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January 18, 2005

Ms. Magalie Roman Salas  
Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

**RE: Joint Filing of the Large Generator Interconnection Agreement of the California Independent System Operator Corporation, Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company -- Docket Nos. ER04-445-00\_, ER04-435-00\_, ER04-441-00\_, ER04-443-00\_.**

Dear Secretary Salas:

In compliance with the Federal Energy Regulatory Commission's ("Commission" or "FERC") June 2, 2005 Final Rule on Interconnection for Wind Energy, Order No. 661, 111 FERC ¶ 61,353 (2005) ("Order No. 661"), its December 12, 2005 Order on Rehearing and Clarification of Order No. 661, Order No. 661-A, 113 FERC ¶ 61,254 (2005) ("Order No. 661-A"), and its December 22, 2005 "Notice Extending Compliance Date," the California Independent System Operator Corporation ("ISO") hereby submits six copies of an amended long-term Standard Large Generator Interconnection Agreement ("LGIA") for Commission approval as a *pro forma* agreement.<sup>1</sup> This filing is made in order to add to the LGIA a new Appendix H setting forth specific rules concerning the requirements with respect to interconnecting wind generating plants to

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<sup>1</sup>

Capitalized terms that are not otherwise defined are defined in the LGIA.

the ISO Controlled Grid.<sup>2</sup> The ISO is also tendering two copies to be time and date stamped and returned to our courier.

## **I. BACKGROUND**

### **A. Order No. 661**

On June 2, 2005, the Commission issued Order No. 661, in which it required that all public utilities that own, control, or operate facilities for transmitting electric energy in interstate commerce to append to their Large Generator Interconnection Procedures (LGIPs) and Large Generator Interconnection Agreements (LGIAs) a new appendix setting forth standard procedures and technical requirements with respect to the interconnection of wind generation facilities.<sup>3</sup> The Commission explained that the new procedures and technical requirements were necessary because some of the technical requirements of the LGIA were inappropriate for non-synchronous technologies, such as wind generators, and therefore, Order No. 661 benefits customers by removing unnecessary obstacles to further development of wind generating resources while ensuring that reliability is protected.

Order No. 661 addressed three primary issues with respect to the technical requirements relating to the interconnection of wind generating plants: (1) low voltage ride-through capability, (2) maintenance of a particular power factor range, and (3) supervisory control and data acquisition ("SCADA") capability.

The issue of low voltage ride-through capability concerns the ability of wind generating plants to remain on-line during periods of sudden voltage decrease on the transmission system. In the NOPR that preceded the issuance of Order No. 661, the Commission proposed to require that wind plants seeking to interconnect to the transmission system demonstrate low voltage ride-through capability, unless waived by a transmission provider on a comparable and not unduly discriminatory basis for all wind plants. Specifically, the NOPR proposed that wind generating plants would be required to demonstrate the ability to remain on-line during voltage disturbances up to the time periods and associated voltage levels set forth therein.

In Order No. 661, the Commission adopted the low voltage ride-through standard

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<sup>2</sup> As explained below, the ISO is also proposing one minor conforming change to the text of the LGIA itself.

<sup>3</sup> The Commission set the effective date of Order No. 661 for 60 days after publication in the Federal Register, which was made on June 16, 2005. However, the Commission adopted a transition period for application of the standard technical requirements for wind generators. Specifically, the Commission concluded that the standard technical requirements would apply only to LGIAs signed, filed with the Commission in unexecuted form, or filed as a non-conforming agreement, on or after January 1, 2006, or the date six months after publication of the Final Rule in the Federal Register, whichever is later.

proposed in the NOPR, but concluded that this standard would not be required unless the Interconnection System Impact Study shows that it is needed. Specifically, under Order No. 661, a wind plant is required to satisfy the low voltage ride-through standard if the transmission provider shows, through the Interconnection System Impact Study, that such capability is required to ensure safety or reliability. The Commission reasoned that establishing the low-voltage ride through standard in this fashion shows that it is necessary to maintain the safety and reliability of the grid, provides certainty to wind plant developers that their interconnection to the grid will not be frustrated, and limits opportunities for undue discrimination.

