October 14, 2016

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: California Independent System Operator Corporation
Docket No. ER17-_____-000
Compliance with Order No. 827 and Order No. 828

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this filing to comply with Commission Order No. 827[1] and Order No. 828.[2] These orders establish new interconnection requirements for non-synchronous resources to provide reactive power capability as well as frequency and voltage ride through capability for all small generating facilities. The CAISO asks that the Commission accept this filing in compliance with these orders.

I. Introduction

Commission Order No. 827 and Order No. 828 take a positive step to ensure that non-synchronous resources and small generating facilities seeking to interconnect to the transmission system provide essential reliability services as a condition of interconnection. Order No. 827 eliminates the exemption for wind generators from the requirement to provide reactive power by revising the Commission's *pro forma* interconnection agreements. Order No. 827 also requires all newly interconnecting non-synchronous generators to provide reactive power at the high-side of the generator substation as a condition of interconnection. The final rule adopted by Order No. 827 became effective September 21, 2016.

Order No. 828 modifies the Commission's *pro forma* small generating interconnection agreement to require newly interconnecting small generating facilities to ride through abnormal frequency and voltage events comparable to large generating

[1] *Reactive Power Requirements for Non-Synchronous Generation*, 155 FERC ¶ 61,277 (2016) (Order No. 827). Published in the Federal Register on June 23, 2016. Federal Register Vol. 81, No. 121, pp. 40793-40809.

[2] *Requirements for Frequency and Voltage Ride Through Capability of Small Generating Facilities*, 156 FERC ¶ 61,062 (July 2016) (Order No. 828). Published in the Federal Register on August 1, 2016. Federal Register Vol. 81, No. 147, pp. 50290-50298.

facilities. The final rule adopted by Order No. 828 became effective October 5, 2016. Order No. 828 also directed that transmission providers submit compliance filings for Order No. 827 and No. 828 in one combined filing.[3] On August 8, 2016, the Commission issued a notice of extension of compliance dates for transmission providers to submit this compliance filing on or before October 14, 2016.[4]

II. Overview of Order No. 827 and Order No. 828

A. Order No. 827

In Order No. 827, the Commission adopted a final rule establishing reactive power requirements for non-synchronous resources. Under the final rule, newly interconnecting non-synchronous generators that have not yet executed a facilities study agreement as of the effective date of the final rule must provide dynamic reactive power within the range of 0.95 leading to 0.95 lagging at the high-side of the generator substation.[5] This change eliminates the need for public utility transmission providers to assess whether these resources must provide reactive power as a condition of interconnection through system impact studies.

Order No. 827 does not apply these requirements to existing resources making upgrades to their generating facilities.[6] Instead, Order No. 827 states that these resources will be exempt from the requirement to provide reactive power unless the transmission provider's system impact study shows that provision of reactive power by that resource is necessary to ensure safety or reliability.[7] Order No. 827 states that if a system impact study shows the need for reactive power because of an upgrade, the transmission provider may require reactive power capability consistent with the needs identified in the study, including the ability to apply reactive power requirements of Order No. 827 to all of the generator's capacity.[8] Order No. 827 directs transmission providers to propose, as part of their compliance filings, tariff revisions to assess reactive power needs from existing non-synchronous generators making upgrades to their generating facilities that require new interconnection requests.[9] In response to Order No. 827, the CAISO requested timely clarification or, in the alternative, rehearing of this requirement for existing resources.[10]

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3 Order No. 828 at P 45.

4 http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14325792

5 *Id.* at PP 22-25 and PP 34-38.

6 *Id.* at P 65.

7 *Id.*

8 *Id.* at P 66.

9 *Id.* at P 67.

10 *See* CAISO Motion for Clarification or, in the Alternative, Rehearing dated July 18, 2016. http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14311431

Specifically, the CAISO requested that the Commission clarify that a repowering of an existing non-synchronous facility that requires new inverters and an interconnection study constitutes a newly interconnecting facility under Order No. 827. On October 3, 2016, the Commission issued an order granting in part and rejecting in part the CAISO's motion.[11] In its *Order on Clarification and Rehearing,* the Commission clarified that Order No. 827 does not preclude a public utility transmission provider from seeking to adopt a tariff provision defining "newly interconnecting non-synchronous generator" as including a repowering of an existing a repowering of an existing generator as part of its compliance filing.[12] The Commission stated that any such tariff revisions must be sufficiently detailed and narrow to define what constitutes a repowering of an existing generator capable of providing reactive power.[13]

Order No. 827 proposes revisions to the Commission's *pro forma* large and small generator interconnection agreements to implement the adopted requirements. However, Order No. 827 also recognizes the need for potential variations to this language and directs that transmission providers proposing variations to justify them in their compliance filings.[14]

