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California ISO
Direct Telemetry and Metering Requirement for Non-Generator
Resources
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Revision History

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1. Purpose

The purpose of this document is to clarify CAISO's requirement regarding the direct telemetry and revenue meter requirements for non-generator resources (NGR) when they are providing ancillary services. Under these requirements, various NGR modeling options to allow the physical resources to provide ancillary services are also discussed in this document.

Non-generator resources (NGR) can operate as either generation or load that can be continuously dispatched within its entire capacity range. As such, upon certification, these resources can provide ancillary services to CAISO by accurately responding to a CAISO dispatch signals either through an ADS dispatch or an EMS AGC signal.

2. Direct Telemetry and Metering

When a NGR is awarded ancillary service capacity either in day-ahead or real-time, its awarded capacity is counted towards CAISO's ancillary service requirement which is set based on NERC standard. Furthermore, these capacities can be dispatched in real-time. There are two categories;

2.1. Dispatch into Spin and/or Non-Spin

For non contingent Spin or Non-spin, CAISO real-time dispatch (RTD) can dispatch into a resource's non contingent spin or non-spin capacity range if it is economic to do so;
For contingent Spin or Non-Spin, CAISO's contingency run (RTCD) can dispatch into a resource's contingent spin or non-spin capacity range if it is economic to do so.

These dispatch signals are sent to ADS inclusive of the Spin/Non-spin energy components. The spin/non-spin components are used to tell how much spin/non-spin capacity that has been dispatched into for this resource. CAISO expects that the unit does respond with that capacity dispatch. These capacity dispatches are also incorporated into CAISO EMS available reserve calculation.

The main point here is that, CAISO does need to make sure that, when we dispatch, for example, 0.5MW of Spin from a NGR resource, that NGR resource can respond with 0.5MW spin energy for the corresponding interval to ensure reliability of the grid. To do this, ISO will need to know what is the telemetry corresponding to that particular resource capable of providing the reserve, not the entire meter of the physical device itself.

Separately from the operational perspective, CAISO will also use the revenue meter from the NGR resource to evaluate whether this resource has responded or can potentially respond to a Spin/Non-spin dispatch after the fact. This evaluation can lead to the Spin/Non-spin No Pay. To evaluate this No Pay quantity, ISO will need to know what is the delivered meters corresponding to that particular resource capable of providing the reserve, not the entire meter of the physical device itself.

2.2. Dispatches for Regulation Services

For NGR awarded regulation up or down capacities, CAISO's EMS AGC module will use that to determine the appropriate AGC signal to be sent to the NGR in real-time. Such AGC signals are expected to be followed every 4 seconds. The real-time telemetry (Point of Delivery) is used to monitor the individual unit's response to AGC in this case. As such, ISO must have measured MW quantity and proper visibility at the point of delivery. There should not be any logical telemetry calculation that can be used for regulation. As such, the telemetry of the entire physical device may not be sufficient for real time control.

Separate from the operational perspective, CAISO will also use the telemetry and revenue meter from the NGR resource to evaluate whether this resource have responded or can potentially respond to an AGC. This is the Regulation Performance Monitoring. To evaluate this No Pay quantity, ISO will need to know what the telemetry is and the delivered meters corresponding to that particular resource capable of providing the regulation, not the entire meter of the physical device itself.

3. Modeling Alternatives

Under the direct telemetry and metering requirement, there can be some alternative options for market participants to utilize the NGR model. Following examples are used to illustrate the concept. However, these examples shall not be used as CAISO's direction on any particular business practice.

Example 1

Assuming that there are five battery devices with 0.5MW capacity each, if two batteries are used to smooth a solar device 5MW (0-5MW) providing energy to CAISO and the other three are used to provide regulation capacity to CAISO, then

Register two resources to CAISO,

Resource 1 (with Solar + 2 batteries as a generator): Telemetry and metering on the Solar and 2 batteries together. As an example, the maximum capacity shall be 6MW and its minimum capacity shall be 0MW;

- Assuming that the unit does not intend to consume energy off the grid, otherwise, it shall be modeled as a NGR LESR.