The second issue addressed in Order No. 661 concerns the power factor range that wind generators must operate within. In the NOPR, the Commission noted that although transmission providers did not require wind generators to have reactive power capability until recently, because of the larger size of many of the wind plants being built and the increased presence of wind energy on various transmission systems, the Commission was proposing to require wind plants to operate within a specified power factor range to help balance the reactive power needs of the transmission system. Specifically, the NOPR proposed to require that large wind plants maintain a power factor within the range of 0.95 leading to 0.95 lagging (as required by Order No. 2003), to be measured at the high voltage side of the wind plant substation transformer. The Commission also proposed, in the NOPR, to allow wind plants flexibility in how they meet the power factor requirement; for example, using either power electronics designed to supply this level of reactive capability, fixed and switched capacitors if agreed to by the transmission provider, or a combination of the two. Additionally, the NOPR proposed to allow the transmission provider to waive the power factor requirement for wind plants where it is not needed at that location or for a generating facility of that size, provided that such waiver is not unduly discriminatory ( that is, is offered on a comparable basis to similarly situated wind plants).

In Order No. 661, the Commission adopted the power factor range of 0.95 leading to 0.95 lagging for large wind generating plants, but stated that wind generating plants would be required to maintain this power factor range only if the transmission provider shows, through the Interconnection System Impact Study, that such capability is required of that plant to ensure safety or reliability. The Commission explained that this decision would provide assurance to wind plant developers that their interconnection to the grid will not be frustrated or face uncertainty due to a lack of standards, and thus will limit opportunities for undue discrimination, remove unnecessary obstacles to the increased growth of wind generation, and ensure that safety and reliability is protected. The Commission also adopted the NOPR proposal to measure the power factor at the Point of Interconnection.

Finally, with respect to SCADA capability, the Commission, in the NOPR, proposed to require that a large wind plant seeking to interconnect to the transmission grid possess SCADA capability to transmit data and receive instructions from the

transmission provider. Additionally, the Commission proposed requiring that the transmission provider and the wind plant owner determine the type of SCADA information and equipment that is essential for the proposed wind plant, taking into account the size of the plant, its characteristics, its location, and its importance in maintaining generation resource adequacy and transmission system reliability. In Order No. 661, the Commission adopted the SCADA requirement proposed in the NOPR, with the clarification that a wind plant is only required to have the capability to receive instructions, and that nothing in Order No. 661 authorizes a transmission provider to control a wind plant; any such authorization would be subject to separate negotiation and agreement between the Interconnection Customer and the transmission provider.

#### **B. Order No. 661-A**

On August 4, 2005, a number of parties filed requests for rehearing and/or clarification of Order No. 661. Additionally, the North American Electric Reliability Council ("NERC") and the American Wind Energy Association ("AWEA") filed a request for a 60-day extension to the effective date of Order No. 661 to October 14, 2005, in order to allow them to engage in discussions to resolve NERC's concern regarding the low voltage ride-through standard. On August 5, 2005, the Commission granted this request, and required NERC and AWEA to submit a final report on their discussions by September 14, 2005. Pursuant to a request from NERC and AWEA, the Commission thereafter extended this date to September 19, 2005.

On December 12, 2005, the Commission issued its Order on Rehearing and Clarification of Order No. 661, Order No. 661-A. Therein, the Commission addressed the joint recommendations of NERC and AWEA, as well as the requests for rehearing and/or clarification filed by parties on August 4, 2005.

With respect to the low voltage ride-through provisions adopted in Order No. 661, the Commission granted rehearing and adopted the joint recommendations of NERC and AWEA. These recommendations consisted of a new low-voltage ride through standard, and a limitation on the variations to the standard as permitted in Order No. 661 pursuant to the "consistent with or superior to" or independent entity variation standards. Specifically, NERC and AWEA recommended that variations to their proposed low voltage ride-through provisions be permitted on an interconnection-wide basis only, reasoning that such a limitation is appropriate because the provisions are intended to satisfy a NERC reliability standard, and because wind generators could incur significant additional costs if they had to meet many different standards.