B. Order No. 828

In Order No. 828, the Commission adopted a final rule establishing frequency and voltage ride through capabilities for small generating facilities. Under the final rule, generating facilities of no more than 20 MW must design their facilities to ride through abnormal frequency and voltage events and not disconnect during such events. Transmission providers must apply ride through settings to small generating facilities on a comparable basis with large generating facilities interconnecting to their systems.[15]

Order No. 828 proposes revisions to the Commission's *pro forma* small generating interconnection agreement to implement the adopted requirements. However, Order No. 828 also recognizes the need for potential variations to this language and directs that

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[11] *Reactive Power Requirements for Non-Synchronous Generation*, RM16-1, 157 FERC 61,003 (2016) (*Order on Clarification and Rehearing*). http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14368466

[12] *Order on Clarification and Rehearing* at P 8.

[13] *Id.*

[14] *Order No. 827* at PP 68-69. Order no. 827 states in part: "We apply here all three of the methods for proposing variations adopted in Order No. 2003: (1) variations based on Regional Entity reliability requirements; (2) variations that are "consistent with or superior to" the Final Rule; and (3) "independent entity variations" from ISOs/RTOs."

[15] Order No. 828 at P 21.

transmission providers proposing variations to the requirements of Order No. 828 to justify them in their compliance filings.[16]

III. Tariff revisions to comply with the Commission's Orders

In compliance with the Commission's orders, the CAISO is proposing to incorporate new language into Appendices EE and FF of its tariff, the CAISO's *pro forma* Large Generator Interconnection Agreement and Small Generator Interconnection Agreement. These agreements apply to interconnection requests processed under the CAISO Generator Interconnection and Deliverability Allocation Procedures set forth in Appendix DD of the CAISO's tariff.[17] The CAISO also proposes to revise tariff sections 8 and 25. As explained below, the CAISO's proposed tariff revisions are consistent with, or superior to, the *pro forma* language adopted by Order No. 827 and Order No. 828 or meet the Commission's independent entity variation standard. The CAISO also explains when it will treat a resource making upgrades to its generating facility as a newly interconnecting resource under Order No. 827 and when it will not.

In Section 9.6.1 of Appendix EE and Section 1.8.1 of Appendix FF to the CAISO tariff, the CAISO has incorporated language governing the reactive power requirements for the newly interconnecting resources as set forth in Order No. 827. This language applies the requirements of Order No. 827 to newly interconnecting resources using the queue cluster and fast track interconnection process.[18] This language generally tracks the Commission's *pro forma* language adopted in Order No. 827, although the CAISO has proposed to align the language with existing provisions of the CAISO tariff that already deviate from the Commission's *pro forma* interconnection agreements and processes.

The changes to Appendices EE and FF are consistent with, or are superior to, the language in the Commission's final rule. For example, the CAISO has modified the reference to *transmission provider* to refer instead to the *CAISO* in the *pro forma* language. Additionally, the CAISO uses the term *Asynchronous Generating Facilities* in its tariff. The defined term is consistent with the Commission's use of the term *non-synchronous*

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[16] *Order No. 828* at PP 40-41.

[17] Out of an abundance of caution, the CAISO is also including similar revisions to Appendix BB, Appendix V and Appendix T of the CAISO tariff that apply to interconnection customers remaining in the CAISO serial interconnection process. These changes would apply the requirements of Order No. 827 to interconnection customers for large generating facilities that submit a re-study request on or after September 21, 2016 and to interconnection customers for small generating facilities that execute a facilities study on or after September 21, 2016. These changes would also apply the requirements of Order No. 828 to interconnection customers that execute, or request that an unexecuted small generator interconnection agreement be filed, on or after October 5, 2016.

[18] The CAISO tariff already applies uniform reactive power requirements to interconnection customers using the independent study process. *See generally*, Appendix EE to the CAISO tariff at Appendix H, Section A. iii.

generation.[19] The CAISO has also included proposed tariff language to allow interconnection customers to meet the required power factor range using fixed and switched capacitors *and reactors*, or a combination of the two. This language is more permissive than Order No. 827. Finally, the CAISO has proposed to include the actual effective date of Order No. 827 – September 21, 2016 – to clarify the date on which the language applies to interconnection customers.