Resource 2 (3 Batteries as a NGR LESR): Telemetry and metering on the three batteries together. As an example, the maximum capacity shall be 1.5MW and the minimum capacity shall be -1.5MW.

Example 2

Assuming that there are a demand respond resource that its load can be changed between 2MW and 5MW (demands) and five battery devices with 0.5MW capacity each, if two batteries are used to smooth the demand response providing real-time energy to CAISO and the other three are used to provide regulation capacity to CAISO,

Register two resources to CAISO,

Resource 1 (with the demand response + 2 Batteries as a NGR DDR): Telemetry and metering on the Demand Response and 2 batteries together. As an example, the maximum capacity shall be -1MW and its minimum capacity shall be -6MW;

Resource 2 (3 Batteries as a NGR LESR): Telemetry and metering on the three batteries together. As an example, the maximum capacity shall be 1.5MW and its minimum capacity shall be -1.5MW.

Example 3

Assuming that there is a demand response resource that its load can be changed between 2MW and 5MW (demands) and another demand response can be changed between 1MW and 3MW, And the intent is to offer regulation capacity to CAISO from both of them, then

Register one resource to CAISO,

Resource 1 (with the two demand responses combined as a NGR DDR): Telemetry and metering on the two demand responses together. As an example, the maximum capacity shall be -3MW and its minimum capacity shall be -8MW.

4. Relevant Tariff and Business Process Manual

Following are the relevant tariff and business process manual that support the need of direct telemetry and metering when unit is providing ancillary service.

4.1. Certification and Compliance of Ancillary Service (Tariff Section)

Following sections state the need to provide direct response to the ancillary service range both in the certification process and the compliance to CAISO dispatch to ancillary services.

REM Tariff Filing, Appendix K,

Part A, CERTIFICATION FOR REGULATION

A 7 Design, acquisition, and installation of the CAISO-approved communication and control equipment shall be under the control of the CAISO. The CAISO shall bear no cost responsibility or functional responsibility for such equipment, except that the CAISO shall arrange for and monitor the maintenance of the communication and control system at the Ancillary Service Provider's expense, unless otherwise agreed by the CAISO and the Ancillary Service Provider. The CAISO shall be responsible for the design, acquisition and installation of any necessary modifications to the CAISO EMS at its own cost.

A10

Testing shall be performed by the CAISO, with the cooperation of the Ancillary Service Provider. Such tests shall include, but not be limited to, the following:

- (a) confirmation of control communication path performance;



- (b) confirmation of voice circuit for receipt of Dispatch Instructions;
- (c) confirmation of the resource’s control performance; and
- (d) confirmation of the CAISO EMS control to include changing the resource operating level over the range of Regulation proposed at different set points, from minimum to maximum, and at different rates of change from the minimum to the maximum permitted by the design of the resource.

Part B CERTIFICATION FOR SPINNING RESERVE

B 12.3 confirmation of the resource performance to include changing the resource’s real power over the range of Spinning Reserve proposed from minimum to maximum, and at different rates of change from the minimum to the maximum permitted by the design of the resource; and

PART C CERTIFICATION FOR NON-SPINNING RESERVE

C 13.4 confirmation of the range of resource control to include changing the real power (MW) over the range of Non-Spinning Reserve proposed.

From existing tariff,

7.6.1 Actions For Maintaining Reliability Of CAISO Controlled Grid

The CAISO shall obtain the control over Generating Units that it needs to control the CAISO Controlled Grid and maintain reliability by ensuring that sufficient Energy and Ancillary Services are procured through the CAISO Markets. When the CAISO responds to events or circumstances, it shall first use the generation control it is able to obtain from the Energy and Ancillary Services Bids it has received to respond to the operating event and maintain reliability. Only when the CAISO has used the Energy and Ancillary Services that are available to it under such Energy and Ancillary Services Bids which prove to be effective in responding to the problem and the CAISO is still in need of additional control over Generating Units, shall the CAISO assume supervisory control over other Generating Units. It is expected that at this point, the operational circumstances will be so severe that a Real-Time system problem or emergency condition could be in existence or imminent.

