

**TECHNICAL CONDITIONS
TABLE OF CONTENTS
RFP NO. 090457.CJB**

TC-1	GENERAL	1
TC-2	REFERENCES AND SUPPLEMENTAL DATA.....	1
TC-3	SITE INFORMATION	2
TC-4	ENVIRONMENTAL IMPACT REPORT	2
TC-5	WIND TURBINE SITING GUIDELINES	3
TC-6	SITE WIND CHARACTERISTICS.....	5
TC-7	SMUD-PERFORMED WORK	6
TC-8	WIND TURBINE DESIGN REQUIREMENTS.....	7
TC-9	SCADA SYSTEM	14
TC-10	REQUIRED DESIGN DOCUMENTATION.....	16
TC-11	SMUD FIELD OFFICE TRAILER	17
TC-12	MINIMUM ROAD DESIGN AND CONSTRUCTION	18
TC-13	SHIPPING AND TRANSPORTATION PLAN.....	20
TC-14	UNDERGROUND UTILITIES.....	20
TC-15	STRUCTURAL DESIGN REQUIREMENTS.....	21
TC-16	FENCING AND GATES.....	21
TC-17	METEOROLOGICAL (Met) TOWERS	22
TC-18	ELECTRICAL COLLECTION SYSTEM	23
TC-19	SCADA COMMUNICATION SYSTEM	25
TC-20	LABELING AND LOCKS.....	26
TC-21	SMUD HOLD POINTS	27
TC-22	WIND TURBINE COMMISSIONING AND ACCEPTANCE TESTS	27

TC-23	WIND TURBINE POWER CURVE TEST	29
TC-24	WIND TURBINE POWER CURVE GUARANTEE	30
TC-25	COLLECTION SYSTEM TESTING	31
TC-26	SCADA COMMUNICATION SYSTEM FIBER TESTING	32
TC-27	AS-BUILT DRAWINGS.....	32
TC-28	FINAL SYSTEM DOCUMENTATION	32
TC-29	PHASE 3 FULL SERVICE O&M (OPTIONAL O&M CONTRACT).....	34
TC-30	AVAILABILITY GUARANTEE (OPTIONAL O&M CONTRACT).....	35
TC-31	OPERATION AND MAINTENANCE (O&M) BUILDING	37
TC-32	OPERATION AND MAINTENANCE (O&M) BUILDING LEASE (OPTIONAL O&M CONTRACT).....	37

TC-1 GENERAL

The Technical Conditions provide requirements and specification of materials, methods, and equipment applicable to the Solano Wind Project Phase 3 Engineering, Procurement (except as indicated), and Construction (EPC) contract to provide up to a net 130 megawatts (MW) of wind turbine generator (WTG) capacity at the point of interconnection, including 10 Year Warranty, as identified in the contract documents. In addition, a second contract for full service 5 year minimum operations and maintenance (O&M) will be awarded, based on Proposers' bid for such services. As an alternative, at SMUD's option, a contract for the supply and shipment of WTGs only (with specified auxiliary systems) may be issued, if bids for WTG supply only are fully responsive and deemed a better value to SMUD. These requirements and specifications shall be applicable to all bid items for the Phase 3 Project. If not identified as optional, requirements apply to the EPC Base Bid and Full Service O&M proposals. Relevant EPC requirements are applicable to the WTG supply option for equipment and shipping, as noted.

TC-2 REFERENCES AND SUPPLEMENTAL DATA

This section references the latest revisions of the following non-SMUD standards. They are a part of this Contract insofar as specified and modified herein:

Title

American National Standards Institute (ANSI)
American Society of Civil Engineers (ASCE)
California Building Code (CBC)
Institute of Electrical and Electronic Engineers (IEEE)
National Electric Code (NEC, NFPA 70)
National Electric Safety Code (NESC)
IEC 61400-01, Ed. 3, Wind Turbine Safety and Design
IEC 61400-12 Power Performance Testing
IEC 61400-13 Measurement of Mechanical Loads
IEC 61400-21 Power Quality
IEC 61400-23 Full-Scale Structural Testing of Rotor Blades
IEC 61400-24 Lightning Protection

The latest edition of the *Standard Specifications* for the State of California, Business and Transportation Agency, Department of Transportation, also are referenced, as applicable.

The following table identifies the attachments that are a part of this Contract, and their location:

Appendix	Contents	Appendix Location
Appendix A	Solano Wind Project Overview – Summer 2009	Attached to RFP
Appendix B	(Not Used)	
Appendix C	(Not Used)	
Appendix D	Solano Wind Project Phase 3 Environmental Impact Report (Recirculated Draft, October 2009)	CD Number 1
Appendix E	SMUD Solano Wind Project, Phase 3 Geotechnical Engineering Study	CD Number 1
Appendix F	Final Hydrologic and Hydraulic Report for the Solano Wind Project, Phase 3	CD Number 1
Appendix G	Sample Energy Production Table	Attached to RFP
Appendix H	Geographic Information System Supporting Data, Including Aerial Survey, Topography, and Siting Constraints Mapping for the SMUD-Solano Wind Project, Phase 3	CD Number 1
Appendix I	The Technical Basis for the New WECC Voltage Ride-Through (VRT) Standard, dated June 13, 2007	CD Number 1
Appendix J	Operation and Maintenance Building Technical Requirements	Attached to RFP
Appendix K	SMUD Engineering Specification, D001, 35 kV Underground Cable Specifications, Rev. 6	Attached to RFP
Appendix L	Large Generator Interconnection Agreement, CAISO and PG&E	CD Number 1
Appendix M	SMUD Power Engineering Standards 01 and 02	Attached to RFP
Appendix N	Russell Generation Step-Up Transformer Riser Drawing	Attached to RFP
Appendix O	Meteorological Data for Phase 3	CD Number 2

TC-3 SITE INFORMATION

General information on the Solano Wind Project is provided in Appendix A, Solano Wind Project Overview – Summer 2009. This overview includes general location maps with a preliminary site plan for the buildout of the 4,244 acres of Phase 3, Project background and history, and Project evolution. No setbacks are required along the boundary of the 411-acre excluded area. Appendices are available as described in the preceding table.

TC-4 ENVIRONMENTAL IMPACT REPORT

A Compact Disk (CD Number 1) containing Appendix D, the complete Solano Wind Project Phase 3 Recirculated Draft Environmental Impact Report (EIR), will be made available, upon request, to Proposers. To request a copy of CD Number 1, contact the Procurement Professional identified in this RFP in writing and a copy will be issued. Adherence to the applicable EIR design criteria and mitigation monitoring requirements is the responsibility of the Proposer. If there is any discrepancy between the requirements of the EIR and the requirements of this specification, the EIR shall have precedence. The EIR is subject to change prior to Certification by SMUD.

TC-5 WIND TURBINE SITING GUIDELINES

Final WTG siting shall be evaluated and designed by the Proposer in compliance with these siting guidelines, to provide the optimum utilization of the existing ridge-top topography within the Phase 3 Project areas (the base bid and base plus expansion parcel buildout areas) for maximum wind energy production. Site-specific geotechnical, site access, and related information are available in Appendix E, Appendix F, and Appendix H on CD Number 1. To request a copy of this CD, contact the Procurement Professional identified in this RFP in writing, and a copy will be issued.

- **80-m Hub Height:** The nominal WTG hub height for the Phase 3 Project is 80m. This height may vary, depending on which hub height is appropriate for the WTG being bid and the most appropriate tower strengths, dynamic properties, and lowest delivered cost of energy. The minimum WTG hub height is also 80 m.
- **Up to 105-m Hub Height:** An option for Proposers is to consider a hub height of up to 105m. Given the wind shear at the site, WTGs with such a height may capture more energy; however, due to property-line and other setbacks that vary with hub height and/or rotor size, the total installed capacity, total energy production, and lowest cost-of-energy may not be appealing. The Proposer is given latitude to bid the appropriate height in the range stated based on tower characteristics and costs. In no event shall the total WTG height (defined as the hub height plus 0.5 times the rotor diameter) exceed 152m.

As indicated in the EIR, all of the ridge-top areas are preapproved by SMUD for WTG placement, except as constrained by the EIR requirements and as directed in these guidelines. The siting of the Proposer's chosen WTGs shall comply with the following guidelines, in full compliance with the EIR. Many of the setbacks and WTG spacings refer to distances in terms of rotor diameters (RD) and WTG height. Note that there are no residences or public roadway setbacks within the Phase 3 property.

- **Topography.** The topography in the project area generally determines the siting of the WTGs. WTGs are to be sited where secure foundations can be placed for the towers, within topographic constraints.
- **Sufficient spacing.** The WTGs shall be sited to provide enough space between the towers to reduce the energy losses and stress on the WTGs created by turbulence downwind from other WTGs under prevailing wind conditions.
- **Safety setback.** The Proposer shall provide an evaluation of the proposed siting plan documenting that the WTGs will be sited to maintain minimum safety setbacks. The Proposer's minimum safety setback evaluation shall include an analysis of the five types of failure that could occur:
 1. Blade Throw. Loss of an entire blade by failure at the hub attachment.
 2. Tower Failure. Complete failure of the tower, particularly at the base.
 3. Rotor Delamination. Failure of the fiberglass rotor skin, resulting in flying fragments.
 4. Ice Throw. Ice accretions being thrown from a moving rotor.
 5. Blade-Throw Strike. Impact of a failed rotor blade on the tubular tower.

- **Distances from transmission lines.** The WTGs shall be located to maintain the minimum safety setback from adjacent transmission lines.
- **Distance from roads.** The WTGs shall be located to maintain a minimum setback from adjacent public roads.
- **Distance from property boundaries.** WTGs shall be located to maintain the minimum safety setback from the property boundaries, except as specified herein.. Property boundaries between Phase 3 and Phases 1 and 2 properties, the Greenport Energy LLC property, and between the Phase 3 base bid and expansion parcel areas, do not require boundary setbacks (see Appendices D and H, CD Number 1).
- **Noise levels and distances from property boundaries.** Solano County zoning regulations pertaining to WTG permitting state that WTG noise must not exceed a community noise equivalent level (CNEL) value of 50 decibels A-scale (dBA) at any property line abutting a residential zone, or 60 dBA at any other property line. No residences are in the project area. The closest residence is 3,600 feet from the project boundary.
- **Distance from railroads.** No railroads are in the project area. Therefore, no siting restrictions relative to railroads apply.
- **Distance from residences.** No residences are in the project area or within 0.5 mile of any planned WTGs. Therefore, no additional siting restrictions apply relative to residences.
- **Avoidance of sensitive biological resources.** To avoid impacts on waters of the U.S. and protected species, WTGs shall be sited outside of drainage areas, raptor nesting areas, and other sensitive natural features. Environmental constraints relative to the various resources in the project area that must be considered during the siting of the WTGs and other project infrastructure are described in each resource analysis section of the EIR. Wetlands are labeled on the accompanying geographic information system (GIS) maps in Appendix H (CD Number 1).
- **Visual impacts.** The *Wind Turbine Siting Plan* (Solano County, 1987) states that no siting restrictions apply relative to visual impacts.
- **Avoidance of natural gas lines.** To avoid impacts to existing gas lines in the project area, the WTGs shall be sited outside of the 25- or 75-foot setbacks from these lines.
- **Avoidance of microwave and radio signals.** The WTGs shall be sited to avoid a fiber optic trunk line that crosses the property and to avoid one microwave beam as shown on the GIS map (Appendix H, CD Number 1).