Order No. 827 directs that the requirements of the final rule apply to new synchronous resources that execute a facilities study agreement on or after September 21, 2016. The CAISO, however, is proposing to apply the final rule based on whether the interconnection customer has posted interconnection financial security pursuant to Appendix DD of the CAISO tariff section 11.2.2 as of September 21, 2016. The CAISO does not use a facilities study agreement under its queue cluster interconnection process. Instead, interconnection customers post interconnection financial security after the issuance of the final phase I interconnection study for queue cluster projects in order to proceed with a phase II interconnection study. This is a comparable milestone to the execution of a facilities study agreement under FERC's *pro forma* interconnection process. As such, the CAISO's tariff revisions are consistent with Order No. 827 and satisfy the independent entity standard. Effectively, this means that the requirements of Order No. 827 as they relate to newly interconnecting resources in the CAISO will apply to queue cluster 9 and future queue clusters. In addition, the CAISO has included language to clarify that it will treat interconnection customers submitting fast track interconnection requests for asynchronous generating facilities on or after September 21, 2016 as newly interconnecting resources under Order No. 827.

In connection with its compliance with Order No. 827, the CAISO is also proposing minor changes to Section 8.2.3.3 of its tariff. These changes clarify that all participating generators shall maintain the CAISO specified voltage schedule if required under their interconnection agreements, while operating within the power factor range specified in their interconnection agreements. This clarification will address concerns about which requirements apply to individual resources. Resources need only operate within the power factor range specified in their interconnection agreement and need not operate to some other power factor range.

For purposes of addressing how Order No. 827 will apply to existing resources that are making upgrades to their resources, the CAISO has proposed new tariff section 25.4.1. This proposed tariff language tracks the requirements of Order No. 827 and the Commission's *Order on Clarification*. The proposed tariff language also recognizes that the CAISO has an established process under existing tariff section 25 that permits existing resources to make modifications to their facilities without the need to undergo an

[19] *See* Appendix A of the CAISO tariff, which defines Asynchronous Generating Facility to mean "An induction, doubly-fed, or electronic power generating unit(s) that produces 60 Hz (nominal) alternating current."

interconnection study process.[20] Under the CAISO's existing tariff, interconnection customers may amend their interconnection agreement in connection with upgrading their generating units without participating in the CAISO's interconnection study process. To do so, they demonstrate that the total capability and electrical characteristics of the resource will remain substantially unchanged. Under these circumstances, the CAISO will not place that request into the interconnection queue, and will not undertake a system impact study.

Under the CAISO's proposed language, upgrades to existing resources that do not require an interconnection study process would not be required to provide reactive power capability as a newly interconnecting resource under Order No. 827. Instead, the existing requirements set forth in the resource's interconnection agreement would apply. In contrast, for interconnection customers making upgrades to their existing resources that do need to undergo an interconnection study process, the CAISO is proposing to treat these repowering projects as newly interconnecting resources under the provisions of Order No. 827. The CAISO's process for assessing whether modifications to an existing resource would require a new interconnection study is a reasonable approach to classify which repowering projects constitute newly interconnecting resources for purposes of Order No. 827. This process, explained in Section 12 of the CAISO's Business Practice Manual for Generator Management, provides a detailed approach for resources to request a review of a proposed repowering as well as evaluation criteria that the CAISO will apply in making an assessment of whether a repowering needs to undergo an interconnection study. The assessment includes a review of whether repowering is changing the resource's fuel source as well as various analytical studies regarding the electrical characteristics of the resource. Based on this evaluation criteria, if an upgrade to a resource substantially changes the total capability and electrical characteristics of the resource, this repowering would constitute a newly interconnecting resource for purposes of Order No. 827.

In Section 1.5.7 of Appendix FF to the CAISO tariff, the CAISO has included language to implement the ride through requirements applicable to small generating facilities adopted in Order No. 828. For purposes of frequency ride through requirements, the CAISO proposes to include comparable language from its current *pro forma* Large Generating Interconnection Agreement. This language recognizes that asynchronous generating resources have specific rules for frequency ride though, as already set forth in Attachment 7 to the CAISO's *pro forma* small generating interconnection agreement. The CAISO is not proposing to change the requirements for asynchronous generating resources on compliance with Order No.828.

For voltage ride through, the CAISO is proposing to adopt the Commission's *pro forma* language as outlined in Order No. 828. This language recognizes that asynchronous generating resources have specific rules for voltage ride through, as already set forth in Attachment 7 to the CAISO's *pro forma* Small Generating Interconnection Agreement. The

[20] *See* CAISO tariff section 25.1.2; *see also* Section 12 of the CAISO's Business Practice Manual for Generator Management.
https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Generator%20Management

CAISO is not proposing to change the requirements for asynchronous generating resources on compliance with Order No.828.

In Attachments A and B to this filing, the CAISO has provided its proposed tariff changes to comply with Order No. 827 and Order No. 828 in both clean and redline formats.