Each Participating Generator shall take, at the direction of the CAISO, such actions affecting such Generator as the CAISO determines to be necessary to maintain the reliability of the CAISO Controlled Grid. Such actions shall include (but are not limited to):

- (a) compliance with Dispatch Instructions including instructions to deliver Energy and Ancillary Services in Real-Time pursuant to the AS Awards, Day-Ahead Schedules and HASP Intertie Schedules, and HASP AS Awards;
- (b) compliance with the system operation requirements set out in this Section 7;
- (c) notification to the CAISO of the persons to whom an instruction of the CAISO should be directed on a 24-hour basis, including their telephone and facsimile numbers; and
- (d) the provision of communications, telemetry and direct control requirements, including the establishment of a direct communication link from the control room of the Generator to the CAISO in a manner that ensures that the CAISO will have the ability, consistent with this CAISO Tariff, to direct the operations of the Generator as necessary to maintain the reliability of the CAISO Controlled Grid, except that a Participating Generator will be exempt from CAISO requirements imposed in accordance with this

subsection (d) with regard to any Generating Unit with a rated capacity of less than ten (10) MW, unless that Generating Unit is certified by the CAISO to provide Ancillary Services.

4.2. Settlement Quality Meter (Tariff Section)

10.3.2.1 Duty to Provide Settlement Quality Meter Data

Scheduling Coordinators shall be responsible for: (i) the collection of Meter Data for the Scheduling Coordinator Metered Entities it represents; (ii) the provision of Settlement Quality Meter Data to the CAISO; and (iii) ensuring that the Settlement Quality Meter Data supplied to the CAISO meets the requirements of Section 10. Scheduling Coordinators shall provide the CAISO with Settlement Quality Meter Data for all Scheduling Coordinator Metered Entities served by the Scheduling Coordinator no later than the day specified in Section 10.3.6. Each Scheduling Coordinator for a Demand Response Provider shall aggregate the Settlement Quality Meter Data of the underlying Proxy Demand Resource to the level of the registration configuration of the Proxy Demand Resource in the Demand Response System. Settlement Quality Meter Data for Scheduling Coordinator Metered Entities shall be either (1) an accurate measure of the actual consumption of Energy by each Scheduling Coordinator Metered Entity in each Settlement Period; (2) for Scheduling Coordinator Metered Entities connected to a UDC Distribution System and meeting that Distribution System's requirement for Load profiling eligibility, a profile of that consumption derived directly from an accurate cumulative measure of the actual consumption of Energy over a known period of time and an allocation of that consumption to Settlement Periods using the applicable Approved Load Profile; or (3) an accurate calculation by the Scheduling Coordinator representing entities operating pursuant to Existing Contracts.

10.1.3.1 Permitted Netting

CAISO Metered Entities and Scheduling Coordinators may, when providing Meter Data to the CAISO, net MWh values for Generating Unit output and auxiliary Load equipment electrically connected to that Generating Unit at the same point provided that the Generating Unit is on-line and is producing sufficient output to serve all of that auxiliary Load equipment. For example, where a Generating Unit's auxiliary Load equipment is served via a distribution line that is separate from the switchyard to which the Generating Unit is connected, that Generating Unit and auxiliary Load equipment will not be considered to be electrically connected at the same point.

10.1.3.2 Prohibited Netting

CAISO Metered Entities or Scheduling Coordinators may not net values for Generating Unit output and Load. CAISO Metered Entities or Scheduling Coordinators that serve third party Load connected to a Generating Unit's auxiliary system must add that third party Load to the Generating Unit's output. The CAISO Metered Entity may add that third party Load to the Generating Unit's output either by means of a hard wire local meter connection between the metering systems of the third party Load and the Generating Unit or by requesting the CAISO to use RMDAPS to perform the addition. Scheduling Coordinators representing Scheduling Coordinator Metered Entities that serve third party Load connected California Independent System Operator Corporation Fifth Replacement FERC Electric Tariff April 1, 2011

to the auxiliary system of a Generating Unit must ensure that those Scheduling Coordinator Metered Entities add the Energy consumed by such third parties to that Generating Unit's output so as to ensure proper settlement of that Generating Unit's gross output. The CAISO Metered Entity or the Scheduling

Coordinator must ensure that the third party Load has Metering Facilities that meet the standards referred to in this Section 10 and the Business Practice Manuals.