The Proposer shall be responsible for obtaining the WTG manufacturer's acceptance of the proposed siting plans, based on lateral and downwind spacing, wakes, and turbulence intensity prior to providing a siting plan in the proposal. Easements for roads and collection system elements within the Greenport Energy LLC property are as shown on the GIS map (Appendix H, CD Number 1).

SMUD requests that Proposers strive to site up to a net 128 MW of wind capacity (at the point of interconnection) on the site, while proposing the maximum WTG energy output and being limited to SMUD's wind turbine siting guidelines. In consideration of the limitations set in the EIR, SMUD will consider as unresponsive and will reject any proposal for the installation of more than a net 130

MW or less than 115 MW of nameplate capacity. Furthermore, SMUD will consider as unresponsive and will reject any proposal for the installation of more than a total of 65 WTGs. **If special control features are required as a result of WTG spacing (for example “wind sector management” [WSM]), the Proposer shall describe such requirements and the estimated impact on annual Gross Energy Production (GEP), per Appendix G (attached to this RFP). Each Proposer shall incorporate any and all energy losses associated with special controls in its estimate of GEP. SMUD will evaluate all losses and wake impacts in its technical evaluation criteria that are based on net energy production.**

Should a Proposer desire to submit a proposal that includes two different WTG hub heights or rotor diameters, the Proposer shall submit two versions of the table found in Appendix G, by which the GEP is calculated. One such table shall apply to each of the WTG hub heights or rotor diameters proposed. The numbers and locations of the WTGs of each height or rotor diameter shall be detailed in the proposal.

The PDF and ESRI Shapefile-formatted site plan maps detailing the extent of SMUD’s property, base bid area and expansion area, are included in Appendix H. The site plan maps also identify wetland areas, sensitive environmental items, transmission lines, gas pipeline routes, and other siting restrictions imposed by SMUD. The Proposer shall be responsible for full compliance with the siting requirements described in this RFP.

TC-6 SITE WIND CHARACTERISTICS

For the benefit of all Proposers, SMUD has assembled, on CD Number 2, the wind data that applies to SMUD’s site. SMUD has acquired wind data using three Met towers on the Project site, as described below.

Meteorological Towers Used. Several Met towers are in the Montezuma Hills region. The data have been used to establish the wind data provided in Appendices B and C.

- **Site 6:** A 60-m high, guyed Met tower located within the property is the subject of this procurement. It is instrumented at several heights. It was installed in July 2005 and is downwind of the High Winds Power Project, which is owned by another entity.
- **Site 7:** A 60-m high, guyed Met tower located near the Sacramento River and beyond the western edge of the Phase 3 property. It is instrumented at several heights. Approximately three years ago, the tower replaced a 50-m instrumented tower that had developed records, over several years, of very good site wind data.
- **Site 8:** An 80-m high, free-standing Met tower located within SMUD’s Phase 2A wind project area (i.e., near the first eight Model V90 WTGs that were brought on line in June 2006), off of Stewart Lane.

Proposer is responsible for the analysis of the site meteorological data (Appendix O) and selection of the appropriate WTG model for the Phase 3 Project site conditions.

Energy Production Projections Assumptions: The Proposers shall use the WTG warranted power curve for the local average annual air density of 1.20 kg/m³.

Wind Turbulence Intensity. Proposer is responsible determining the applicable Turbulence Intensity (TI) based on Proposer's analysis of the site meteorological data (Appendix O) and selection of the appropriate WTG model for the Phase 3 Project site conditions.

Other relevant site data is described below:

1. Ambient temperature range: 30° Fahrenheit (F) to 110°F (-1.1°Celsius [C] to 43.3°C). Maximum operating temperature for WTG equipment shall be 113°F (45°C).
2. Annual average air density at the site elevation of approximately 200 feet above sea level: 1.20 kg/m³ at 70°F (21.1°C).
3. Maximum glaze ice covering: 0.25 inch.

TC-7 SMUD-PERFORMED WORK

To reduce risk to the Proposer and expedite the Project, SMUD will perform the following tasks.

1. Step-up Transformer—Under a separate contract, SMUD will build a new 170-MVA step-up power transformer and substation bus arrangement, with five, 600A, 34.5 kV circuit breakers for collection system lines. All design and construction of this upgrade will be performed by SMUD or SMUD's other contractors.
2. Solano Wind Project EIR—SMUD will be responsible for completing and certifying the Final EIR for Phase 3 of the Solano Wind Project. Appendix D includes the Recirculated Draft EIR and is available on CD Number 1 to Proposers by request. The Final EIR is scheduled for certification in March 2010. The Final EIR is subject to change prior to Certification by SMUD.
3. Geotechnical Engineering Study for Solano Wind Project Phase 3—SMUD has completed a Geotechnical Engineering Study for the Solano Wind Project, Phase 3. The study report (Appendix E) is available on CD Number 1 to Proposers by request.
4. Wetlands Delineation—SMUD has completed the delineation of identified jurisdictional wetlands, seeps, and other sensitive environmental locations on the Phase 3 Project site. Confirmation by the United States Army Corps of Engineers (USACE) is pending. The jurisdictional wetlands GIS layer is provided in Appendix H, which is available on CD Number 1. Appendix H includes the environmental and other features as additional layers, along with the electronic version of the Aerial Survey Map.
5. Technical Memorandum of Hydrologic and Hydraulic Analyses for the Solano Wind Project, Phase 3—SMUD has completed the Hydrologic and Hydraulic Analyses for the Solano Wind Project, Phase 3. The final report (Appendix F) is available on CD Number 1.
6. Aerial Survey Map—SMUD has developed an ortho-rectified, geo-referenced survey photo of the entire Phase 3 area. In addition, SMUD has developed 2-foot contour interval topographic maps for the primary turbine location areas, O&M building location, and likely access road routes. This information is provided in Appendix H (CD Number 1) to the prime Proposers in

electronic CAD format, upon request. Any additional survey data required by the Proposer shall be the Proposer's responsibility.

7. Burrowing Owl Survey—SMUD will be responsible to perform the required winter and preconstruction burrowing owl survey for the Project. The preconstruction survey will be performed not less than 30 days prior to the start of construction. The Proposer shall comply with all necessary actions and adhere to any conditions required by SMUD, regulatory agencies, or their representatives in this regard.
8. Permitting—SMUD will be responsible to obtain septic system, wetland (USACE), and Federal Aviation Administration (FAA) permits for the Project. The Contractor shall supply the necessary documentation and support required by SMUD in obtaining these permits. Refer to the Special Conditions for more permit scope requirements.

TC-8 WIND TURBINE DESIGN REQUIREMENTS

1. **Wind Turbines, General Requirements.** Through this RFP, SMUD seeks the installation of modern, cost-effective, state-of-the-art WTGs. The WTGs proposed shall be type-certified in accordance with IEC standard 61400-01 (except as noted otherwise), by a recognized international standards organization, and shall be aesthetically attractive. Because of concerns regarding avian mortality, all Proposers shall plan to install WTGs with fully enclosed cylindrical towers that minimize bird-perching opportunities. The proposed WTGs shall be of robust, proven structural designs that meet or exceed the requirements of the site wind characteristics as defined by IEC Standard 61400-01, except for the modified environmental conditions for annual average ambient air density and maximum ambient air temperature, as listed in TC-6, SITE WIND CHARACTERISTICS. The WTGs shall be located on SMUD land to maximize energy production on a yearly basis over the project life, and conform to state-of-the-art siting practices and the WTG siting guidelines defined in TC-5, WIND TURBINE SITING GUIDELINES.

Each WTG shall be capable of autonomous control, using its own sensors and controllers and shall have remote control features, including output and VAR control. Acquisition of key control functions and status indication data shall be available by direct access to the information readout from the control system, in the down-tower control box within the base of the tower, and by remote interrogation through the SCADA system.

2. **Specific Requirements.** WTG selection shall include specific WTG siting, turbine design, SCADA engineering, unit transformers, fabrication, and shop testing. Turnkey EPC WTG supply and installation includes all WTG supply scope items and the balance of plant (BOP) supply and installation. The BOP work scope includes all additional site improvement designs, mobilization, site work, foundations, power collection system design and installation, shipment of all equipment, two Met towers, complete system startup and testing, and SCADA system installation, connection to SMUD's SCADA System, testing, and commissioning for a complete and operable system. Proposers must provide the maximum available warranties and guarantees from all manufacturers. Proposers must offer a minimum 5 year full service O&M. The Proposer shall provide two power curve tests for two of the supplied WTGs. The power curve test shall be as specified in IEC 61400-12 and modified by language described below that

simplifies and reduces the cost of the power curve test (see TC-23, WIND TURBINE POWER CURVE TEST).

The total installed capacity of the Phase 3 WTGs may vary, but the Proposer shall propose a system design that will provide maximum energy output. The total delivered capacity offered shall not exceed 130 MW nor be less than 115 MW at the Russell Generation Step-Up Transformer connection, assuming a two percent (2%) SMUD-defined line loss (see TC-18 for line loss definition). The nameplate capacity of the individual proposed WTGs shall be not less than 2.0 MW or more than 3.6 MW.

The Phase 3 collection shall be designed to accommodate build-out of the project expansion area. Proposers shall assume 18 Megawatts of additional WTGs. Bid shall include site designs, collection system designs, and appurtenances sized and located for the ultimate full build-out to minimize/eliminate any rework required when the full build-out proceeds. All Proposers must also provide the following with their bids:

- (a) A detailed description of past projects and WTG performance to support the requirements listed above;
- (b) A detailed description (including technical specifications) of the WTGs proposed;
- (c) A set of detailed specifications on all aspects of the WTG design and method of control/operation; and
- (d) A detailed description of the SCADA system being offered, its features, and the method of integration of the SCADA system into the existing communication system with the power system operators (CAISO).

The successful Contractor shall meet the following requirements:

- (a) **WTG Features:** Each WTG shall include, but not be limited to, the following subsystems and/or documents:
 - i) Yaw system.
 - ii) Rotor.
 - iii) Drive train (including transmission, bearings and shafts, as appropriate).
 - iv) Pitch system.
 - v) Brake system.
 - vi) Generator and excitation control system and/or generator output converter, if used..
 - vii) Enclosed tower.
 - viii) Nacelle.
 - ix) Foundation and associated design loads.
 - x) Internal WTG control system for stand-alone operation that controls turbine cut-in and cut-out operation; proper synchronization and tie-in to the utility network; on-line

operation; and fail-safe safety system performance under all expected operating and fault conditions.

- xi) All relaying and switchgear required to assure safe and proper connection and disconnection with the local utility, including uninterruptible power supply (UPS) for safe shutdown upon loss of grid power.
 - xii) Design drawings, copies of O&M manuals (see hereafter), as-built drawings, parts lists, warranty descriptions, and other documentation.
 - xiii) WTG, control system, and safety system warranties for all parts and labor from the date of acceptance for the duration of the Full Service O&M contract.
 - xiv) The successful Contractor shall provide to SMUD six copies of complete Mechanical and Electrical Operations and Maintenance Manuals for the WTG and transformers that shall be updated as needed when turbine service bulletins or O&M procedural changes are instituted.
- (b) **WTG Quality.** The manufacturing Quality Assurance (QA) and Quality Control (QC) programs of the wind turbine manufacturer and those of its major suppliers shall meet ISO 9000-series requirements. All Proposers shall provide a copy of such certificate(s) with their proposal.
- (c) **WTG Design Life.** The selected Contractor must propose to supply WTGs that have a minimum design life of 20 years in the Project site's wind and environmental conditions. In addition, all main components (e.g., generator, gearbox, electrical parts) shall be warranted against failure for a period of 10 years (see SC-12, WARRANTIES).

