Section 48 15 00 – Wind Energy Electrical Power Generation

PART 1 - GENERAL

1.00 SCOPE

Renewables are designed to minimize life cycle cost. This is a rapidly changing field. DOE – Energy Efficiency and Renewable Energy (EERE) and the National Renewable Energy Laboratory (NREL) offer resources for renewable energy, green power, and high performance buildings. Refer to http://www.nrel.gov/ and to http://www.eere.energy.gov.

This bid specification is for a 100KW community Scale Wind Generation System. This system shall not utilize a gear box, shall be direct-drive, and shall have less than (10) mechanical wear points in the electrical generation equipment. It shall utilize permanent magnet excitation technology. The variable AC voltage output from it's permanent magnet generator (PMG) shall be rectified and converted to true RMS 480-volt, 3-phase, electrical energy with a total harmonic distortion of less than 5% through an IGBT based inverter. It shall meet IEEE 519, be UL 1741 and 1004 listed, and be covered by a minimum 2-year warranty and 5-year service agreement. See service agreement description below.

A. General:
   1. Wind Energy System(s).
      a. SUBMITTALS
         1.1 Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:
             a) Foundation Drawings
             b) Transformer
             c) Electrical one-line
             d) Site Feasibility Report

   2. Local/Regional Materials:
      a. This product shall be in compliance with the "Buy American" clause.

   3. Renewable Energy:
      a. Submit manufacturer's product data for system.
      b. Submit calculations indicating the energy produced by the system.

QUALITY ASSURANCE:

A. Wind Energy Systems:
   1. The American Wind Energy Association (AWEA) has worked to develop wind industry consensus standards in partnership with the U.S. Department of Energy and other organizations. These standards, currently in development, are intended to be compatible with International Electro technical Committee (IEC) standards to ensure that U.S. wind businesses have full access to foreign markets.
      a. Performance:
         1.1 IEC 1400-1: Safety Requirements for Large Wind Turbines
         1.2 IEC 1400-2: Small Wind Turbine Systems

1.3 IEC 1400-11: Acoustic Emission Measurement Techniques
1.4 IEC 1400-12: Performance Measurement Techniques

2. Service agreement: The Turbine shall come with a minimum 5-year service agreement after commissioning by factory-trained professionals. Proof of personnel certification shall be made available upon request at the job site.

3. The Turbine shall carry the following listings:
   a. CSA C22.2 No. 107.1-01 General Use Power Supplies, dated 2001, (Reaffirmed 2006)
   b. CSA C22.2 No. 100.04, Motors and Generators, dated 2004 including update No. 2 May 2006
   c. UL 1741, Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources, First Edition, Dated May 7, 1999 including revision through November 7, 2005.
   d. UL1004-4, Electric Generators, First Edition, Dated September 15, 2008.

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:
1. The installation shall be constructed in accordance with any and all applicable codes and regulations. It is assumed the contractor has included all costs associated with code and ordinance compliance.

1.02 ELECTRICAL SPECIFICATIONS AND REQUIREMENTS

A. Section Overview
1. The customer shall design and install the electrical system using a qualified engineer (or licensed electrician with design experience), and in accordance with manufacturer specifications, site conditions, and all codes and regulations applicable to the site.
2. The Turbine scope includes Turbine (nacelle, rotor, tower, and associated internal components), electrical equipment to and including the fused disconnect, and junction box located at the bottom of the tower. An isolation transformer shall be provided by the Electrical Contractor for use with the OEM wind turbine product.

B. Electrical Requirements
1. Permitting and determination of locally applicable installation codes and standards shall be determined by the Electrical Contractor (EC).
   a. Grid Requirements:
      1.1 The Turbine shall be connected to a transformer provided by the EC.
      2.1 The transformer’s grounded Wye, 480Y/277-volt side shall be electrically connected to the fused disconnect at the tower base.

b. Transformer Requirements:
   1.1 Each Turbine must have a dedicated interconnect/isolation transformer. This transformer is required for the Turbine to meet IEEE519 and UL1741 standards. This transformer is required even if connecting to a distribution system matching its 480V output voltage. The transformer must have isolated primary and secondary windings. An autotransformer is not acceptable. This shall be provided by the EC and not be furnished by the Turbine manufacturer.

2. Transformer Winding Requirements
   a. The Turbine-side connection of the isolation transformer is required to be grounded wye. The grid-side connection can be either wye or delta.

3. Interconnect Feeder
   a. This installation shall connect to the utility distribution as shown in drawings prepared for the EC by a licensed electrician with design experience or an electrical engineer. The EC is responsible for obtaining all necessary permits, zoning, as well as filing interconnect agreements and obtaining all necessary permissions from public, private, and co-operative authorities.