5. Minimum Point Requirement (BPM for Direct Telemetry)

5.1. Telemetry Data Points List

The following values are the minimum requirements for real-time visibility of each resource. The CAISO's Operations & Engineering groups have approved these requirements. They are the minimum standards that will allow the CAISO to manage effectively the reliability of the grid. At any time, the CAISO may require additional points to be added to meet real-time requirements. The following points must be provided for each resource in the specified category. The resource owner must obtain the required point list from a CAISO RIG Engineer.

5.2. Points Matrix

The following pages represent the minimum point requirement matrix for each type of RIG configuration that the CAISO requires for real-time control or monitoring. The matrix specifies the telemetry points required for the following categories of resources:

AGC: Resources certified to provide Regulation in the CAISO Markets.

Spinning Reserve: Resources certified to provide Spinning Reserve in the CAISO Markets.

Non-Spinning Reserve: Resources certified to provide Non-Spinning Reserve in the CAISO Markets.

QF Conversion: Resources that are Qualifying Facilities not exempt from CAISO Tariff telemetry requirements pursuant to pre-existing agreements. Note that MW, MVAR, and voltage values are measured based on the Point of Demarcation for a Net Scheduled QF subject to a QF PGA.

Energy Only: Resources that provide Energy only.

PDR: Proxy Demand Resources.

Solar: Solar resources.

Wind: Wind resources.

If a resource falls within more than one category, the resource owner or RIG Aggregator must provide the telemetry points specified for each applicable category.

Section 17 has the detailed definitions for the following point matrix.

Direct Telemetry Requirement for Non-Generator Resources

Analogs	AGC	Spinning Reserve	Non-Spinning Reserve	QF Conversion	Energy Only	PDR	Solar	Wind
Unit Gross MW	X	X	X	X Note9	X	X Note10	X	X
Unit Net MW	X Note1	X Note1	X Note1	X Note1 & 9	X Note1		XNote1	
Unit Point of delivery MW	X	X	X	X	X		X	X
Unit Auxiliary MW	X Note2	X Note2	X Note2	X Note2 & 9	X Note2		XNote1	
Pseudo Gen MW						X		
Storage Energy Limit(SOC) in MWh	X							
Bias Load MW						X		
Unit Generator Terminal Voltage	X	X	X	X	X		X	X
Unit Gross MVAR	X	X	X	XNote9	X		X	X
Unit Net MVAR	X Note3	X Note3	X Note3	X Note3 & 9	X Note3		XNote3	
Point of delivery MVAR	X	X	X	X	X		X	X
Auxiliary MVAR	X Note4	X Note4	X Note4	X Note4 & 9	X Note4		XNote3	
Capacitor Bank VAR							X	X
High\Line Side Bank MW	X Note5	X Note5	X Note5	X Note5	X Note5		X	X
High\Line Side Bank MVAR	X Note5	X Note5	X Note5	X Note5	X Note5		X	X
High\Line Side Bank Voltage	X Note5	X Note5	X Note5	X Note5	X Note5		X	X
Aggregated Gross MW	X Note6	X Note6	X Note6	X Note9	X Note6	X Note10		
Aggregated Net MW	X Note6	X Note6	X Note6	X Note9	X Note6			
Aggregated Point of delivery MW	X Note6	X Note6	X Note6	X Note6	X Note6			
Aggregated Gross MVAR	X Note6	X Note6	X Note6	X Note6	X Note6			
Resource ID Setpoint Feedback	X							
RIG Heart Beat	X	X	X	X	X	X	X	X
Analogs	AGC	Spinning Reserve	Non-Spinning Reserve	QF Conversion	Energy Only	PDR	Solar	Wind
Unit Gross MW	X	X	X	X Note9	X	X Note10	X	X
Unit Net MW	X Note1	X Note1	X Note1	X Note1 & 9	X Note1		XNote1	
Unit Point of delivery MW	X	X	X	X	X		X	X
Unit Auxiliary MW	X Note2	X Note2	X Note2	X Note2 & 9	X Note2		XNote1	
Pseudo Gen MW						X		
Bias Load MW						X		