With regard to the power factor standard for wind generators, the Commission concluded that it would not modify Order No. 661 to require wind plants to meet the power factor standard without a showing by the transmission provider, through the Interconnection System Impact Study, that it is needed for safety or reliability. The Commission also declined to clarify that wind generators would be required to meet a

wider power factor range than 0.95 leading to 0.95 lagging if a wider range was universally applied by a particular transmission provider. However, the Commission noted that if the Interconnection System Impact Study shows the need for a power factor range wider than +/- 0.95 for safety or reliability, the transmission provider must file a non-conforming agreement, as Order No. 2003 permits, and the Commission will consider these non-conforming agreements on a case by case basis. Moreover, the Commission noted that if a transmission provider has a different power factor range in its LGIA and wishes to apply that same range in Appendix G, it may seek a variation from the Commission under the variation standards approved in the Final Rule.

Finally, with respect to the date that entities would be required to make compliance filings pursuant to Order No. 661-A, the Commission noted that it had already extended to December 30, 2005 the date by which all public utilities that own, control, or operate transmission facilities in interstate commerce must adopt the wind interconnection appendix. Also, the Commission stated that public utilities who had already filed the wind generation appendix, pursuant to Order No. 661, as amendments to the LGIPs and LGIAs must file, by December 30, 2005, the revisions to the appendix made in Order No. 661-A.

**C. CAISO and PTO Request for Extension**

On December 19, 2005, the ISO and SCE filed separate requests for an extension of time from December 30, 2005 to January 18, 2005 to file a revised LGIP and LGIA in accordance with Orders No. 661 and 661-A. On December 20, 2005, SDG&E filed a motion asking for an identical extension. On December 22, 2005, the Commission issued an order granting these motions.

**II. CONTENTS OF FILING**

This filing comprises:

- This Transmittal Letter
- Attachment A LGIA Tariff Language Blacklined Against LGIA filed on November 1, 2005
- Attachment B LGIA Tariff Sheets Clean
- Attachment C Document Showing the ISO's Proposed Modifications to the Commission's Pro Forma LGIA Wind Appendix

### III. COMMUNICATIONS

Correspondence and other communications regarding this filing should be directed to:

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### IV. DESCRIPTION OF THE FILING

#### A. Structure of the Filing

As described above, the instant filing is submitted in compliance with Order Nos. 661 and 661-A, which require all public utilities to amend their LGIAs and LGIPs to include new appendices addressing procedures and technical requirements for the interconnection of wind generating facilities.

The ISO has used the LGIA filed on November 1, 2005, as the baseline against which the changes proposed herein are reflected. Included as Attachment A are blackline sheets showing each proposed change from the LGIA filed on November 1, 2005.<sup>4</sup> The ISO is also including, as Attachment C, a document which shows the ISO's proposed modifications to the Commission's *pro forma* LGIA wind appendix.

<sup>4</sup>

The Commission has yet to act on the November 1, 2005 LGIA filing.

## **B. Proposed Changes to the Commission's Pro Forma LGIA Wind Generation Appendix**

As explained below, the ISO is proposing a number of modifications to the Commission's *pro forma* LGIA appendix addressing wind generators, as set forth in Orders Nos. 661 and 661-A. The majority of these revisions are minor in nature, made in order to conform the Commission's *pro forma* appendix to the terminology used in the ISO/PTO-specific LGIA, which was filed with the Commission most recently on November 1, 2005. The ISO is also proposing, pursuant to the independent entity variation standard, a substantive modification to the provision in the Commission's *pro forma* appendix addressing reactive power support. Finally, the ISO is proposing several minor conforming change to the body of the LGIA itself.