3. **WTG Design Requirements.**

(a) **Overall Engineering and Experience of WTG Supplied.**

- i) Rated power: 2.0 MW (min.) to 3.6 MW (max.).
- ii) Type Certification to standard IEC 61400-01 (3rd Edition) by a recognized international certifying organization such as GL.
- iii) WTG being bid has passed the following tests:
 - (1) Documented Highly Accelerated-Life Tests (HALT) or manufacturer's equivalent engineering accelerated-life, fatigue and wear tests on blades and gearbox. Demonstrate that components have a fatigue design margin and wear capability to last for the equivalent of a 20-year-design life in the field under a set of representative loads and conditions that are applicable to the wind class for which the WTG has been designed and SMUD's site meteorological conditions.
 - (2) A one-time, ultimate-load test on a blade where the maximum applied load is at least equal to 120 percent of the peak bending load expected during a 50-year time period. Blade design and strength shall be based on applicable loading and force evaluations

consistent with methods presented in IEC 61400-1 and 61400-13 and suitable for the specific Phase 3 site conditions.

- (3) Variable-speed operation with a minimum ability to change speeds from the nominal or average rotor rotational speed by plus or minus twenty (20) percent.
 - (4) No history of serial component failures or generic problems that have not been understood through a root-cause analysis and successfully addressed. All such historical reliability problems and solutions are to be fully described by the Proposer.
 - iv) The WTG being bid has been in commercial operation for at least two years and at least 500 MW of the same model WTG have been installed.
 - v) The field performance of the WTG being bid indicates that the fleet-wide average WTG availability is greater than 95 percent following the first six months of commercial introduction of the WTG model.
- (b) Tower and Nacelle.** The Proposer shall provide a tubular steel tower, designed to support the proposed WTG with a minimum design life of 30 years under the environmental conditions at the site. The tower is required to comply with applicable OSHA safety regulations. At a minimum, the tower and nacelle must include the following:
- i) A lockable metal door at the bottom of the tower. If steps are required to access the door the step structure must be securely anchored to the base of the tower and/or ground as required.
 - ii) A metal ladder from the base of the tower to the top, with intermediate landing(s) and safety ladder properly secured to the structure.
 - iii) An electrically driven personnel lift that can convey at least 2 workers and light parts from the base of the tower to the nacelle. The lift must have a minimum lift capability of 0.454 metric tons (1,000 pounds). The lift shall meet the design, construction, and installation requirements of the ANSI A120.1 standard, be OSHA-certified, and have an interior light as well as an access door that can be secured safely from within the lift.
 - iv) Interior fluorescent lights in the base of the tower, at all platforms at intermediate heights, in the tower-top region adjacent to the yaw bearing/bull gear, and at least two lights in the nacelle that are strategically located to illuminate the key components in the nacelle (such as an hydraulic power unit [HPU]). Additional lights shall be mounted along the ladder route inside the tower to provide adequate lighting of the tower interior, but shall be shielded from shining directly at the climbing area of the ladder, to prevent glare. The power source for the tower lighting shall plug into the base of the tower allowing it to be independently powered from the collection system.
 - v) Duplex, interior 120V AC, 20-amp, ground fault interrupter (GFI) power receptacles installed in the base of the tower, at all intermediate landings, and at the tower top (below the nacelle).

- vi) Corrosion and adequate electrical bonding and grounding protection.
- vii) Work platform(s) or other means to allow access to all components mounted within the tower.
- viii) Attachment points on all components that require materials handling devices.
- ix) A safety climb cable to which personnel can attach when climbing a ladder.
- x) Attachment points for personnel on work platform(s) and within and on top of the nacelle.
- xi) A maintenance access door, located within the nacelle, that permits such systems as the HPU or yaw drives to be lowered through the access door.
- xii) A nacelle-mounted, electrically powered lifting device that permits such components as the yaw motors, nacelle mounted transformer, gearboxes, and the HPU, to be lifted and lowered during maintenance.
- xiii) For ease of electrical and electronic maintenance during adverse weather conditions, SMUD highly recommends that the downtower controller(s) and all electrical relaying and protective equipment be enclosed within the base of the tower structure in National Electrical Manufacturers Association (NEMA) Type 12, gasketed, or equivalent type enclosures/panels.
- xiv) To minimize lightning damage to the blades, bearings, and WTG (in general), the blades and nacelle shall be designed to have a clear electrical path to ground, without going through bearings. The design for lightning immunity shall conform to standard IEC 61400-24. All metallic components within the WTG shall be bonded to the WTG and the tower shall be bonded to a single earth-grounding system with a resistance of not more than 2.0 ohms to ground, as measured using IEEE Standard 81, under all atmospheric and climatic conditions.
- xv) Appropriate FAA-approved lighting, controls, and installation for safety during dark and foggy conditions. The FAA lights shall be installed in accordance with FAA regulations. Because the exact number of FAA lights required for the Project will not be determined until after the contract is awarded, the Proposer shall bid the unit cost of the FAA lights for the total quantity shown in the Cost Proposal. SMUD shall add or remove contract value using this unit cost in accordance with the actual quantity of lights required by the FAA permits.
- xvi) No external markings on the nacelle cover or tower, other than 6-inch-tall stenciled markings at the base of the towers that indicate SMUD tower number and collection system circuit number.
- xvii) The WTG tower and bedplate shall be provided with corrosion protection. The exterior surfaces of the WTG tower shall be painted with a light, off-white, nonglare finish of SMUD's choice. The paint should be selected and applied using a suitable specification

that will assure durability and longevity (for at least 20 years) in the presence of the environmental conditions found at the site.

xviii) WTG step-up transformers that increase the generator voltage to 34.5 kV for the power collection system lines shall be painted with a manufacturer's standard color of SMUD's choice if mounted exterior. The transformers can be located in the nacelle or on a concrete pad adjacent to the WTG tower. If the transformers are mounted external to tower bollards shall be installed for protection. In addition a 10 foot gravel pad shall surround the transformer. Transformer shall be a minimum of 10% oversized.

xix) Transformers shall be connected solidly grounded wye on the generator side and solidly grounded wye on the high voltage (34.5 kV) grid side. Other winding configurations/connections may be submitted for consideration. Detailed documentation/justification is required before alternative configurations will be approved. Transformers and all electrical power equipment shall comply with applicable ANSI, IEEE and SMUD design standards.

(c) Generators and Gearboxes (Transmissions). Given the importance of the long-term reliability of the generators and gearboxes, SMUD requires the right to review the available types of generators and gearboxes that the successful Proposal offers and, based on a list of manufacturer-approved suppliers, to specify which type (supplier) will be installed in the WTGs. SMUD seeks copies of historical reliability data and experiences related to any generators and gearboxes offered by Proposers.

Generators are to be sealed and employ form wound, inverter duty windings that are triple-dipped. All internal components shall be manufactured to Class H insulation.

(d) Power Quality. SMUD requires the output of the wind turbine, at the interface with the collection line, to meet the power quality requirements defined in IEEE Standard 519, or subsequent, replacement standards (see References). All WTGs provided for this Project must also meet the current reliability/interconnection requirements of the following agencies:

- i) Federal Energy Regulatory Commission (FERC);
- ii) National Electric Reliability Corporation (NERC);
- iii) California Independent Operator System Corporation (CAISO);
- iv) Western Electric Coordination Council (WECC); and,
- v) Large Generator Interconnection Agreements between SMUD and PG&E.

The wind facility shall be designed to produce power in accordance with the following electrical characteristics:

- i) Generation voltage: 3-phase, minimum 480V AC.
- ii) Electrical frequency: 60 Hz $\pm$ 0.05 Hz.

- iii) Utility connection: Automatic and continuous from startup to shutdown employing “soft-start,” variable-slip, or variable-speed features during connection at all wind speeds as a means of reducing wind turbine and system transient mechanical loads.
- iv) FERC requirements: WTGs being bid must conform to the latest FERC rulemaking 18 CFR Part 35 that relates to electrical and SCADA system reporting requirements for new WTGs installed in the U.S. market. The FERC requirements pertain to (a) Voltage Ride-Through (VRT) standards, (b) power factor control, and (c) SCADA system accessibility for transmission-operator control.

The FERC VRT standard requires wind generating plants to remain in service during three-phase faults with normal clearing (which is a time period of approximately 4 to 9 cycles) and single line to ground faults with delayed clearing, and subsequent post-fault voltage recovery to prefault voltage unless clearing the fault effectively disconnects the generator from the system. The maximum clearing time the wind generating plant shall be required to withstand for a three-phase fault shall be 9 cycles, after which, if the fault remains following the location-specific normal clearing time for three-phase faults, the wind generating plant may disconnect from the independent system operator (ISO) Controlled Grid. A wind generating plant shall remain interconnected during such a fault on the ISO Controlled Grid for a voltage level as low as zero volts, as measured at the high voltage side of the Russell Generation Step-Up Transformer upgrade.

- v) Power Factor (PF) Design Criteria (Reactive Power)—Each WTG shall operate within an adjustable (locally and remotely adjustable) range of at least 0.95 leading to 0.95 lagging at rated power. Reactive power may be limited at production levels below rated power. However, at a minimum, the WTG should be capable of operating at unity PF over the entire production range. It is expected that the PF of the WTG is measured at the stator, and does not include the step-up transformer. The WTG design shall incorporate SMUD defined set points of reactive power as well as PF set points, or a combination of the two, allowing real-time, SCADA control of individual reactive power, based on park-wide PF requirements. The park-wide PF will be measured at the high voltage side of the Russell Generation Step-Up Transformer. Project power factor shall be controllable within the Interconnection Agreement (Appendix L) requirements.
- vi) SCADA Capability—The wind plant shall include full WTG remote control and SCADA capability to transmit data and receive instructions, including curtailing generation, from SMUD to participating transmission operator (TO) and ISO to protect system reliability. The Participating TO and ISO and SMUD will determine what SCADA information is essential for the proposed wind plant, taking into account the size of the plant and its characteristics, location, and importance in maintaining generation resource adequacy and transmission system reliability in its area.
- vii) In addition to the FERC VRT standards, the WTGs being bid must conform to the WECC VRT guideline in the white paper titled “The Technical Basis for the New WECC Voltage Ride-Through (VRT) Standard,” dated June 13, 2007 (Appendix I).

- (e) **Power Rating.** Each WTG supplied, exclusive of the towers, shall be of the same design and configuration (except that two hub heights or two rotor diameters may be proposed for the same model/rating). Furthermore, each WTG shall be rated at no less than 2.0 MW and no more than 3.6 MW at standard sea level conditions.
4. **Audible Noise.** Given the remoteness of the planned Project site, the audible noise levels generated by the WTG are not expected to be a major concern if the WTG meets the standards described and other requirements listed elsewhere in this RFP and the Project permits (i.e., including the EIR). However, with their proposals, all Proposers must supply a copy of the WTG noise characteristics and a copy of an appropriate independent test that was conducted to verify the reported noise characteristics of the WTG being bid.
5. **Equivalent WTG.** For purposes of this RFP, a generically equivalent WTG shall be one that has exactly the same design features and control approach of the wind turbine proposed in this RFP.