IV. Conclusion

The CAISO requests that the Commission accept the tariff revisions contained in this filing without modification and in full compliance with the Commission's Order No. 827 and Order No. 828. Please contact the undersigned if you have any questions regarding this matter.

Dated: October 14, 2016

Respectfully submitted,

/s/ Andrew Ulmer
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General Counsel
Anthony Ivancovich
Deputy General Counsel
Andrew Ulmer
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CERTIFICATE OF SERVICE

I certify that I have served the foregoing document upon the parties listed on the official service list in the 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 at Folsom, California this 14th day of October, 2016.

/s/ Grace Clark

Grace Clark

Attachment A – Clean Tariff Records

Filing in Compliance with FERC Order No. 827 and Order No. 828

California Independent System Operator Corporation

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8.2.3.3 Voltage Support

The CAISO shall determine on an hourly basis for each day the quantity and location of Voltage Support required to maintain voltage levels and reactive margins within NERC and WECC reliability standards, and any requirements of the NRC using a power flow study based on the quantity and location of scheduled Demand. The PTO or, from time to time, the CAISO shall issue daily voltage schedules (Dispatch Instructions) to Participating Generators, Participating TOs and UDCs, which are required to be maintained for CAISO Controlled Grid reliability. All other Generating Units shall comply with the power factor requirements set forth in contractual arrangements in effect on the CAISO Operations Date, or, if no such contractual arrangements exist and the Generating Unit exists within the system of a Participating TO, the power factor requirements applicable under the Participating TO's TO Tariff or other tariff on file with the FERC.

All Participating Generators shall maintain the CAISO specified voltage schedule if required under their Generator Interconnection Agreement, while operating within the power factor range specified in their interconnection agreements. For all other Generating Units, Participating Generators shall maintain the CAISO specified voltage schedule, while operating within the power factor range specified in their interconnection agreements, or, for Regulatory Must-Take Generation with Existing QF Contracts or Amended QF Contracts, Regulatory Must-Run Generation and Reliability Must-Run Generation, consistent with existing obligations. For Generating Units that do not operate under one of these agreements, the minimum power factor range will be within a band of 0.90 lag (producing VARs) and 0.95 lead (absorbing VARs) power factors. Participating Generators with Generating Units existing at the CAISO Operations Date that are unable to meet this operating power factor requirement may apply to the CAISO for an exemption. Prior to granting such an exemption, the CAISO shall require the Participating TO, UDC or other utility to whose system the relevant Generating Units are interconnected to notify it of the existing contractual requirements for Voltage Support established prior to the CAISO Operations Date for such Generating Units. Such requirements may be contained in CPUC Electric Rule 21 or the

Interconnection Agreement with the Participating TO, UDC or other utility. The CAISO shall not grant any exemption under this Section from such existing contractual requirements. The CAISO shall be entitled to instruct Participating Generators to operate their Generating Units at specified points within their power factor ranges. Participating Generators shall receive no compensation for operating within these specified ranges.

If the CAISO requires additional Voltage Support, it shall procure this either through Reliability Must-Run Contracts or, if no other more economic sources are available**,** by instructing a Generating Unit to move its MVar output outside its mandatory range. Only if the Generating Unit must reduce its MW output in order to comply with such an instruction will it be eligible to recover its opportunity cost in accordance with Section 11.10.1.4.

All Loads directly connected to the CAISO Controlled Grid shall maintain reactive flow at grid interface points within a specified power factor band of 0.97 lag to 0.99 lead. Loads shall not be compensated for the service of maintaining the power factor at required levels within the bandwidth. A UDC interconnecting with the CAISO Controlled Grid at any point other than a Scheduling Point shall be subject to the same power factor requirement.

The CAISO will establish voltage control standards with UDCs and the operators of other Balancing Authority Areas and will enter into operational agreements providing for the coordination of actions in the event of a voltage problem occurring.

* * * *

25.4.1 Asynchronous Generating Faculties–Reactive Power

After September 21, 2016, an existing Asynchronous Generating Facility making upgrades to its Generating Unit(s) that require a new Interconnection Request under Section 25 will provide reactive power capability as described in Section 25.4.1.

The Generating Unit will maintain a composite power delivery at continuous rated power output at the

high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 reactors, or a combination of the two.

After September 21, 2016, an existing Asynchronous Generating Facility making upgrades to its Generating Unit(s) through the Fast Track Process will maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 reactors, or a combination of the two.

After September 21, 2016, an existing Asynchronous Generating Facility making upgrades to its Generating Unit(s) that does not require a new Interconnection Request under Section 25 will provide reactive power capability consistent with requirements of its existing Generator Interconnection Agreement.