### **Modifications to the Commission's Pro Forma Wind Appendix**

The ISO is proposing to modify Section A.ii of the Commission's *pro forma* LGIA wind appendix in order to delete, in the first sentence of that section, the word "maintain" and replace it with the words "operate within." The ISO further proposes to modify that same sentence to insert the phrase "in order to maintain a specified voltage schedule."

The ISO is proposing these changes because it is the practice of the ISO and Participating TO's to use voltage levels or a "voltage schedule" as an adjustable operating parameter used to address various system conditions that include seasonal variations and/or equipment or facility outages. The ISO submits that these modifications are warranted both under the independent entity variation standard and the "consistent with or superior to" standard, because the modified language clearly conveys the actual operating requirements of the system operator regarding Generating Facilities interconnected to the system. It is standard operating practice for synchronous Generating Facilities that have reactive power capability to have their facility automatically move within their power factor range to maintain the established (scheduled) voltage of the electrical line(s) to which they are interconnected. It would therefore be appropriate for wind Generating Facilities to operate in a comparable manner. Simply put, for the system operator to be able to reliably operate the power system, Generating Facilities must be able to both maintain a voltage and be able to operate within the designed power factor range. These proposed changes to the Commission's *pro forma* language proposed by the ISO clearly reflect this operational requirement.

The remainder of the proposed changes consist of changes made in order to conform the terminology in the wind appendix with the terminology used throughout the remainder of the ISO/PTO-specific LGIA. Because none of these proposed changes is substantive in nature, and these changes will harmonize the Commission's *pro forma*

wind appendix with the ISO/PTO-specific LGIA, the ISO submits that these modifications are just and reasonable, and should be adopted.

**Modifications to the Body of the LGIA**

The ISO is proposing to modify Article 9.6.1 of the LGIA. The most recent version of the LGIA, as filed on November 1, 2005, provides, in Article 9.6.1, that wind generators must maintain a power factor of unity at the Point of Interconnection. In order to conform this section to reflect the fact that the requirements for wind generators will now be set forth in a new appendix to the LGIA, the ISO proposes to delete the reference to the unity power factor requirement from Article 9.6.1 and replace it with a sentence that states that the power factor requirements relating to wind generators are set forth in Appendix H to the LGIA. In addition, the Table of Contents and the listing of the contents of the appendices has been modified to change the title of Appendix H to use the title of the new appendix specified by the Commission.

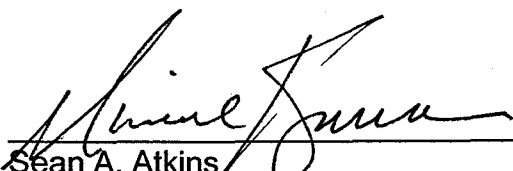
**V. CONCLUSION**

For the reasons set forth above, the ISO respectfully requests that the Commission accept the enclosed LGIA, revised in accordance with the Commission's Order Nos. 661 and 661-A.

Respectfully submitted,

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# **ATTACHMENT A**

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## ARTICLE 9. OPERATIONS

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### 9.6 Reactive Power.

**9.6.1 Power Factor Design Criteria.** The Interconnection Customer shall design the Large Generating Facility to maintain a composite power delivery at continuous rated power output at the terminals of the Electric Generating Unit at a power factor within the range of 0.95 leading to 0.90 lagging, unless the ISO has established different requirements that apply to all generators in the Control Area on a comparable basis. ~~Wind generators of the induction type must maintain unity power factor at the Point of Interconnection. Power Factor Design Criteria for wind generators is~~ are provided in Appendix H of this LGIA.