TC-9 SCADA SYSTEM

The Contractor shall bid a SCADA system that is normally and routinely used in conjunction with the WTGs being bid with specific additional features as required herein. The SCADA system shall be a system developed and marketed by the WTG vendor or a third party system. Either of such systems must: (a) have been proven to be effective in monitoring system performance; (b) report sufficient parameters to allow the key WTG performance measures to be routinely reported and to provide sufficient detailed information so that all anticipated technical problems can be evaluated and debugged; and (c) provide the capabilities required under TC-8, WIND TURBINE DESIGN REQUIREMENTS. The cost of the SCADA system, including installation, licenses, testing, commissioning, and training, shall be included in the bid. The Proposer may bid a third party SCADA vendor and/or other turbine manufacturer's SCADA software as options to their bid.

Hardware & Software Requirements

The Contractor shall provide the following hardware and software for the SCADA system:

1. Two redundant personal computers (PCs) mounted in the new O&M building control room. The software/ hardware shall be designed so that if one computer fails, the plant operation and data collection will continue using the backup computer. At a minimum, the computers shall be equipped with the following hardware and software:
 - (a) 21-inch flat panel monitor.
 - (b) Ergonomic keyboard and optical mouse with roller.
 - (c) Minimum 500 GB hard-disk memory.
 - (d) A CD R/W and a DVD R/W media driver/burner.
 - (e) 200 GB (minimum) hard disc partition backup drive programmed to back up all data weekly.
 - (f) A minimum of four Type-2 USB ports.

2. Supervisory and analysis/reporting software licenses for the Phase 3 turbines installed under this contract.
3. Eight supervisory and analysis/reporting licenses for remote users.
4. Battery-based UPS devices for the PCs and SCADA system.
5. Communication devices and programming for transmitting data with SMUD's data acquisition (DAQ) Callisto remote telemetry unit (RTU) and CAISO data processing gateway (DPG) installed at the Russell Generation Step-Up Transformer.

Software Design & Capabilities

The SCADA system software shall contain both supervisory control and data analysis/recording functions. The software shall be capable of scanning, trending, and storing data for every point made available by the WTG controller and SMUD's DAQ Callisto RTU. Data scanning shall occur at 4-second intervals or faster. Real time recording shall be available up to the maximum scan rate. Data shall be stored in the SCADA system database as 10-minute averages, with minima, maxima, and standard deviation values. The main supervisory screen shall list turbines and Met towers individually, along with the turbine status and power generation level; display total power, on-line and fault counts, and atmospheric conditions; and show a one-click toolbar complete with key detailed data access and WTG control functions. The SCADA software shall allow the WTGs to be fully controlled individually or in groups, including power factor adjustment. When a WTG is taken off-line for any reason, the SCADA software shall require the operator to categorize the reason for the outage, such as curtailment, cable fault, system fault, repair, preventive maintenance, etc., using simple check boxes. All off-line events shall be recorded and categorized as indicated in TC-30, AVAILABILITY GUARANTEE.

The SCADA system shall be connected to the Internet at all times. Remote communication with the SCADA system shall be by virtual private network (VPN) connection. All functions of the SCADA system shall be available via remote access. Multiple users shall be able to access the system simultaneously. SCADA server data shall be backed up to an off-site location automatically, at least once a week. Additional equipment shall be included that is capable of ensuring a secure Internet connection and prevent SCADA system hacking from unauthorized users.

CAISO Reporting. The SCADA system also shall be equipped to dial out based on pre-programmed alarm inputs. The SCADA system shall be designed to communicate the following values to a CAISO DPG via modbus or distributed network protocol (DNP3): gross MW, gross MVA, voltage, wind speed, wind direction, ambient temperature, and barometric pressure. The SCADA system shall maintain a record of data transmitted to CAISO. It shall be possible to run reports to review historical meter data.

The analysis/reporting software shall be capable of generating the following reports and graphs:

- Power curve plotting with results corrected for project stated density (individual or park wide) against the warranted power curve.

- Sorted performance report showing the WTGs sorted by their performance as measured against the warranted power curve.
- Wind rose graph.
- Energy production, lost production, fault records, and other availability parameters (see TC-30, AVAILABILITY GUARANTEE). All reports shall be capable of sort functions.
- Wind distribution graphs for any time period (week, month, year, etc.).
- Trend comparison graphs for all monitored data points. The software shall allow the user to select specific data points to trend and the trend time period.
- Histogram type distributions of all recorded data points.

Power Curve Test Reports. All power curve test reports shall be corrected to a standard air density. All stored data and generated reports shall be exportable to Microsoft (MS) Excel format. The software shall prohibit any tampering or modification of any raw data in the systems database. The supervisory and analysis/reporting software functions shall make use of multiple password-protected security settings to control access to sensitive data or functions.

Met Tower Data Access. In addition to the above SCADA data access and archival features, data from the sensors on the Met towers being supplied shall be recorded on a new Contractor-supplied SCADA system. (see TC-17, METEOROLOGICAL (Met) TOWERS).

TC-10 REQUIRED DESIGN DOCUMENTATION

This section describes only the level of detail required in the design documents prepared by the Contractor. Other submittals also may be required by this RFP. For submittal deadlines, quantity of copies required, or format, refer to the appropriate section of the RFP. The Contractor shall prepare and submit the following design documentation for this Project:

1. Turbine siting plan with exact locations of all turbines, transformers, and Met tower.
2. Foundation design loads and detailed drawings for the foundation interface with WTG tower base.
3. Electrical collection system single line drawings.
4. Tower lighting layout drawing, schematic, and bill of material.
5. Electrical schematics for the WTGs and transformer arrangement, as well as the Met towers.
6. "Single line" fiber or fiber/radio SCADA communication system drawing.
7. Detailed description (including technical specification) of the SCADA system proposed.
8. Detailed schematics of individual fiber optic interconnections and radio system wiring.
9. Detailed description (including technical specification) of the WTG proposed.
10. Baseline schedule for Project.

11. Electrical and SCADA system layout/plan drawings, showing the exact routing of all underground electrical power, control, and fiber optic cables. All cable splice and cross-bond connections shall be shown on the layout drawing.
12. Electrical ground grid calculations, collection system cable thermal ampacity calculations, proposed collection system cable specifications (including cable impedance), and electrical bonding design.
13. All trenching and bedding details.
14. Detailed design drawings of the fiber optic routing and connections in the turbine controller cabinet.
15. Detailed design drawings of the electrical and SCADA system (if applicable) Montezuma Hills Road crossing.
16. Electrical collection system and SCADA installation system bills of material.
17. Detailed road design drawings and specifications, including plan and detail sheets with adequate information to completely describe the style, method, and materials required.
18. Transformer test reports, both zero and positive sequence, and nameplates, for SMUD review and approval.
19. Power flow calculations demonstrating the Project's power factor capability range and VAR compensation required for unity power factor measured at the 230 kV side of the Russell Generation Step-Up Transformer. Contractor shall assume that the 34.5 kV to 230 kV transformer has a 15 MVAR demand.

All WTG tower, electrical collection system, and access road design drawings shall be wet stamped by a Registered California Professional Engineer of the appropriate discipline before they are submitted to SMUD for review.

TC-11 SMUD FIELD OFFICE TRAILER

The Contractor shall provide one 12-foot by 60-foot field office trailer for SMUD's use throughout the Project construction phase through final commissioning, acceptance, and completion of all punch list items. The field office trailer shall be placed within 50 yards of the new O&M Building location, or as directed by SMUD. The final trailer location shall be determined by mutual agreement between SMUD and the Contractor. The field office trailer shall contain two offices with lockable desks and chairs, one conference room with conference table and a conference speakerphone (two-line capability), a four-drawer filing cabinet, and drawing rack. The trailer shall be wired with one fax line, one data line, and two voice lines. The Contractor shall make all necessary arrangements to supply PG&E electrical and communication service to the field office trailer. All utility service fees associated with the field office trailer shall be paid by the Contractor throughout the duration of the Project. All utilities to the field office trailer shall be removed by the Contractor upon Project completion. The Contractor is responsible for providing all necessary temporary facilities on site, such as the Contractor's construction trailer(s), associated utilities, water, and sanitary facilities.

TC-12 MINIMUM ROAD DESIGN AND CONSTRUCTION

To facilitate proper WTG site access and functionality of the access road system, the Contractor is required to comply with the following minimum road design requirements:

Design Standards

1. All road design shall comply with the turbine manufacturer's standard minimum road design requirements. Where a discrepancy appears between the manufacturer's standards and SMUD's standards, the more stringent of the two requirements shall apply. SMUD shall be the sole authority in the determination of which standard is more stringent.
2. All road design shall be subject to Solano County grading permit review and approval. Any encroachment of Montezuma Hills Road or Talbert Lane shall be subject to Solano County encroachment permit review and approval. Related information is provided in Appendix H (CD Number 1) and available to the prime Proposer's in electronic (PDF and GIS) format, upon request.
3. Access roads shall be designed for construction loads and project as equipment, as necessary, and for the weather conditions to be expected.
4. All turbine locations shall have adequate graveled parking and service areas for a minimum of three service trucks. The Contractor shall also provide a 20-foot graveled roadway surrounding the turbine (and transformer) locations. All turbine access doors shall be located on the leeward side (east to east northeast) of the turbine location.
5. The Contractor shall design the access roads for a width of 32 feet of graveled roadway, with subgrade cleared and compacted to 90% relative density, a minimum 8-inch thick Class II road base, and a maximum grade of 10 percent.
6. All access road entries, intersections, and turns shall be designed using the greater of 135 feet inside radius or the longest wheelbase truck dimensions that will be used on the Project. The Contractor shall use turning radius software to verify that the longest Project vehicle will be able to maneuver the entire site without leaving the graveled road area.
7. All dead end access roads shall be designed with adequate turnout space for a standard 60-foot tractor/trailer truck to turn around without leaving the graveled road area. Access road spurs to a single turbine are exempt from the turnout requirement. All turnouts shall be constructed using the same gravel design as the access roads.
8. All access roads, culverts, catch basins, and swales shall be designed to comply with the requirements and specifications in the EIR Mitigation Monitoring Plan and be designed with adequate drainage and slope for a 25-year frequency storm (except that culverts placed in drainage ways along or adjacent to Montezuma Hills Road and Talbert Lane will be designed for a 100-year frequency storm). Access roads shall be designed and constructed to prevent water ponding. Culvert pipe ends, swales, and ditches with greater than 3 percent grade shall be lined with crushed stone or riprap to control concentrated flow velocities and minimize erosion and

siltation. Wetlands impacts shall be avoided to the maximum extent practicable and are subject to regulatory approval.