* * * *

Appendix T

1.5 Responsibilities of the Parties

1.5.7 For Interconnection Customers that execute or request the executed filing of an SGIA on or after October 5, 2016, the Interconnection Customer shall ensure "frequency ride-through" capability and "voltage ride through" capability of its Small Generating Facility.

Frequency Conditions. The CAISO Controlled Grid is designed to automatically activate a load-shed program as required by the Applicable Reliability Standards and the Applicable Reliability Council in the event of an under-frequency system disturbance. The Interconnection Customer shall implement under-frequency and over-frequency protection set points for the Small Generating Facility as required by Applicable Reliability Standards and the Applicable Reliability Council to ensure "ride through" capability. Small Generating Facility response to

frequency deviations of pre-determined magnitudes, both under-frequency and over-frequency deviations, shall be studied and coordinated with the Participating TO and CAISO in accordance with Good Utility Practice. The term "ride through" as used herein shall mean the ability of a Generating Facility to stay connected to and synchronized with the CAISO Controlled Grid during system disturbances within a range of under-frequency and over-frequency conditions, in accordance with Good Utility Practice. Asynchronous Generating Facilities are subject to the frequency ride through requirements set forth in Attachment 7.

* * * *

1.8 Reactive Power

1.8.1 The Interconnection Customer shall design its Small Generating Facility to maintain a composite power delivery at continuous rated power output at the terminals of each generating unit at a power factor within the range of 0.95 leading to 0.90 lagging, unless the CAISO has established different requirements that apply to all similarly situated generators in the CAISO Balancing Authority Area on a comparable basis. The requirements of this paragraph shall not apply to asynchronous generators and the requirements of Attachment 7 shall apply instead. For Asynchronous Generating Facilities, executing a Facilities Study Agreement on or after September 21, 2016, the Interconnection Customer shall design the Small Generating Facility to maintain power factor criteria in to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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Appendix V

Standard Large Generator Interconnection Agreement

STANDARD LARGE GENERATOR INTERCONNECTION AGREEMENT (LGIA)

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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 CAISO has established different requirements that apply to all generators in the Balancing Authority Area on a comparable basis. Power factor design criteria for wind generators are provided in Appendix H of this LGIA.

For Asynchronous Generating Facilities submitting a written request to continue a re-study under Section 6.4 of Appendix U of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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CAISO TARIFF APPENDIX BB

Standard Large Generator Interconnection Agreement

ARTICLE 9. OPERATIONS

* * * *

9.6 Reactive Power.

9.6.1 Power Factor Design Criteria. For all Generating Facilities other than Asynchronous Generating Facilities, 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 CAISO has established different requirements that apply to all

generators in the Balancing Authority Area on a comparable basis. For Asynchronous Generating Facilities, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria in accordance with Appendix H of this LGIA.

For Asynchronous Generating Facilities submitting a written request to continue a re-study under Section 6.4 of Appendix U of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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Appendix EE

Large Generator Interconnection Agreement

for Interconnection Requests Processed under the Generator Interconnection and Deliverability Allocation Procedures (Appendix DD of the CAISO Tariff)

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9.6 Reactive Power.

9.6.1 Power Factor Design Criteria. For all Generating Facilities other than Asynchronous Generating Facilities, 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 CAISO has established different requirements that apply to all generators in the Balancing Authority Area on a comparable basis. For Asynchronous Generating Facilities, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria in accordance with Appendix H of this LGIA except in the following cases: (a) an Interconnection Customer posts Interconnection Financial Security for an Asynchronous Generating Facility pursuant to Appendix DD of the CAISO Tariff Section 11.2.2 on or after September 21, 2016; or (b) an Interconnection Customer that submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016.

When an Interconnection Customer submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016 the Interconnection Customer will design the Large Generator Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

When an Interconnection Customer submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer will design the Large Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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Appendix FF

Small Generator Interconnection Agreement for Interconnection Requests Processed Under the Generator Interconnection and Deliverability Allocation Procedures (Appendix DD to the CAISO Tariff)

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1.5 Responsibilities of the Parties

1.5.7 For Interconnection Customers that execute or request the executed filing of an SGIA on or after October 5, 2016, the Interconnection Customer shall ensure “frequency ride-through” capability and “voltage ride through” capability of its Small Generating Facility.

Frequency Conditions. The CAISO Controlled Grid is designed to automatically activate a load-shed program as required by the Applicable Reliability Standards and the Applicable Reliability Council in the event of an under-frequency system disturbance. The Interconnection Customer shall implement under-frequency and over-frequency protection set points for the Small Generating Facility as required by Applicable Reliability Standards and the Applicable Reliability Council to ensure “ride through” capability. Small Generating Facility response to frequency deviations of pre-determined magnitudes, both under-frequency and over-frequency deviations, shall be studied and coordinated with the Participating TO and CAISO in accordance with Good Utility Practice. The term "ride through" as used herein shall mean the ability of a Generating Facility to stay connected to and synchronized with the CAISO Controlled Grid during system disturbances within a range of under-frequency and over-frequency conditions, in accordance with Good Utility Practice. Asynchronous Generating Facilities are subject to the frequency ride through requirements set forth in Attachment 7.