**9.6.2 Voltage Schedules.** Once the Interconnection Customer has synchronized an Electric Generating Unit with the ISO Controlled Grid, the ISO or Participating TO shall require the Interconnection Customer to maintain a voltage schedule by operating the Electric Generating Unit to produce or absorb reactive power within the design limitations of the Electric Generating Unit set forth in Article 9.6.1 (Power Factor Design Criteria). ISO's voltage schedules shall treat all sources of reactive power in the Control Area in an equitable and not unduly discriminatory manner. The Participating TO shall exercise Reasonable Efforts to provide the Interconnection Customer with such schedules at least one (1) day in advance, and the ISO or Participating TO may make changes to such schedules as necessary to maintain the reliability of the ISO Controlled Grid or the Participating TO's electric system. The Interconnection Customer shall operate the Electric Generating Unit to maintain the specified output voltage or power factor within the design limitations of the Electric Generating Unit set forth in Article 9.6.1 (Power Factor Design Criteria), and as may be required by the ISO to operate the Electric Generating Unit at a specific voltage schedule within the design limitations set forth in Article 9.6.1. If the Interconnection Customer is unable to maintain the specified voltage or power factor, it shall promptly notify the ISO and the Participating TO.

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## Appendices to LGIA

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- Appendix B Milestones
- Appendix C Interconnection Details
- Appendix D Security Arrangements Details
- Appendix E Commercial Operation Date
- Appendix F Addresses for Delivery of Notices and Billings
- Appendix G Reliability Management System Agreement
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### Appendix H To LGIA

#### Requirements of Generators Relying on Newer Technologies INTERCONNECTION REQUIREMENTS FOR A WIND GENERATING PLANT

Appendix H sets forth requirements and provisions specific to a wind generating plant. All other requirements of this LGIA continue to apply to wind generating plant interconnections.

#### A. Technical Standards Applicable to a Wind Generating Plant

##### i. Low Voltage Ride-Through (LVRT) Capability

A wind generating plant shall be able to remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the standard below. The LVRT standard provides for a transition period standard and a post-transition period standard.

##### Transition Period LVRT Standard

The transition period standard applies to wind generating plants subject to FERC Order 661 that have either: (i) interconnection agreements signed and filed with FERC, filed with FERC in unexecuted form, or filed with FERC as non-conforming agreements between January 1, 2006 and December 31, 2006, with a scheduled in-service date no later than December 31, 2007, or (ii) wind generating turbines subject to a wind turbine procurement contract executed prior to December 31, 2005, for delivery through 2007.

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4 – 9 cycles) and single line to ground faults with delayed clearing, and subsequent post-fault voltage recovery to pre-fault voltage unless clearing the fault effectively disconnects the generator from the system. The clearing time requirement for a three-

phase fault will be specific to the wind generating plant substation location, as determined by and documented by the Participating TO. The maximum clearing time the wind generating plant shall be required to withstand for a three-phase fault shall be 9 cycles at a voltage as low as 0.15 p.u., as measured at the high side of the wind generating plant step-up transformer (i.e. the transformer that steps the voltage up to the transmission interconnection voltage or "GSU"), 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 transmission system.

2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU or to faults that would result in a voltage lower than 0.15 per unit on the high side of the GSU serving the facility.
3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.
4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (e.g., Static VAr Compensator, etc.) within the wind generating plant or by a combination of generator performance and additional equipment.
5. Existing individual generator units that are, or have been, interconnected to the network at the same location at the effective date of the Appendix H LVRT Standard are exempt from meeting the Appendix H LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix H LVRT Standard.

#### **Post-transition Period LVRT Standard**

All wind generating plants subject to FERC Order No. 661 and not covered by the transition period described above must meet the following requirements:

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4 – 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 clearing time requirement for a three-phase fault will be specific to the wind generating plant substation location, as determined by and documented by the Participating TO. 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 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 wind GSU.
2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU.
3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.
4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (e.g., Static VAr Compensator) within the wind generating plant or by a combination of generator performance and additional equipment.
5. Existing individual generator units that are, or have been, interconnected to the ISO Controlled Grid at the same location at the effective date of the Appendix H LVRT Standard are exempt from meeting the Appendix H LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix H LVRT Standard.