Public Safety and Traffic Control

1. The Contractor is responsible for compliance with all currently applicable safety laws of all jurisdictional bodies. The Contractor is directed to contact the State Industrial Relations Department. The Contractor shall be responsible for all barricades, safety devices, and control of traffic within and around the construction area. For trench excavations 5 feet or more in depth, the Contractor shall obtain a permit from the Division of Industrial Safety before beginning any excavation.
2. Public safety and traffic controls shall be provided in accordance with the Caltrans traffic manual (see Chapter 5, *Manual of Traffic Controls for Highway Construction and Maintenance Operations*) and as directed by SMUD. Safe vehicular access shall be provided at all times during construction.
3. The Contractor shall, in accordance with generally accepted construction practices, assume sole and complete responsibility for job site conditions during the course of Project construction, including safety of all persons and property; this requirement shall be made to apply continuously and not be limited to normal working hours.

Erosion Control

1. The Contractor shall prepare and submit all applicable plans and reports, including, but not limited to, a Storm Water Pollution Prevention Plan, to SMUD and the State Water Resources Control Board, and obtain an NPDES permit and SMUD's approval before beginning earthwork activities. Erosion- and sediment-control measures shall be in accordance with applicable state and local regulations and Best Management Practices (BMPs).
2. Erosion and sediment control, both during and after construction, shall be provided as required to retain sediment on site and to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpile(s). Silt fence, check dams, drainage ditches or swales, straw mulch, and pre-manufactured geotextiles, geotubes, geogrids, cellular geoweb, etc., shall be utilized as appropriate. However, the Contractor is responsible for ensuring that no synthetic, toxic, or otherwise harmful erosion-control materials are accessible to livestock on the site during the construction period.
3. During the execution of the work at the site, operations shall be continuously monitored to avoid creating conditions that could lead to excessive erosion of soil with surface runoff from work areas. Controls shall be provided to protect the water quality and shall be in accordance with Project documents and all local, state, and federal laws and regulations.
4. Contractor acknowledges that Solano County enforces requirements that limit certain construction activities during a portion of the year (due to rain) and Contractor has fully incorporated these requirements into the proposed erosion-control plan and Project schedule.

5. The Contractor shall be subject to Solano County requirements for erosion control including, but not limited to, the use of large entryway aggregate and/or truck washing to avoid tracking soil onto public roads.
6. The Contractor shall use lined washout pits, washout dumpsters, or other suitable means to contain the excess concrete and runoff from the cleaning of concrete trucks. All washout waste shall be properly disposed of off site by the Contractor.
7. Once access roads are complete for construction traffic, all traffic shall remain on the access roads or other graveled area and shall avoid cross country travel on ungraveled areas.
8. The access roads shall meet all required design elements at Project Notice of Completion. All wear, tear, and other damage to the access roads during the Project shall be the responsibility of the Contractor. The Contractor shall re-dress all road surfaces at project completion.

TC-13 SHIPPING AND TRANSPORTATION PLAN

The Contractor shall prepare and submit to SMUD a Shipping and Transportation Plan to describe the shipping methods and routes for the WTGs and WTG towers, as well as the transportation routes for the remainder of the construction traffic. The Plan shall include the estimated quantity, type, size (number of axles and length), weight, and transportation route for all trucks or other transportation methods used to transport equipment or material to or from the Project. Equipment and material includes, but is not limited to, WTGs, parts containers, towers, crane trucks, road equipment carriers, transformers, foundation cans, bolts, cable, gravel, concrete, and other miscellaneous material. This plan must be submitted before site construction begins. SMUD will use this plan as proof of adequate forethought on the Contractor's part. The Contractor shall use the Plan to secure a road bond agreement with Solano County. SMUD assumes no liability or responsibility for the Contractor's transportation planning.

TC-14 UNDERGROUND UTILITIES

The types and locations of existing underground utilities, as shown on the maps and figures provided in this RFP, were obtained from sources of varying reliability. The Proposer is cautioned that SMUD does not warrant or represent that SMUD-provided information accurately or fully represents the types and locations of such underground utilities. SMUD assumes no responsibility for the completeness or accuracy of its delineation of such underground utilities, nor for the existence of other buried objects or utilities that may be encountered but are not shown on these documents.

It shall be the Contractor's responsibility to verify the location of all underground utilities prior to any excavation. The Contractor is responsible for contacting the utility companies involved and requesting a visual verification of the locations of their underground facilities. SMUD also shall be notified by the Contractor of the scheduled time and place of such visual verification to enable SMUD to have representatives present.

The Contractor or any subcontractor for this contract shall notify members of the Underground Service Alert (USA) One-Call Program 48 hours in advance of performing excavation work. Excavation is defined as being more than 18 inches below the existing surface grade.

It is in SMUD's interest to assist the Contractor in locating possible underground utilities. SMUD is aware of two locations for possible underground utilities for which no documentation or owner could be identified. One location is along Toland Lane between Montezuma Hills Road and the existing residence/office near the intersection of Toland and Stewart Lanes. It is possible that underground gas lines and other utilities are present that feed the residence or other buildings. The other location is the possible presence of a natural gas pipeline along Toland Lane, near the residence of Toland Landing. Pipeline markers are visible in certain areas near this location, but no documentation of location, service, or owner is available. SMUD recommends that the Contractor be aware of these areas and, if necessary, diligently determine the exact location of these utilities prior to construction activities.

TC-15 STRUCTURAL DESIGN REQUIREMENTS

Besides meeting all WTG design standards listed in IEC-61400-01, all WTG towers, Met towers, foundations, and other structures shall be designed in accordance with the requirements of the CBC 2007, Seismic Zone 4, and shall be designed for site's wind speeds, TI, and other site conditions. Tower and foundation design calculations shall be "wet stamped" by a California Registered Civil or Structural Engineer. Tower drawings shall clearly show maximum foundation loading and shall specify bolt torque requirements for connections. Foundation drawings shall clearly reference the tower type, loading requirements, governing load case, concrete requirements, material specifications, reinforcement placement, slurry specifications, tightening sequence, depth, diameter, and bolt tension requirements. Spoils shall be reused on site.

The WTG foundation design engineer must provide stamped foundation designs based on WTG loads provided by the WTG manufacturer and necessary UBC and/or CBC loads for review by SMUD staff. The Contractor's design engineer shall develop all additional installation and construction details required for installation of the foundations. If part of the code requirements is to log data from borings, then the data logs must be included as part of the final acceptance package.

WTG towers shall be water-tight, and WTG foundations shall be sloped to the center. Tower foundation drawings shall depict finished grade and slope requirements surrounding the foundation. The foundation design engineer shall review and approve final WTG locations with respect to the surrounding contours and soil conditions.

TC-16 FENCING AND GATES

The Contractor shall supply and install approximately 1,000 feet (200 feet wide by 300 feet long) of 6-foot-high, anti-climb chain link perimeter fencing around the new O&M building and associated yard. The chain link fence shall be equipped with three barbed wires mounted on 45-degree, one-piece, three-wire extension arms above the fence. Two double-hung, 16-foot-wide vehicle gates shall be installed for yard access (one entrance gate and one exit gate). Gates shall be designed for large truck traffic and installed with a concrete-mounted, center hole lock mechanism and padlock. All fence and gate material shall be galvanized steel. Sufficient spaces and graded area shall be provided near each gate to allow truck turning area.

At every place where the access roads penetrate an existing fence line, the Contractor shall supply two double-hung, 16-foot-wide prefabricated finished metal gates, with a metal hinge post and

removable center post. Gates shall be suitable for retaining livestock and providing construction access. All powered gates shall be powered only on one side and shall allow the opposite side to swing manually. All gates shall be designed to adequately contain cattle without being pushed open, bending, or otherwise failing. The unpowered side of the gate shall be padlocked with locks that are keyed alike with one another but different from the locks for the O&M building gates or the WTGs.

TC-17 METEOROLOGICAL (Met) TOWERS

Permanent Meteorological Towers

SMUD requires two new, permanent, free-standing, hub-height Met towers.

The permanent Met towers shall be connected to, and communicate with, the new SCADA system provided by the Contractor and allow data recording and storage through the data archival features of the SCADA system. In addition, the Contractor shall supply a Campbell Scientific CR-3000 data logger mounted in a weatherproof fiberglass equipment shelter. The system shall contain an independent solar power system sized to supply all power to operate tower and transmit data for a minimum of 1 week without sunshine. Logger shall have sufficient memory to store one year of data. Ten minute averages, minimum, maximum and standard deviation for all data shall be transmitted to the SCADA system and logged. Communication from logger to SCADA system shall be via dedicated fiber optic circuit or data radio. If communication is lost logger shall be able to repopulate missing data in SCADA server when communication is reestablished. Project's SCADA system shall communicate selected meteorological data to the SMUD SCADA system.

Met towers shall include the following sensors at the locations listed:

1. Spinning cup wind speed sensors located at heights of 10 m, 30 m, 50 m, 80m and the WTG hub heights. In addition, there shall be a second redundant wind speed sensor, with a grounded lightning guard installed at the WTG hub heights.
2. Single wind-vane, wind direction sensors at heights of 50 m, 80m and the hub heights of the WTGs.
3. Barometric pressure sensor at the hub heights of the WTG and a temperature sensor and relative humidity sensor at a height of 10 m, or greater, above ground level.
4. All wind speed sensors shall have avian perch guards. SMUD shall review and approve wind speed and direction sensors.
5. One pyrometer mounted on the south side of the tower projecting 1m from tower and 3m above ground. Other equipment shall be located such that it does not cast a shadow on the sensor.
6. All sensors shall be provided with a factory calibration sheet.
7. Avian perch guards shall be provided for all sensors and solar cells as required.

The Contractor shall bid the design and installation of each free-standing permanent Met tower as a unit price. The temporary towers shall be priced with the power curve test line item. Placement and

installation of the towers shall be scheduled early in the project to allow for adequate site wind data collection before WTG installation.

If the installation of a new Met tower requires the relocation of the existing Met tower named Site #6, then the Contractor also should include the relocation of Met tower #6 to another location on SMUD's property that will be defined later. If any additional Met towers must be removed or relocated, the Contractor shall so note it and bid such work as a separate item in the pricing. If SMUD directs the Contractor to perform this additional replacement(s) or relocations, all such work shall consist of unit pricing, and price will be added to the contract value as full compensation for the work. SMUD reserves the right to salvage any usable equipment from the removed Met tower. The Contractor shall properly dispose of any remaining equipment.

Temporary Meteorological Towers

In addition, two new, free-standing, hub-height temporary Met towers are required for the power curve testing in accordance with IEC 61400-12, Annex B.

The Contractor shall install the two temporary, hub-height, free-standing Met towers on the Project site where winds impinging on the Met tower from the predominant wind direction will not be affected by upwind, Phase 3 WTGs or other large upwind WTGs. Each tower shall be located directly upwind, in the prevailing wind direction, from the test WTG that is to be recommended by the Contractor, and approved by SMUD, during contract negotiations. The towers and associated sensors shall be designed and located to comply with the requirements of IEC 61400-12.

TC-18 ELECTRICAL COLLECTION SYSTEM

The Phase 3 standard electrical power collection system voltage shall be 34.5 kV. The electrical collection system shall be installed underground throughout the Phase 3 Project site and interface with riser poles at the point of interconnection. The code of record for the electrical collection system design and installation shall be the 2007 version of the NESC. Applicable requirements of the NEC (NFPA-70) also shall apply.