Voltage Conditions. The Interconnection Customer shall ensure "voltage ride through" capability of its Small Generating Facility. The Interconnection Customer shall enable these capabilities such that its Small Generating Facility shall not disconnect automatically or instantaneously from the system or equipment of the CAISO and any Affected Systems for an under-voltage or over-voltage condition, as tested pursuant to section 2.1 of this Agreement. The defined conditions shall be in accordance with Good Utility Practice and consistent with any standards and guidelines that are applied to other generating facilities in the Balancing Authority Area on a comparable basis. Asynchronous Generating Facilities are subject to the voltage ride through requirements set forth in Attachment 7.

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1.8 Reactive Power

1.8.1 For synchronous Generating Facilities, the Interconnection Customer shall design its Small Generating Facility to maintain a composite power delivery at continuous rated power output at the terminals of each generating unit at a power factor within the range of 0.95 leading to 0.90 lagging, unless the CAISO has established different requirements that apply to all similarly situated generators in the CAISO Balancing Authority Area on a comparable basis. The requirements of this paragraph shall not apply to Asynchronous Generating Facilities and the requirements of Attachment 7 shall apply instead except in the following cases: (a) an Interconnection Customer posts Interconnection Financial Security for an Asynchronous Generating Facility pursuant to Appendix DD of the CAISO Tariff Section 11.2.2 on or after September 21, 2016; or (b) an Interconnection Customer that submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 16, 2016.

When an Interconnection Customer posts Interconnection Financial Security for an Asynchronous Generating Facility pursuant to Appendix DD of the CAISO Tariff Section 11.2.2 on or after September 21, 2016, the Interconnection Customer will design the Small Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

When an Interconnection Customer submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer will design the Small Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

* * * *

Attachment B – Marked Tariff Records

Filing in Compliance with FERC Order No. 827 and Order No. 828

California Independent System Operator Corporation

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8.2.3.3 Voltage Support

The CAISO shall determine on an hourly basis for each day the quantity and location of Voltage Support required to maintain voltage levels and reactive margins within NERC and WECC reliability standards, and any requirements of the NRC using a power flow study based on the quantity and location of scheduled Demand. The PTO or, from time to time, the CAISO shall issue daily voltage schedules (Dispatch Instructions) to Participating Generators, Participating TOs and UDCs, which are required to be maintained for CAISO Controlled Grid reliability. All other Generating Units shall comply with the power factor requirements set forth in contractual arrangements in effect on the CAISO Operations Date, or, if no such contractual arrangements exist and the Generating Unit exists within the system of a Participating TO, the power factor requirements applicable under the Participating TO's TO Tariff or other tariff on file with the FERC.

All Participating Generators ~~that operate Asynchronous Generating Facilities subject to the Large Generator Interconnection Agreement set forth in Appendix BB or CC~~ shall maintain the CAISO specified voltage schedule if required under ~~Appendix H of~~ their ~~Large~~ Generator Interconnection Agreement, while operating within the power factor range specified in their interconnection agreements. For all other Generating Units, Participating Generators shall maintain the CAISO specified voltage schedule ~~at the Generating Unit terminals to the extent possible~~, while operating within the power factor range specified in their interconnection agreements, or, for Regulatory Must-Take Generation with Existing QF Contracts or Amended QF Contracts, Regulatory Must-Run Generation and Reliability Must-Run Generation, consistent with existing obligations. For Generating Units that do not operate under one of these agreements, the minimum power factor range will be within a band of 0.90 lag (producing VARs) and 0.95 lead (absorbing VARs) power factors. Participating Generators with Generating Units existing at the CAISO Operations Date that are unable to meet this operating power factor requirement may apply to the CAISO for an exemption. Prior to granting such an exemption, the CAISO shall require the Participating TO, UDC or other utility to whose system the relevant Generating Units are interconnected to notify it of

the existing contractual requirements for Voltage Support established prior to the CAISO Operations Date for such Generating Units. Such requirements may be contained in CPUC Electric Rule 21 or the Interconnection Agreement with the Participating TO, UDC or other utility. The CAISO shall not grant any exemption under this Section from such existing contractual requirements. The CAISO shall be entitled to instruct Participating Generators to operate their Generating Units at specified points within their power factor ranges. Participating Generators shall receive no compensation for operating within these specified ranges.

