEI&T
ESP Equipment:										
33kV Intra Array Cables/Fiber Optic Cable terminations		EI & TI		EI & TI		EI & TI		EI & TI		EI & TI
33kV ESP cables and connection to 33kV GIS Switchgear		EI & TI		EI & TI		EI & TI		EI & TI		EI & TI
33kV surge suppression equipment										
33kV GIS Switchgear and Bus to SU Transformers										
33kV disconnect and earthing switches		EI & TI		EI & TI		EI & TI		EI & TI		EI & TI
4- Step Up Transformers	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*
115kV GIS Switchgear and Bus to SU Transformers		TI		TI		TI		TI		TI
115kV disconnect and earthing switches		TI		TI		TI		TI		TI
115kV surge suppression equipment		TI		TI		TI		TI		TI
115kV Bus and Cable Termination Compartments		TI		TI		TI		TI		TI
115kV Reactor System		TI		TI		TI		TI		TI
115kV Submarine Cable/Fiber Optic Cable						DEI&T				
AC auxiliary power distribution system (480/240/120V)	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*
Auxiliary Motors and starters	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*	EI	EI & TI*
Facility Lighting systems	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI
Protective relaying system										DEI&T
Metering system		EI		EI		DEI&T		EI		EI
Telecommunication system (voice, data, control, data acquisition)		EI		EI		DEI&T		EI		EI
Life boat and deployment systems	EI	EI*	EI	EI*	EI	EI*	EI	EI*	EI	EI*
Fire and Safety Alarm and Deluge systems	EI	EI*	EI	EI*	EI	EI*	EI	EI*	EI	EI*
Service Crane System		EI*		EI*		EI*		EI*		EI*
Navigation Lighting and Sound System	EI	EI*	EI	EI*	EI	EI*	EI	EI*	EI	EI*
Heating Ventilation and Cooling Systems	EI	DEI&T	EI	DEI&T	EI	DEI&T	EI	DEI&T	EI	DEI&T
Sanitary Systems	EI	EI	EI	EI	EI	EI	EI	EI	EI	EI
Battery storage and charging system	EI	DEI&T	EI	DEI&T	EI	DEI&T	EI	DEI&T	EI	DEI&T
115kV Submarine/115kV On shore Cable transition duct						DEI&T				
115kV On Shore duct enclosed cable						DEI&T				
115kV Termination at Nstar Substation						DEI&T				

Legend:

- EI = Means Energized Inspection
- DEI&T = De-Energized Inspection and Testing
- TI = Thermal Image (infrared Scanning)