4. Disconnect Requirements
   a. A means of disconnecting all power from the Turbine and its control circuits is required between of the Turbine’s downtower and protective relay electrical boxes and the transformer. This disconnecting means must be:
      - Readily accessible from the Turbine base, external
      - Externally operable
      - Lockable
      - Fusible, service rated
      - Rated for the environment in which it is installed.

5. Grounding Requirements
   a. The Turbine installation requires an earth ground electrode system. An earth ground electrode system typically is comprised of driven ground rods and buried copper wire in the surrounding soil and/or connection to foundation concrete and steel.
   b. The customer is responsible for the design, installation and connection of/to the earth ground electrode system in compliance with codes mandated by the local authority having jurisdiction and the following Northern requirements:

      - The earth ground electrode system shall

have a resistance value of 5 ohms or less
- The interconnection transformer ground shall be connected to the tower earth ground electrode system using #1/0 AWG copper wire minimum.
- Tower foundation bolts shall not be used as terminations for ground conductors
- The foundation reinforcing steel and foundation piles (if used) shall be electrically bonded together to serve as or supplement the foundation electrode. Exothermic welding is the only acceptable method for this step.
- Two conductors shall be attached using an exothermic welding process to the electrically interconnected reinforcing steel in two separate locations that are on opposite sides of the Turbine tower. Each conductor shall be connected to the Turbine tower bonding bus. Refer to Figure 1 for connection detail.
- The Turbine bonding bus shall be pre-drilled and tapped to accept ground conductors with crimp type or compression lugs and is located at the Turbine tower base. Anti-oxidation compound shall be used on these connections.
- Ground conductors used for attachment to the earth.
- Provide a ring earth-ground encircling the foundation, in addition to the electrode system formed by foundation reinforcing steel.

c. When designing and installing the earth ground electrode system, the EC shall utilize the following references:
- IEC 62305 (Protection Against Lightning)
- Germanischer Lloyd Guideline for the Certification of Wind Turbines
- MIL-HDBK 419, Grounding, Bonding and Shielding for Electronic Equipment and Facilities
- IEEE 141=1993 (Red Book)
- IEEE 142-2007 (Green Book)
- NFPA 780 art 3 (Standard for Installation of Lightning Protection Systems)
- NFPA 10 art 250 (Grounding and Bonding)
- Motorola R-56, “Standards and Guidelines for Communications Sites”

PART 2 – CONTROL AND MONITORING REQUIREMENTS

2.01 SECTION OVERVIEW

A. This section defines the control and remote data interconnect requirements for the wind Turbine.

2.02 Control Interface

A. The Turbine shall include a fully automatic control system that safely operates the Turbine to maximize energy capture in all operating conditions. The controller shall be housed in the nacelle, with a communication interface in the junction box at the base of the tower.

2.03 Monitoring System

A. The Turbine shall include a SCADA based Monitoring System, which provides a data logging and diagnostic interface to provide remote support for the Turbine. It shall also provide a web-based (TCP/IP) human-machine interface (HMI) that can be accessed by any authorized person from anywhere in the Internet. The SCADA based monitoring System shall include a Remote Terminal Unit (RTU) computer to be installed at or near the site of the Turbine.

B. The EC is responsible for installing and wiring the RTU in a protected environment, and for providing an Ethernet switch appropriate for the link chosen (i.e. fiber, Cat Ve, or wireless “free space propagating” Ethernet communication network) for manufacturer-monitoring of the Turbine systems. The customer is responsible for providing Internet access to the RTU throughout the warranty period as well as providing a static IP address with port-forwarding enabled.

PART 3 – EXECUTION

3.1 SITE ENVIRONMENTAL PROCEDURES

A. Resource Management:

1. Energy Efficiency: Verify equipment is properly installed, connected, and adjusted. Verify that equipment is operating as specified.
2. Renewable Energy: Verify proper operation in all modes of system operation be testing. Verify proper operation under a wide range of conditions to verify energy delivery as calculated for those conditions.
3. Site shall have a feasibility study submitted to the manufacturer and the owner/client for review prior to installation beginning. The results of this study shall include either met-mast or calculated hub-height wind speed in SI as well as English units. The feasibility study shall include estimated average energy production by the manufacturer-specific Turbine power curve, utilizing Weibull-Rayleigh distribution curves as well as documented, reportable data from the manufacturer for at least (3) other sites that are close the client’s wind speed. The power curve of the manufacturer shall be independently certified by NREL.
4. Approval of the installation from the FAA, local zoning, local permitting shall be submitted for review.
5. Soils analysis shall be submitted to the manufacturer for review.
6. Site-specific foundation design shall be submitted to the manufacturer for review. Foundation designs without the stamp of a registered Professional Engineer (PE) shall be rejected automatically.

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