If padmount transformers are used, the transformer foundation shall meet the design requirements of CBC 2007. Transformers shall be designed with two-position load break loop switches, such that either side of the 34.5 kV string may be disconnected at the transformer without affecting terminations. Transformers shall contain current limiting fuses for protection and two (+/-) 2.5 percent taps adjustable through a manual, no-load tap changing switch. Transformers shall be connected solidly grounded wye on the generator side and 34.5 kV solidly grounded wye on the power collection side. Other winding configurations may be submitted for consideration. Detailed documentation/justification is required before alternative configurations will be approved. Transformers and all electrical power equipment shall comply with applicable ANSI and IEEE design standards. Surge arrestors, rated 35 kV (MCOV), shall be installed at all "end of line" turbines. The surge arrestors shall be installed at the "end of line" transformers, if pad-mount transformers are used, or at the "end of line" switchgear, if nacelle-mounted transformers are used.

All underground 34.5 kV cable shall be rated for direct-bury service underground residential distribution (URD), minimum 100 percent insulation level, three single-phase conductor installations with a minimum 30-year design life. The power cable shall meet the SMUD's Engineering

Specification D001, Rev. 6 or latest revision, provided in Appendix K (attached to this RFP). A separate earthing cable of appropriate-sized stranded copper shall be installed in all circuits. Underground cable systems shall have short circuit withstand rating of at least two (2) seconds.

Concentric neutrals at the cable ends, and any cross-bond neutrals, shall be connected to the earthing cable with galvanically neutral type bonds, e.g., copper crimps or CADWELD. The ground grid shall be designed for a maximum resistance to ground of 2.0 ohms. Electrical design calculations shall include consideration of peak loading, power factor, soil thermal resistivity, cable spacing and neutral currents. Complete collection system diagrams and calculations shall be submitted to SMUD for review and approval by the Contractor before ordering or installing the collection system. Ampacity calculations shall use the following design assumptions: 100 percent load factor, direct buried cable, 30°C ambient temperature, 0.90 power factor, 42 inches of cover, and 170°C-cm/Watt thermal resistivity of the native soil if soil test results do not indicate a higher value is necessary. Soil thermal resistivity tests along the proposed collection system routes shall be conducted by the Contractor to establish soil thermal resistivity values at least every 1,500 feet along the collection system routes. The Phase 3 power collection system shall be designed for no more than 2 percent (2%) line loss from the most remote turbine to the Phase 3 point of interconnection at Russell Generation Step-Up Transformer. Line loss will be based on annual energy production comparisons between metered WTG power output values and at the point of interconnection at Russell Generation Step-Up Transformer. Cable ampacity will provide 125% of full load cable design amperage. SMUD intends to independently test each cable reel.

Power flow calculations at no load and full load shall be performed with the electrical parameters of the proposed electrical collection system and proposed WTGs. The Proposer must demonstrate that the Project can maintain a unity power factor as measured at the 230 kV side of the Russell Generation Step-Up Transformer. Proposers shall assume a 15 MVAR demand by the transformer. The Proposer shall submit the power factor range capability of the Project (WTGs and underground collection system). If unity power factor cannot be obtained at this location by the Project, then the Proposer shall also submit the required VAR compensation at the 34.5 kV side of the Russell Generation Step-Up Transformer necessary to obtain unity power factor. Any VAR compensation required shall be provided by the Contractor.

All URD cable splices and cross-bond splices shall be of the 3M “Cold Shrink QS III” type applicable for the particular cable size. Splices shall be made in UG cable vaults. A service loop shall be provided in UG vault such that three complete splice replacements are possible. Cross-bond splice neutral and ground conductors shall be brought to an above-ground terminal box, with surge arresters and terminal blocks, for periodic testing of the connections. Terminal box shall be made of a fire resistant non corrosive material and securely mounted to the ground. Splice vaults and terminal boxes shall have suitable bollards placed for protection. Splice vault and terminal box installations shall have a 10 foot gravel pad with weed block cloth under gravel. The underground electrical power collection system lines shall terminate at pole-mounted cutouts mounted on their respective SMUD-provided riser poles at the interconnection point.

The new power collection system shall include not more than five 34.5 kV, three-phase power homerun lines (line numbers 9, 10, 11, 12, and 13) carrying no more than 560 A and 30 MW of WTG capacity per line. The Contractor shall design the Phase 3 collection system to pass under Montezuma Hills Road and any permanent wetlands or streambeds that must be crossed. The

Contractor shall obtain the required permits from Solano County for the design and installation. SMUD will assist in this effort. SMUD will obtain any required permits from the U.S. Army Corp of Engineers for wetlands or streambed crossings. Contractor is responsible for adherence to all permit requirements and adherence to specified collection system rights-of-way and routing limitations.

Sectionalizing above-grade junction cabinets shall be used to combine collection lines from multiple turbine strings. Additional cabinets shall be installed to allow for cable testing and troubleshooting at every 7,500 feet of continuous cable length. Cross-bond and sectionalizing junction cabinets shall be protected from vehicle damage by a steel posts set in concrete at each corner.

The collection system shall be configured with sufficient disconnect switches such that individual turbine stings may be isolated.

The collection system shall include a cable fault indication system capable of allowing personnel to determine in which collection line a fault exists. Collection lines to be monitored include all homeruns, all lines connected to a sectionalizing junction cabinet, and all turbine-to-turbine lines longer than 1,200 feet. The system shall be capable of detecting and indicating a fault within a string of turbines. The system shall provide visual indicators and a check list to allow an individual to inspect the system and determine the faulted collection line within 8 hours from the fault event.

Electronic markers shall be used to locate underground collection lines and accessories at every 500 feet of straight path length, all changes in path direction, each side of all road crossings within 10 feet of the road. The electronic marker manufacturer and model shall be approved by SMUD.

The Contractor shall document the exact route of underground electrical collection lines throughout the Project by means of an as-built survey. All cable splice and cross-bond locations shall be identified and located on the as-built drawings. The minimum depth for the top of cable placement is 42 inches below finished grade.

The Contractor shall provide the entire power collection system from each WTG to the Russell Generation Step-Up Transformer location. Feeders shall be completed to District-installed riser poles, as shown on the Drawing SWP-ERFP-001 in Appendix N (attached to this RFP). SMUD will install poles and termination hardware at the pole (exclusive of cable termination hardware and bolts). The Contractor shall install conduit risers, extend the conductors up the risers, and make final collection cable terminations to SMUD provided disconnect switch hardware at the top of each circuit's riser pole.

TC-19 SCADA COMMUNICATION SYSTEM

The SCADA communications system shall be fiber optic or a combination of fiber optic and wireless. No copper SCADA communications system designs will be allowed. The fiber optic lines may be buried in the same trench as the electrical power collection system. If co-located with URD power cables, the fiber optic should be separate and adjacent to URD power cables, and at the same depth to minimize damage if exposing the cables becomes necessary. The location of the fiber duct with respect to the underground power cables shall be specified and documented for the entire collector system. Where the fiber optic cable is not co-located with the URD a suitable locating cable shall be installed in the interdict/conduit.

Fiber cable shall be multimode with a 62.5- μ m core diameter. (Maximum allowable attenuation is 3.5 dB/km at 850 nm and 1.0 dB/km at 1300 nm). All fiber optic cables shall be designed with a minimum of 50 percent spare fibers. Fiber optic cables shall be placed in conduit or continuous innerduct and rated for underground use. The Contractor shall prepare and submit pull calculations and cable ratings before pulling the fiber optic cable through the conduits. The optical system should be designed for a minimum of 5 dB system margin. The following typical losses should be used in the system design: Fusion splice loss 0.2 dB, connector loss 2.0 dB, and fiber loss 3.5 dB/km (1.0 dB/Kft).

The SCADA communications system shall be designed with data continuity and reliability as a priority. Data collection loops shall be designed so that loss of a power circuit does not cause a loss of data collection from more than the WTGs in the power outage. All data collection methods shall have at least one alternate method of data storage or collection as a backup. Any battery backup device shall immediately activate an alarm in the SCADA system to alert the operators that the battery backup has been activated. Any battery backup device shall be capable of operating a minimum of 24 hours on battery power. No single failure shall prevent the collection of data from the field devices/controllers.

In addition to the standard WTG control functions, the SCADA system shall be designed to transmit data with SMUD's DAQ Callisto RTU mounted in the substation. Contractor shall install a communication system, for monitoring purposes only, using new 24-fiber multimode fiber optic cables from the new O&M building to Russell Generation Step-Up Transformer location. SMUD will program the RTU and connect the fiber optic cables to the RTU. The Contractor shall terminate the cable in a Fiber Distribution Panel (FDP) at the Russell Generation Step-Up Transformer location at the point of interconnection. The Contractor shall assume 24 I/O points from the Russell Generation Step-Up Transformer location will be made available to the Contractor's SCADA system via this fiber optic connection. Only 2 of the 24 fibers will be used for this purpose.

TC-20 LABELING AND LOCKS

The Contractor shall install permanent labels on all WTG tower access doors, transformers (if applicable), sectionalizing junction boxes, and Met towers. The labels material and process shall be approved by SMUD. The labeling protocol shall be discussed and be mutually agreeable to both SMUD and the Proposer before the labels are ordered.

Collection system cables shall be labeled for each phase and at each junction as required by SMUD standards. At the conclusion of construction all cable phasing shall be verified and then labels installed.

The Contractor shall also supply padlocks for all WTG towers, transformers, Met boxes (if applicable), sectionalizing junction cabinets, access road gates, and O&M building yard gates. The locks shall be separated into groups by function, and each group shall be keyed alike. The groups shall be divided as follows:

1. WTG towers, Met boxes, and O&M building yard gates.
2. Access road gates.
3. Transformers, sectionalizing, and cross-bond junction cabinets.

The Proposer shall supply 12 spare locks of each type provided, and 24 copies of each type of key to SMUD for SMUD's use.

TC-21 SMUD HOLD POINTS

SMUD requires certain hold points throughout the Project to ensure that the design, product, and installation meet or exceed the Project specifications. SMUD hold points for this Project follow:

1. WTG and tower design approval.
2. Foundation design approval.
3. Road design approval.
4. Electrical collection system design approval.
5. SCADA communications system design approval.
6. Shipping and transportation plan review & county road bond agreement.
7. WTGs ready-to-ship inspection.
8. WTG towers ready-to-ship inspection.
9. Inspection of installed underground electrical and SCADA communications system (prior to backfilling; continuous inspection may be arranged).
10. Ready for collection system outage.
11. Ready to re-energize collection system.

The Contractor shall not proceed with the applicable task until SMUD approval of the hold point is obtained.

TC-22 WIND TURBINE COMMISSIONING AND ACCEPTANCE TESTS

The selected Contractor shall assume responsibility for commissioning, startup, and acceptance tests on the wind turbines. These tasks cover all activities relating to the operation, or simulated operation, of equipment and systems, from preparation for installation through initial operations at the site, while interconnected to the local utility network through the Russell Generation Step-Up Transformer. The various tests that the successful Contractor shall carry out are summarized hereafter.

1. **General Tests.** The successful Contractor shall be responsible for checkout, testing, startup, and initial operation of various systems and for scheduling adequate subcontractor or vendor support for such services. In general, the selected Contractor shall demonstrate that the wind facility complies with the specifications by performing the acceptance test. The selected Contractor shall provide initial operation of all equipment and verify the design capability of all equipment and components. The selected Contractor shall demonstrate the ability of all subsystems to operate

safely and reliably in a coordinated way as a complete, working system throughout the range of wind speeds and under transient operating conditions, such as startup/shutdown (under both low- and high-wind speed conditions), fault conditions, loss of utility load, etc.