#### **ii. Power Factor Design Criteria (Reactive Power)**

A wind generating plant shall operate within a power factor within the range of 0.95 leading to 0.95 lagging, measured at the Point of Interconnection as defined in this LGIA in order to maintain a specified voltage schedule, if the Interconnection System Impact Study shows that such a requirement is necessary to ensure safety or reliability. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors, or a combination of the two, if agreed to by the Participating TO and ISO. The Interconnection Customer shall not disable power factor

equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the Interconnection System Impact Study shows this to be required for system safety or reliability.

**iii. Supervisory Control and Data Acquisition (SCADA) Capability**

The wind plant shall provide SCADA capability to transmit data and receive instructions from the Participating TO and ISO to protect system reliability. The Participating TO and ISO and the wind plant Interconnection Customer shall 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.

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- 9.2 Control Area Notification.** At least three months before Initial Synchronization Date, the Interconnection Customer shall notify the ISO and Participating TO in writing of the Control Area in which the Large Generating Facility intends to be located. If the Interconnection Customer intends to locate the Large Generating Facility in a Control Area other than the Control Area within whose electrically metered boundaries the Large Generating Facility is located, and if permitted to do so by the relevant transmission tariffs, all necessary arrangements, including but not limited to those set forth in Article 7 and Article 8 of this LGIA, and remote Control Area generator interchange agreements, if applicable, and the appropriate measures under such agreements, shall be executed and implemented prior to the placement of the Large Generating Facility in the other Control Area.
- 9.3 ISO and Participating TO Obligations.** The ISO and Participating TO shall cause the Participating TO's Transmission System to be operated and controlled in a safe and reliable manner and in accordance with this LGIA. The Participating TO at the Interconnection Customer's expense shall cause the Participating TO's Interconnection Facilities to be operated, maintained and controlled in a safe and reliable manner and in accordance with this LGIA. The ISO and Participating TO may provide operating instructions to the Interconnection Customer consistent with this LGIA and Participating TO and ISO operating protocols and procedures as they may change from time to time. The Participating TO and ISO will consider changes to their operating protocols and procedures proposed by the Interconnection Customer.
- 9.4 Interconnection Customer Obligations.** The Interconnection Customer shall at its own expense operate, maintain and control the Large Generating Facility and the Interconnection Customer's Interconnection Facilities in a safe and reliable manner and in accordance with this LGIA. The Interconnection Customer shall operate the Large Generating Facility and the Interconnection Customer's Interconnection Facilities in accordance with all applicable requirements of the Control Area of which it is part, including such requirements as set forth in Appendix C, Interconnection Details, of this LGIA. Appendix C, Interconnection Details, will be modified to reflect changes to the requirements as they may change from time to time. A Party may request that another Party provide copies of the requirements set forth in Appendix C, Interconnection Details, of this LGIA. The Interconnection Customer shall not commence Commercial Operation of an Electric Generating Unit with the Participating TO's Transmission System until the Participating TO provides prior written approval, which approval shall not be unreasonably withheld, for operation of such Electric Generating Unit.
- 9.5 Start-Up and Synchronization.** Consistent with the Parties' mutually acceptable procedures, the Interconnection Customer is responsible for the proper synchronization of each Electric Generating Unit to the ISO Controlled Grid.
- 9.6 Reactive Power.**
- 9.6.1 Power Factor Design Criteria.** The Interconnection Customer shall design the Large Generating Facility to maintain a composite power delivery at continuous rated power output at the terminals of the Electric Generating Unit at a power factor within the range of 0.95 leading to 0.90 lagging, unless the ISO has established different requirements that apply to all generators in the Control Area on a comparable basis. Power factor design criteria for wind generators are provided in Appendix H of this LGIA.

**Appendices to LGIA**

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**Appendix H  
To LGIA**

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**i. Low Voltage Ride-Through (LVRT) Capability**

A wind generating plant shall be able to remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the standard below. The LVRT standard provides for a transition period standard and a post-transition period standard.