If the CAISO requires additional Voltage Support, it shall procure this either through Reliability Must-Run Contracts or, if no other more economic sources are available**,** by instructing a Generating Unit to move its MVar output outside its mandatory range. Only if the Generating Unit must reduce its MW output in order to comply with such an instruction will it be eligible to recover its opportunity cost in accordance with Section 11.10.1.4.

All Loads directly connected to the CAISO Controlled Grid shall maintain reactive flow at grid interface points within a specified power factor band of 0.97 lag to 0.99 lead. Loads shall not be compensated for the service of maintaining the power factor at required levels within the bandwidth. A UDC interconnecting with the CAISO Controlled Grid at any point other than a Scheduling Point shall be subject to the same power factor requirement.

The CAISO will establish voltage control standards with UDCs and the operators of other Balancing Authority Areas and will enter into operational agreements providing for the coordination of actions in the event of a voltage problem occurring.

* * * *

25.4.1 Asynchronous Generating Faculties–Reactive Power

After September 21, 2016, an existing Asynchronous Generating Facility making upgrades to its Generating Unit(s) that require a new Interconnection Request under Section 25 will provide reactive

power capability as described in Section 25.4.1.

The Generating Unit will maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 reactors, or a combination of the two.

After September 21, 2016, an existing Asynchronous Generating Facility making upgrades to its Generating Unit(s) through the Fast Track Process will maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 reactors, or a combination of the two.

After September 21, 2016, an existing Asynchronous Generating Facility making upgrades to its Generating Unit(s) that does not require a new Interconnection Request under Section 25 will provide reactive power capability consistent with requirements of its existing Generator Interconnection Agreement.

* * * *

Appendix T

1.5 Responsibilities of the Parties

1.5.7 ~~[This provision is intentionally omitted.]~~ For Interconnection Customers that execute or request the executed filing of an SGIA on or after October 5, 2016, the Interconnection Customer shall ensure “frequency ride-through” capability and “voltage ride through” capability of its Small Generating Facility.

Frequency Conditions. The CAISO Controlled Grid is designed to automatically activate a load-shed program as required by the Applicable Reliability Standards and the Applicable Reliability Council in the event of an under-frequency system

disturbance. The Interconnection Customer shall implement under-frequency and over-frequency protection set points for the Small Generating Facility as required by Applicable Reliability Standards and the Applicable Reliability Council to ensure “ride through” capability. Small Generating Facility response to frequency deviations of pre-determined magnitudes, both under-frequency and over-frequency deviations, shall be studied and coordinated with the Participating TO and CAISO in accordance with Good Utility Practice. The term "ride through" as used herein shall mean the ability of a Generating Facility to stay connected to and synchronized with the CAISO Controlled Grid during system disturbances within a range of under-frequency and over-frequency conditions, in accordance with Good Utility Practice. Asynchronous Generating Facilities are subject to the frequency ride through requirements set forth in Attachment 7.

* * * *

1.8 Reactive Power

1.8.1 The Interconnection Customer shall design its Small Generating Facility to maintain a composite power delivery at continuous rated power output at the terminals of each generating unit at a power factor within the range of 0.95 leading to 0.90 lagging, unless the CAISO has established different requirements that apply to all similarly situated generators in the CAISO Balancing Authority Area on a comparable basis. The requirements of this paragraph shall not apply to asynchronous generators and the requirements of Attachment 7 shall apply instead. For Asynchronous Generating Facilities, executing a Facilities Study Agreement on or after September 21, 2016, the Interconnection Customer shall design the Small Generating Facility to maintain power factor criteria in to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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Appendix V

Standard Large Generator Interconnection Agreement

STANDARD LARGE GENERATOR INTERCONNECTION AGREEMENT (LGIA)

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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 CAISO has established different requirements that apply to all generators in the Balancing Authority Area on a comparable basis. Power factor design criteria for wind generators are provided in Appendix H of this LGIA.

For Asynchronous Generating Facilities submitting a written request to continue a re-study under Section 6.4 of Appendix U of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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CAISO TARIFF APPENDIX BB

Standard Large Generator Interconnection Agreement

ARTICLE 9. OPERATIONS

* * * *

9.6 Reactive Power.

9.6.1 Power Factor Design Criteria. For all Generating Facilities other than Asynchronous Generating Facilities, 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 CAISO has established different requirements that apply to all

generators in the Balancing Authority Area on a comparable basis. For Asynchronous Generating Facilities, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria in accordance with Appendix H of this LGIA.