2. **Pre-Installation Tests.** The selected Contractor shall be responsible for component tests that verify proper in-plant assembly and demonstrations of functional capability performed by the manufacturer and its suppliers prior to delivery of components, equipment, or systems to the site. The selected Contractor's specifications for procurement shall include testing requirements that demonstrate compliance with the functional purpose and design capability of the various pieces of equipment, the systems, or sub-components. Testing under this section shall be accomplished before shipping from the point of fabrication and/or the manufacturer's facility. Contractor shall provide a pre-installation test plan with the proposal. SMUD's project manager, engineer, or designated representative will have the right to be present during such tests at SMUD's discretion.
3. **Pre-Operational Tests.** The selected Contractor shall be responsible for system checkout, verification of design conformance, electrical continuity, adjustment of initial set points, and other such tests that may require the wind facility equipment to be fully energized.
4. **Acceptance Tests.** The wind turbines shall be subjected to an acceptance test procedure that meets the requirements described hereafter. A written test procedure shall be prepared by the Proposer and included with the proposal. The Contractor may rely on its "standard" forms and procedures for such tests; but SMUD reserves the right to review and, where mutually agreeable with the selected Contractor, to modify portions of the acceptance test procedure that are deemed by SMUD to be inadequate. An inspection of the test results by an independent engineer, designated and provided by SMUD, will be performed to determine that (1) the WTGs have satisfactorily passed the acceptance tests, and (2) the facility is built in accordance with the agreed-upon drawings and specifications. A suitable agreement will be developed with the selected Contractor that defines the required documentation that must be satisfactorily completed to receive payment following completion of the acceptance tests.
5. **Requirements of Acceptance Tests.** At a minimum, the acceptance tests shall confirm the factors listed hereafter. If all other requirements are demonstrated, but wind velocities are insufficient to allow certain requirements to be proven over a period of up to 14 days from test initiation, the selected Contractor may satisfy the requirements of the acceptance test by providing sufficient evidence that the requirements were met for the same model of WTG at a comparable site. All such data developed at another site shall be provided, and power curve data shall be converted to equivalent data at the average annual air density of SMUD's site. If certain operational requirements are demonstrated in this alternative way, but cannot be achieved during normal operation with SMUD's machine at a later time, and the appropriate conditions have existed, the operational requirement must be fulfilled and demonstrated as a warranty item. The acceptance tests must demonstrate proper operation under the following conditions or meet the following requirements.
 - (a) Startup;
 - (b) Low- and high-wind shutdowns;

- (c) Normal and emergency shutdown for a fault;
 - (d) Overspeed shutdown from loss of load or other factor;
 - (e) Control capability from cut-in to above rated wind speed;
 - (f) Output (in accordance with the guaranteed power curve);
 - (g) Demonstration of required local and remote power factor and output control;
 - (h) Demonstration that Project electrical output does not exceed component ratings at rated wind speed;
 - (i) VRT tests; and,
 - (j) SCADA system performance.
6. **Alternative Means to Meet Wind-Sensitive Requirements.** Because winds or other factors may preclude testing such cases as a normal, high wind-speed shutdown, and VRT, the selected Contractor may propose, for SMUD approval, alternative means or methods to meet such wind-sensitive requirements, as already suggested. Written results of all tests conducted shall be provided to SMUD's project manager.
7. **Formal Commissioning.** Each wind turbine will be formally commissioned once it has demonstrated compliance with the requirements of the acceptance test. Commissioning will constitute SMUD's acceptance that the wind turbine and its supporting subsystems meet the contract requirements and will start the warranty period on that WTG.

TC-23 WIND TURBINE POWER CURVE TEST

The Proposer shall conduct power curve tests on two wind turbines in accordance with IEC 61400-12. The two wind turbines shall both pass the power curve test or the WTG power curve will be considered to be deficient and will be subject to penalties as described below. The tests shall be conducted by using the Met towers (described in TC-17, METEOROLOGICAL [Met] TOWERS). If the Proposer finds that it cannot acquire temporary, hub-height, Met towers at a reasonable cost, it shall propose alternative approaches to meeting the requirements of IEC 61400-12, Annex B (Calibration of Test Site). Such alternative methods may include using the existing WTG tower for a period prior to either installing the nacelle or activating the WTG. SMUD requests that all Proposers price the power curve test separately from the WTG supply. The Proposer shall propose on the following:

1. The Contractor, or an experienced, independent third party, shall conduct the power curve tests on two WTGs that represent the diverse wind characteristics of the site. The wind speed correlation required by the IEC power curve test shall be developed by the use of two met masts, one permanent and one temporary free-standing Met tower, located approximately 2 rotor diameters upwind from the test WTG—in the prevailing wind direction. This set of measurements will allow the correlation of the winds entering the rotor plane with those monitored by the Met towers, as described in IEC 61400-12.
2. Following the installation and commissioning of the WTG, and within 6 months of the commissioning of the turbine, the Proposer, or its third-party contractor, shall conduct and complete the power curve test in accordance with IEC 61400-12.

3. In addition to meeting guidelines established by IEC 61400-12, the Contractor shall provide a copy of the following to SMUD or its authorized representative at the conclusion of the test.
 - (a) The power curve test results and conclusions.
 - (b) An electronic and hard copy of the measured wind data and the correlation between the two sets of wind speed measurements.
 - (c) A copy of the hub height wind speed data measured on the upwind temporary Met tower and simultaneous wind speeds measured by the permanent Met tower. This data set consists of two columns of 10-minute, binned wind speed data in a spreadsheet that includes all of the data used during the period of the power curve test.
4. Should the Contractor desire or require an IEC-compliant power curve test on more than two WTGs, the Contractor shall identify such test(s) and the associated costs in its proposal. SMUD may consider alternative test instrumentation schemes for such additional power curve tests, where such additional tests would be simpler and less costly.

TC-24 WIND TURBINE POWER CURVE GUARANTEE

If, at any time during the warranty period, or full service O&M contract period (as contracted), SMUD suspects that either of the two tested WTGs, or any of the remaining WTGs, are not meeting their warranted power curve, SMUD reserves the right (at its sole discretion) to re-perform the power curve tests or conduct a similar power curve test on any Phase 3 WTG. The costs of this test, including, but not limited to, additional Met tower and sensors to conduct of the test, would be borne by SMUD. If such a test is deemed to be necessary by SMUD, SMUD will consult with the WTG supplier and seek to define a cost-effective method of measuring the wind speed entering the rotor plane. For example, SMUD may suggest mounting an anemometer off of the nacelle, with the rotor in a locked configuration, to establish the correlation between the wind speed measured on the upwind reference Met tower and the wind entering the rotor plane. As an alternative, SMUD may suggest using the turbine-mounted anemometer (TMA) to monitor winds entering the rotor plane, while relying on the correlation established under TC-23, above. Where appropriate, the errors and uncertainties in such alternative approaches shall be taken into account in the data analysis and interpretation of the results. SMUD anticipates that the remainder of the IEC 61400-12 test standard will be implemented in the normal way.

If any power curve test reveals that a wind turbine is not meeting 96 percent of the warranted power curve, based on the WSFDs listed in Appendix B, the Contractor shall compensate SMUD for the cost of the power curve test(s), including, but not limited to, the Met tower, sensors, and the cost of conducting the test. The Contractor will then be given an opportunity to remedy the cause of the power curve deficiency in the tested turbine and the other Phase 3 turbines (within 90 days) or pay liquidated damages.

If, after seeking to remedy the power-curve shortfall, the Contractor is still unable to correct the power curve deficiency sufficiently to at least meet the stated criteria, as liquidated damages the Contractor shall be obligated to compensate SMUD for the energy shortfall below 96 percent of the expected level for a period of 15 years, or until the Contractor has demonstrated to SMUD that the power curve deficiency has been corrected. The value of the energy included in calculating the

financial penalty shall commence at 8.5 cents/kWh at the time of commissioning and escalate in accordance with the Dow Jones NP15 Electricity Price Index each year thereafter, as shown hereafter.

$$\text{Annual Payment} = (0.96 - \text{MPCF}) \times \text{NEP} \times (.085) \times (1+i) \times n$$

Where:

MPCF = The measured power curve fraction, as defined hereafter;

NEP = The annual Net Energy Production (in kWh/year) derived by multiplying the GEP by a factor of 0.89 (an assumed and reasonable factor to account for all losses associated with wakes, powerline losses, controls, blade soiling, etc.). GEP is developed by the convolution of the manufacturer's warranted power curve and the site-averaged, hub height wind distribution defined by the use of Appendix B of this RFP;

i = The annual escalation, based on the annual percentage change in the published Dow Jones NP15 Electricity Price Index; and

n = The number of Phase 3 WTGs.

Appendix G contains a sample of the power curve and associated energy production calculations.

For SMUD to be able to plan its resources, it requires all Proposers to deliver with their proposals copies of the warranted power curve for the WTGs at the annual average air density of SMUD's site (i.e., assume average annual air density for the site is 1.20 kg/m³).

The MPCF, which defines the above-described test criterion of 96 percent for the power curve warranty, shall be achieved when the fraction of energies resulting from the two factors defined hereafter exceeds 0.96:

- (a) Numerator: The energy that results when the measured power curve is convolved with the appropriate WSFD (or use of the two WSFDs provided and the energy calculation adjusted for the hub height being bid). The WSFDs developed by the contractor in developing their proposal shall be used as described above.
- (b) Denominator: The energy that results when the Proposer's warranted power curve is convolved with the appropriate. The WSFDs developed by the contractor in developing their proposal shall be used as described above.

TC-25 COLLECTION SYSTEM TESTING

All contractor supplied 34.5 kV URD cable shall be from a reputable manufacturer that has type tested the specific cable and has performed a Partial Discharge test of the cable before it leaves the factory. Contractor shall submit test results for every spool of cable. Receiving, storing, and handling of the cable/cable reels shall follow the manufacturer's recommended guidelines to minimize potential damage. If any neutral current reduction techniques (i.e., cross-bonding or single-point bonding) are used in the design, the neutral currents shall be measured to verify the reduced current. Measurements shall be performed with the appropriate cables at greater than 80 percent power output of the connected generation.

Prior to energization of the collection system, and before back-filling cable trenches, all cable sections shall be tested with an AC Hi-Pot test followed by an off-line Partial Discharge (PD) test that conforms to the guidelines set forth in IEEE 400.3. All cable test plans and results shall be provided to SMUD for review and approval.

TC-26 SCADA COMMUNICATION SYSTEM FIBER TESTING

The SCADA fiber optic communication system shall be tested to the following criteria:

1. All fiber jumpers shall be tested for losses and shall have an insertion loss of -0.50 dB or less.
2. All fiber cable shall be tested after installation and shall have losses of 3.5 dB or less per km of cable (@ 850nm).
3. Overall loss measurements should be made for each fiber loop and compared to the original design to ensure that the minimum system margin has been maintained (see TC-19, SCADA COMMUNICATION SYSTEM).
4. All fiber loss measurements shall be documented and include the type of test equipment used as well as the last calibration date.