**Transition Period LVRT Standard**

The transition period standard applies to wind generating plants subject to FERC Order 661 that have either: (i) interconnection agreements signed and filed with FERC, filed with FERC in unexecuted form, or filed with FERC as non-conforming agreements between January 1, 2006 and December 31, 2006, with a scheduled in-service date no later than December 31, 2007, or (ii) wind generating turbines subject to a wind turbine procurement contract executed prior to December 31, 2005, for delivery through 2007.

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4 – 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 clearing time requirement for a three-phase fault will be specific to the wind generating plant substation location, as determined by and documented by the Participating TO or ISO. The maximum clearing time the wind generating plant shall be required to withstand for a three-phase fault shall be 9 cycles at a voltage as low as 0.15 p.u., as measured at the high side of the wind generating plant step-up transformer (i.e. the transformer that steps the voltage up to the transmission interconnection voltage or "GSU"), 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 transmission system.
2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU or to faults that would result in a voltage lower than 0.15 per unit on the high side of the GSU serving the facility.
3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.
4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (e.g., Static VAr Compensator, etc.) within the wind generating plant or by a combination of generator performance and additional equipment.
5. Existing individual generator units that are, or have been, interconnected to the network at the same location at the effective date of the Appendix H LVRT Standard are exempt from meeting the Appendix H LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix H LVRT Standard.

### **Post-transition Period LVRT Standard**

All wind generating plants subject to FERC Order No. 661 and not covered by the transition period described above must meet the following requirements:

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4 – 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 clearing time requirement for a three-phase fault will be specific to the wind generating plant substation location, as determined by and documented by the Participating TO or ISO. 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 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 wind GSU.
2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU.
3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.
4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (e.g., Static VAR Compensator) within the wind generating plant or by a combination of generator performance and additional equipment.
5. Existing individual generator units that are, or have been, interconnected to the ISO Controlled Grid at the same location at the effective date of the Appendix H LVRT Standard are exempt from meeting the Appendix H LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix H LVRT Standard.

#### **ii. Power Factor Design Criteria (Reactive Power)**

A wind generating plant shall operate within a power factor within the range of 0.95 leading to 0.95 lagging, measured at the Point of Interconnection as defined in this LGIA in order to maintain a specified voltage schedule, if the Interconnection System Impact Study shows that such a requirement is necessary to ensure safety or reliability. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors, or a combination of the two, if agreed to by the Participating TO and ISO. The Interconnection Customer shall not disable power factor equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the Interconnection System Impact Study shows this to be required for system safety or reliability.

#### **iii. Supervisory Control and Data Acquisition (SCADA) Capability**

The wind plant shall provide SCADA capability to transmit data and receive instructions from the Participating TO and ISO to protect system reliability. The Participating TO and ISO and the wind plant Interconnection Customer shall 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.

# **ATTACHMENT C**

**BLACKLINE SHOWING ISO PROPOSED MODIFICATIONS TO  
FERC PRO FORMA LGIA WIND APPENDIX**

**APPENDIX G Appendix H  
To LGIA**

**INTERCONNECTION REQUIREMENTS FOR A WIND GENERATING PLANT**

Appendix GH sets forth requirements and provisions specific to a wind generating plant. All other requirements of this LGIA continue to apply to wind generating plant interconnections.

**A. Technical Standards Applicable to a Wind Generating Plant**

**i. Low Voltage Ride-Through (LVRT) Capability**

A wind generating plant shall be able to remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the standard below. The LVRT standard provides for a transition period standard and a post-transition period standard.

**Transition Period LVRT Standard**

The transition period standard applies to wind generating plants subject to FERC Order 661 that have either: (i) interconnection agreements signed and filed with ~~the Commission FERC~~, filed with ~~the Commission FERC~~ in unexecuted form, or filed with ~~the Commission FERC~~ as non-conforming agreements between January 1, 2006 and December 31, 2006, with a scheduled in-service date no later than December 31, 2007, or (ii) wind generating turbines subject to a wind turbine procurement contract executed prior to December 31, 2005, for delivery through 2007.