Direct Telemetry Requirement for Non-Generator Resources

Unit Generator Terminal Voltage	X	X	X	X	X		X	X
Unit Gross MVAR	X	X	X	XNote9	X		X	X
Unit Net MVAR	X Note3	X Note3	X Note3	X Note3 & 9	X Note3		XNote3	
Point of delivery MVAR	X	X	X	X	X		X	X
Auxiliary MVAR	X Note4	X Note4	X Note4	X Note4 & 9	X Note4		XNote3	
Capacitor Bank VAR							X	X
High\Line Side Bank MW	X Note5	X Note5	X Note5	X Note5	X Note5		X	X
High\Line Side Bank MVAR	X Note5	X Note5	X Note5	X Note5	X Note5		X	X
High\Line Side Bank Voltage	X Note5	X Note5	X Note5	X Note5	X Note5		X	X
Aggregated Gross MW	X Note6	X Note6	X Note6	X Note9	X Note6	X Note10		
Aggregated Net MW	X Note6	X Note6	X Note6	X Note9	X Note6			
Aggregated Point of delivery MW	X Note6	X Note6	X Note6	X Note6	X Note6			
Aggregated Gross MVAR	X Note6	X Note6	X Note6	X Note6	X Note6			
Resource ID Setpoint Feedback	X							
RIG Heart Beat	X	X	X	X	X	X	X	X

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Direct Telemetry Requirement for Non-Generator Resources

Analogs	AGC	Spinning Reserve	Non-Spinning Reserve	QF Conversion	Energy Only	PDR	Solar	Wind
Aggregate\Unit Operating High Limit	X							
Aggregate\Unit Operating Low Limit	X							
Wind Speed (Meter / Second)							X	X
Wind Direction (Degrees - Zero North 90CW)							X	X
Air Temperature (Degrees Celsius)							X	X
Barometric Pressure (HPA)							X	X
Back Panel Temperature (Degree C)							X Note11	
Plane Of Array Irradiance Watts\Meter Sq.							X Note11	
Global Horizontal Irradiance Watts\Meter Sq.							X Note11	
Direct Irradiance Watts\Meter Sq.							X Note11	
Diffused Plane Of Array Irradiance Watts\Meter Sq.							X Note11	
Diffused Global Horizontal Irradiance Watts\Meter Sq.							X Note11	
Reference Cell (MW @ .001 resolution)							X Note11	

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Direct Telemetry Requirement for Non-Generator Resources

Digitals	AGC	Spinning Reserve	Non-Spinning Reserve	QF Conversion	Energy Only	PDR	Solar	Wind
Unit\Resource Connect	X	X	X	X	X		X	X
PDR Resource Connect						X		
Power System Stabilizer	X Note 7	X Note 7	X Note 7	X Note 7	X Note 7			
Automatic Voltage Regulator	X Note 7	X Note 7	X Note 7	X Note 7	X Note 7		X Note 7	
Capacitor Bank Breakers							X	X
Unit Low Side Breaker	X	X	X	X	X		X	X
Related Unit Breakers	X	X	X	X	X		X	X
Related Unit MOD's Disconnects	X	X	X	X	X		X	X
Data Port Alarms	X	X	X	X	X	X	X	X
Switchyard Line Breakers (if Generator Owned)	X	X	X	X	X		X	X
Switchyard Line MOD (if Generator Owned)	X	X	X	X	X		X	X
Aggregated\Unit Connected	X Note6	X Note6	X Note6	X Note6	X Note6	X Note6		
Aggregated\Unit Authority Switch	X Note8							
Aggregated\Unit Control Switch	X Note8							
Aggregated\Unit Automatic Generation Control	X Note8							
Aggregated\Unit Ready To Start			X			X		
Aggregated\Unit Start			X			X		