After the fiber optic system is fully tested to the above specifications, the jumpers shall be permanently installed, and the complete fiber (and radio, if applicable) communication system shall be functionally tested using the SCADA software supplied by the Contractor. The functional testing shall include executing standard control and data gathering commands for each turbine individually, as well as in groups. All alarms associated with battery backups or AC power failure shall be functionally tested.

TC-27 AS-BUILT DRAWINGS

At the completion of the Project, the Contractor shall submit a complete as-built drawing package to SMUD. This package is independent of the Final System Documentation list in the Technical Conditions. The as-built drawing package shall be electronic and saved in AutoCAD 2004 per SMUD drawing format standards PG-ENGSTD 01, Revision 0 (see Appendix M). Design documentation other than Project drawings shall be submitted in the software format used for its creation. Adobe Acrobat versions of the documents will not be acceptable. All drawings and other design documentation shall be an accurate depiction of the actual field construction of the Project. Layout drawings shall incorporate as-built survey data, as required by this RFP. In addition, all WTG road and underground cable locations shall be submitted in ESR1 GIS format (Shapefile or geodatabase).

TC-28 FINAL SYSTEM DOCUMENTATION

The Contractor shall provide SMUD a complete set of Project documentation prior to Project close out. At a minimum, the documentation shall include the following information.

1. Turbine Binders—The Contractor shall submit a binder specific to each turbine that shall include all documentation pertaining to that turbine, including, but not limited to, the following:

- (a) Commissioning certificate;
 - (b) Shipping documents;
 - (c) Major component list with serial numbers, model numbers, and all other pertinent information;
 - (d) Transformer documentation;
 - (e) All factory and commissioning test and inspection documentation for the complete WTG, tower, and transformer; and
 - (f) Bolt torque and equipment calibration information.
2. SCADA Software Binder—The Contractor shall submit a manual for the SCADA system software that completely describes the software, operating procedures, trouble shooting instructions, functionality descriptions, technical support contacts, interface with other SCADA systems configuration and licensing information.
 3. SCADA Communication System Binder—The Contractor shall submit a binder complete with material cut sheets, material test results, splice and termination documentation, and all communication and loss test documentation. Binder shall include technical data, manuals, manufacturers instructions, wiring diagrams, etc., for the system hardware, server, switches, etc.
 4. Foundation Binder—The Contractor shall submit a WTG foundation binder complete with as-built foundation drawings, site specific soil testing results, calculations, material test results, concrete mix and break documentation. The foundation information for all the turbines may be combined into one binder or one set of binders.
 5. Electrical Collection System Binder—The Contractor shall submit a binder complete with one-line diagrams, cross-bonding designs, electrical design and equipment sizing calculations, pad-mount transformer details (if applicable), grounding information, material bill-of-materials, material data sheets with part numbers noted, material test results, splice and termination documentation, and collector system AC Hi-pot, PD testing, and neutral current documentation. Contractor shall provide time-current characteristics (TCC) curves showing coordination of the WTG protection system with collection line 34.5 kV breaker trip settings at the Russell Generation Step-Up Transformer.
 6. Access Road Binder—The Contractor shall submit a binder complete with 11-inch by 17-inch as-built road design drawings, cut sheets, or data sheets for all material used for the road, access gate documentation, and soil compaction and sampling test results.
 7. Met Tower Binder—The Contractor shall submit all documentation relating to the Met tower construction, erection, operation, data acquisition and communication equipment, sensors and sensor calibration sheets.
 8. New O&M Building Binder—The Contractor shall submit all documentation relating to the new O&M Building permitting, construction, as-built drawings, etc.

The Contractor shall submit the above documentation in triplicate prior to Project close-out. Final payment shall be withheld until complete documentation is submitted to SMUD's satisfaction.

TC-29 PHASE 3 FULL SERVICE O&M CONTRACT

The Proposer shall propose full service O&M contract services for the Phase 3 scope of the Project. Such services include a combination of the maximum manufacturer's comprehensive warranty on the WTGs and associated subsystems and complete O&M services for a minimum of 5 years, with and option for an addition 5 years. Following is the scope of the optional Phase 3 full service contracts.

1. **Maintenance:** The full service O&M shall cover all parts, equipment, labor, and availability guarantees for the periods indicated on the Cost Proposal. Commercially available warranties from manufacturers will be assigned to the O&M Contractor for applicable O&M based on the years of O&M assumed. To satisfy the terms of the O&M agreement, the Contractor shall assume the warranties and pursue manufacturer resolution for equipment needing warranty repair, parts replacement, or services. In fulfilling its obligations under this contract, the successful Contractor will be able to employ SMUD's new O&M building under the terms of the lease described in TC-32, OPERATION AND MAINTENANCE [O&M] BUILDING LEASE. Under the Optional O&M Contract, the Contractor shall be responsible for maintaining all site access roads and associated gates, performing annual weed abatement, and maintaining chain-link fences around the new O&M building. The Contractor will be responsible for maintaining the collection system.

The Contractor shall maintain the proposed WTGs and associated equipment for the full term of the offered O&M, in accordance with the manufacturer's recommendations (including all regular maintenance to the ending date of the offered O&M period), shall keep all maintenance records on file in the O&M building, and shall be subject to periodic SMUD audits. The Contractor also shall be subject to the requirements of the power curve and availability guarantees set forth in TC-24, WIND TURBINE POWER CURVE GUARANTEE, and TC-30, AVAILABILITY GUARANTEE, respectively.

2. **Operations:** The Contractor shall perform all operational functions for the proposed Phase 3 WTGs, including, but not limited to, responding to faults, determination of fault cause, resetting of faults after response or repair is complete, monitoring and evaluation of performance of all WTGs and other site equipment, optimizing availability and production, and troubleshooting and correction of operational difficulties. The Phase 3 Solano Wind Project shall be operated using full time (24/7) operational supervision. The Contractor may supervise the Project from a remote Operations center outside of normal business hours, with response time to correct the problem within 4 hours.
3. **Reporting:** The Contractor shall submit weekly reports, via email to SMUD staff, listing, at a minimum, the following information:
 - (a) Current date and time and time period for the report;
 - (b) Work performed during the week;
 - (c) Work planned for the next week;
 - (d) Actual generation, month-to-date;
 - (e) Turbine status, with a description of the reason for any turbine not available;

- (f) Current status of all Met tower instruments; and
- (g) Current status of site generation.
- (h) SCADA system status.
- (i) Collection system status.
- (j) Status of roads, gates and fences.

The Contractor also shall prepare and submit monthly reports, via email to SMUD staff, listing, at a minimum, the following information:

- (a) Summary paragraph describing the pertinent data points, such as capacity factor and gross generation;
- (b) Availability and all parameters required for availability calculations (see TC-30, AVAILABILITY GUARANTEE) and generation reports for all turbines individually;
- (c) Power curve report with a curve, corrected for air density (see TC-6, SITE WIND CHARACTERISTICS), for each turbine plotted against the warranted power curve;
- (d) Average wind speed, wind speed distribution, and wind rose for each Met tower;
- (e) Itemized report of all site systems;
- (f) Scheduled and unscheduled outages and scheduled maintenance forecast and status of past month's scheduled maintenance; and
- (g) All curtailment events by WTG number, date, and time implemented/removed.

The annual full service O&M cost itemized by the Proposer in the cost proposal shall be in nominal dollars. Actual payment shall be made monthly, based on one-twelfth (1/12) of the nominal annual (calendar year) payment as bid. The full service O&M contract shall commence at the Project's Notice of Completion Date (see GC -52, NOTICE OF COMPLETION).

TC-30 AVAILABILITY GUARANTEE O&M CONTRACT

1. **Guarantee:** In fulfilling its obligations under the full service O&M portion of its contract with SMUD, Proposer must guarantee that it will meet a minimum annual availability of 96 percent, as defined hereafter.

Availability shall be defined by the following formula:

$$\text{Availability} = (T_{\text{op}} - T_{\text{util out}} - T_{\text{force}}) / (\text{Period Time} - T_{\text{pm}} - T_{\text{util out}} - T_{\text{force}})$$

Where:

$$T_{\text{op}} = \text{The number of hours in the period during which the subject wind turbine is capable of operating and connected to the utility lines irrespective of whether the wind is blowing or the utility lines are energized.}$$

- T_{pm} = The number of preventive maintenance (PM) hours in the period, up to a yearly maximum total of 48 hours. All PM hours must be reported.
- $T_{util\ out}$ = The number of hours during the period that SMUD step-up transformer (utility) is not energized and, as a result, the wind turbines cannot generate power.
- T_{force} = The number of hours during the period when the turbine was not capable of operating due to SMUD-directed shutdown of the WTG or force majeure events.
- Period = The total number of hours in the reporting period (month or year) during which availability is being computed. For example, when computations are carried out on an annual basis, the period is equal to 8,760 hours.

The average availability of all WTGs will be calculated as the linear average of the availability of all of the WTGs by summing the availability of each WTG and dividing by the total number of WTGs involved in the computation.

Availability shall be calculated and reported monthly and annually.

The Contractor will work with SMUD to align the proposed SCADA system with the language in this section.

2. **Liquidated Damages:** In the event that the Contractor fails to meet the minimum availability of 96 percent over the period, the Contractor shall pay liquidated damages in accordance with the following formula:

$$\text{Annual payment} = (0.96 - \text{availability}) \times \text{NEP} \times (.085) \times (1 + i) \times n$$

Where:

- NEP = The annual net energy production (in kWh/year) derived by multiplying the GEP by a factor of 0.89 (an assumed and reasonable factor to account for all losses associated with wakes, powerline losses, controls, blade soiling, etc.). GEP is developed by the convolution of the manufacturer's warranted power curve and the site-averaged, hub height, wind speed frequency distribution defined by the use of Appendix B of this RFP;
- i = The annual escalation, based on the annual percentage change in the published Dow Jones NP15 Electricity Price Index; and
- n = The number of Phase 3 WTGs.

Appendix G contains a sample of the power curve and associated energy production calculations.

Calculations of average annual availability, and payments for liquidated damages under this provision, shall be made annually, where the first year shall be defined as from the date of Notice of Completion of a WTG by SMUD through the end of the first calendar year. In each subsequent year, such payments will be computed on a calendar-year basis. These guarantees and associated liquidated damages shall be in effect for the term of the full service O&M contract and apply only to the WTGs procured under a contract resulting from this RFP.

TC-31 OPERATION AND MAINTENANCE (O&M) BUILDING

Proposers shall include the lump-sum cost noted in the cost proposal schedule (Section 6.12) to provide a new O&M building. The building shall be located as shown in Appendix H, available on CD Number 1 to Proposers, upon request. The O&M building shall include complete features for the required O&M tasks associated with the Project.

The requirements for the O&M building are specified in Appendix J (attached to this RFP).

TC-32 OPERATION AND MAINTENANCE (O&M) BUILDING LEASE (OPTIONAL O&M CONTRACT)

The new O&M building will be leased to the Phase 3 Full Service O&M Contractor based on SMUD's Standard Building Lease Form (to be supplied in an addendum to this RFP), with the following general terms and conditions:

- The lease is for the non-exclusive use by the Contractor for Phase 3 full service O&M activities only.
- SMUD reserves the right to use the O&M building (one office and one conference room).
- The lease will be for consecutive five-year terms (as required).
- The lease amount will be \$5,000 per month, paid in advance.
- Utilities will be billed to and paid by SMUD.
- Maintenance and cleaning shall be performed by the Contractor.