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4 – 9 cycles) and single line to ground faults with delayed clearing, and subsequent post-fault voltage recovery to pre-fault voltage unless clearing the fault effectively disconnects the generator from the system. The clearing time requirement for a three-phase fault will be specific to the wind generating plant substation location, as determined by and documented by the ~~transmission provider~~ Participating TO or ISO. The maximum clearing time the wind generating plant shall be required to withstand for a three-phase fault shall be 9 cycles at a voltage as low as 0.15 p.u., as measured at the high side of the wind generating plant step-up transformer (i.e. the transformer that steps the voltage up to the transmission interconnection voltage or "GSU"), 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 transmission system.
2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU or to faults that would result in a voltage lower than 0.15 per unit on the high side of the GSU serving the facility.
3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.
4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (e.g., Static VAR Compensator, etc.) within the wind generating plant or by a combination of generator performance and additional equipment.
5. Existing individual generator units that are, or have been, interconnected to the network at the same location at the effective date of the Appendix GH LVRT Standard are exempt from meeting the Appendix GH LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix GH LVRT Standard.

**Post-transition Period LVRT Standard**

All wind generating plants subject to FERC Order No. 661 and not covered by the transition period described above must meet the following requirements:

1. Wind generating plants are required to remain in-service during three-phase faults with normal clearing (which is a time period of approximately 4 – 9 cycles) and single line to ground faults with delayed clearing, and subsequent post-fault voltage recovery to pre-fault voltage unless clearing the fault effectively disconnects the generator from the system. The clearing time requirement for a three-phase fault will be specific to the wind generating plant substation location, as determined by and documented by the ~~transmission provider~~ Participating TO or ISO. 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 ~~transmission system~~ ISO Controlled Grid. A wind generating plant shall remain interconnected during such a fault on the ~~transmission system~~ ISO Controlled Grid for a voltage level as low as zero volts, as measured at the high voltage side of the wind GSU.
2. This requirement does not apply to faults that would occur between the wind generator terminals and the high side of the GSU.
3. Wind generating plants may be tripped after the fault period if this action is intended as part of a special protection system.
4. Wind generating plants may meet the LVRT requirements of this standard by the performance of the generators or by installing additional equipment (e.g., Static VAR Compensator) within the wind generating plant or by a combination of generator performance and additional equipment.
5. Existing individual generator units that are, or have been, interconnected to the ~~network~~ ISO Controlled Grid at the same location at the effective date of the Appendix GH LVRT Standard are exempt from meeting the Appendix GH LVRT Standard for the remaining life of the existing generation equipment. Existing individual generator units that are replaced are required to meet the Appendix GH LVRT Standard.

## ii. Power Factor Design Criteria (Reactive Power)

A wind generating plant shall ~~maintain operate within~~ a power factor within the range of 0.95 leading to 0.95 lagging, measured at the Point of Interconnection as defined in this LGIA ~~in order to maintain a specified voltage schedule~~, if the ~~Transmission Provider's Interconnection~~ System Impact Study shows that such a requirement is necessary to ensure safety or reliability. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors, ~~or a combination of the two~~, if agreed to by the ~~Transmission Provider~~ Participating TO and ISO, ~~or a combination of the two~~. The Interconnection Customer shall not disable power factor equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the ~~Interconnection~~ System Impact Study shows this to be required for system safety or reliability.

## iii. Supervisory Control and Data Acquisition (SCADA) Capability

The wind plant shall provide SCADA capability to transmit data and receive instructions from the ~~Transmission Provider~~ Participating TO and ISO to protect system reliability. The ~~Transmission Provider~~ Participating TO and ISO and the wind plant Interconnection Customer shall 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.

## Certificate of Service

I hereby certify that I have this day served a copy of this document upon all parties listed on the official service list compiled by the Secretary in the above-captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated this 18<sup>th</sup> day of January, 2006 at Folsom in the State of California.



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Grant Rosenblum  
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