For Asynchronous Generating Facilities submitting a written request to continue a re-study under Section 6.4 of Appendix U of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

* * * *

Appendix EE

Large Generator Interconnection Agreement

for Interconnection Requests Processed under the Generator Interconnection and Deliverability Allocation Procedures (Appendix DD of the CAISO Tariff)

* * * *

9.6 Reactive Power.

9.6.1 Power Factor Design Criteria. For all Generating Facilities other than Asynchronous Generating Facilities, 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 CAISO has established different requirements that apply to all generators in the Balancing Authority Area on a comparable basis. For Asynchronous Generating Facilities, the Interconnection Customer shall design the Large Generating Facility to maintain power factor criteria in accordance with Appendix H of this LGIA except in the following cases: (a) an Interconnection Customer posts Interconnection Financial Security for an Asynchronous Generating Facility pursuant to Appendix DD of the CAISO Tariff Section 11.2.2 on or after September 21, 2016; or (b) an Interconnection Customer that submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016.

When an Interconnection Customer submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016 the Interconnection Customer will design the Large Generator Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

When an Interconnection Customer submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer will design the Large Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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Appendix FF

Small Generator Interconnection Agreement for Interconnection Requests Processed Under the Generator Interconnection and Deliverability Allocation Procedures (Appendix DD to the CAISO Tariff)

* * * *

1.5 Responsibilities of the Parties

1.5.7 ~~[This provision is intentionally left blank.]~~ For Interconnection Customers that execute or request the executed filing of an SGIA on or after October 5, 2016, the Interconnection Customer shall ensure “frequency ride-through” capability and “voltage ride through” capability of its Small Generating Facility.

Frequency Conditions. The CAISO Controlled Grid is designed to automatically activate a load-shed program as required by the Applicable Reliability Standards and the Applicable Reliability Council in the event of an under-frequency system disturbance. The Interconnection Customer shall implement under-frequency and over-frequency protection set points for the Small Generating Facility as required by Applicable Reliability Standards and the Applicable Reliability Council to ensure “ride through” capability. Small Generating Facility response to frequency deviations of pre-determined magnitudes, both under-frequency and over-frequency deviations, shall be studied and coordinated with the Participating TO and CAISO in accordance with Good Utility Practice. The term "ride through" as used herein shall mean the ability of a Generating Facility to stay connected to and synchronized with the CAISO Controlled Grid during system disturbances within a range of under-frequency and over-frequency conditions, in accordance with Good Utility Practice. Asynchronous Generating Facilities are subject to the frequency ride through requirements set forth in Attachment 7.

Voltage Conditions. The Interconnection Customer shall ensure "voltage ride through" capability of its Small Generating Facility. The Interconnection Customer shall enable these capabilities such that its Small Generating Facility shall not disconnect automatically or instantaneously from the system or equipment of the CAISO and any Affected Systems for an under-voltage or over-voltage condition, as tested pursuant to section 2.1 of this Agreement. The defined conditions shall be in accordance with Good Utility Practice and consistent with any standards and guidelines that are applied to other generating facilities in the Balancing Authority Area on a comparable basis. Asynchronous Generating Facilities are subject to the voltage ride through requirements set forth in Attachment 7.

* * * *

1.8 Reactive Power

1.8.1 For synchronous Generating Facilities, ~~T~~the Interconnection Customer shall design its Small Generating Facility to maintain a composite power delivery at continuous rated power output at the terminals of each generating unit at a power factor within the range of 0.95 leading to 0.90 lagging, unless the CAISO has established different requirements that apply to all similarly situated generators in the CAISO Balancing Authority Area on a comparable basis. The requirements of this paragraph shall not apply to ~~a~~Asynchronous Generating Facilities ~~generators~~ and the requirements of Attachment 7 shall apply instead except in the following cases: (a) an Interconnection Customer posts Interconnection Financial Security for an Asynchronous Generating Facility pursuant to Appendix DD of the CAISO Tariff Section 11.2.2 on or after September 21, 2016; or (b) an Interconnection Customer that submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 16, 2016.

When an Interconnection Customer posts Interconnection Financial Security for an Asynchronous Generating Facility pursuant to Appendix DD of the CAISO Tariff Section 11.2.2 on or after September 21, 2016, the Interconnection Customer will design the Small Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

When an Interconnection Customer submits an Interconnection Request for an Asynchronous Generating Facility under the Fast Track Process pursuant to Appendix DD of the CAISO Tariff on or after September 21, 2016, the Interconnection Customer will design the Small Generating Facility to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation at a power factor within the range of 0.95 leading to 0.95 lagging, unless the CAISO has established a different power factor range that applies to all Asynchronous Generating Facilities on a

comparable basis. This power factor range standard shall be dynamic and can be met 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 and reactors, or a combination of the two.

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