

Submitted By	Company	Date Submitted
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NRG Energy, Inc. (“NRG”) submits the following comments on the CAISO’s March 5, 2015 *Issue Paper and Straw Proposal: Reactive Power Requirements for Asynchronous Resources* (“IPSP”).

The CAISO proposes to apply the following requirements:

1. *Technical requirements for Asynchronous Generating Facilities:*

- a. *An Asynchronous Generating Facility shall be designed to have an over-excited (lagging) reactive power producing capability to achieve a net power factor from 0.95 lagging up to unity power factor at the Point of Interconnection, at the Generating Facility’s maximum real power capability.*
- b. *An Asynchronous Generating Facility shall be designed to have an under-excited (leading) reactive power absorbing capability to achieve a net power factor from 0.95 leading up to unity power factor at the Point of Interconnection, at the Generating Facility’s maximum real power capability.*
- c. *Asynchronous Generating Facilities shall provide dynamic voltage response between 0.985 leading to .985 lagging at rated MW capacity at the Point of Interconnection as specified in Attachment 1.*
- d. *Asynchronous Generating Facilities may meet the power factor range requirement at the Point of Interconnection by using controllable external dynamic and static reactive support equipment.*
- e. *Within the dynamic reactive capability range, Asynchronous Generating Facilities shall vary the reactive power output between the full sourcing and full absorption capabilities in a continuous manner.*
- f. *Outside the dynamic range of .985 leading to .985 lagging, and within the overall reactive capability range of .95 leading and .95 lagging, the reactive power capability could be met at full real power capability with controllable external static or dynamic reactive support equipment.*

NRG Comment: As noted below, the current interconnection procedures determine project-specific power factor ranges, which may be less stringent than the standard 0.95 lead/lag power range proposed by the CAISO. Meeting such project-specific ranges could be less costly than meeting the standard range proposed by the CAISO.

2. *Operational requirements for Asynchronous Generating Facilities: When the plant real power output is at its maximum capability, the Asynchronous Generating Facility shall have the capability to provide reactive power at .95 lagging for voltage levels between .9 per unit and unity power at the Point of Interconnection. Likewise, the Asynchronous Generating Facility shall have the capability to absorb reactive power at .95 leading for voltage levels between unity power factor and 1.1 per unit at the Point of Interconnection.*
3. *Voltage regulation and reactive power control requirements for Asynchronous Generating Facilities:*

- a. *The Asynchronous Generation Facility's reactive power capability shall be controlled by an automatic voltage regulator (AVR) system having both voltage regulation and net power factor regulation operating modes. The default mode of operation will be voltage regulation.*
- b. *The voltage regulation function mode shall automatically control the net reactive power of the Asynchronous Generating Facility to regulate the Point of Interconnection scheduled voltage assigned by the Participating TO or ISO, within the constraints of the reactive power capacity of the Asynchronous Generation Facility.*
- c. *The ISO, in coordination with the Participating TO, may permit the Interconnection Customer to regulate the voltage at a point on the Asynchronous Generating Facility's side of the Point of Interconnection. Regulating voltage to a point other than the Point of Interconnection shall not change the Asynchronous Generating Facility's net power factor requirements set forth in Section A. iii of Appendix H. (See Attachment 3).*
- d. *The ISO, in coordination with the Participating TO, may permit the Interconnection Customer to regulate the voltage at a point on the PTO's side of the Point of Interconnection. Regulating voltage to a point other than the Point of Interconnection shall not change the Asynchronous Generating Facility's net power factor requirements set forth in Section A. iii of Appendix H. (see Attachment 3)*
- e. *The Interconnection Customer shall not disable voltage regulation controls, without the specific permission of the ISO, while the Asynchronous Generating Facility is in operation.*

Comments

Rationale for imposing a uniform reactive power control requirement

The CAISO asserts that imposing a uniform reactive power control argument would provide greater cost certainty for interconnection customers:

Lastly, the system impact study approach potentially introduces unknown investment risks because customers with asynchronous generating projects in the ISO's queue only learn of the need to provide reactive power during the second phase of the ISO's interconnection studies. In contrast, applying uniform reactive power and voltage control requirements for asynchronous generating facilities provides up-front cost certainty for investors and developers. (IPSP at 16)

NRG's experience is that most asynchronous projects already are assigned a reactive power control requirement through the CAISO's interconnection process. As such, the cost certainty value of extending this requirement to *all* asynchronous resource seems dubious. Further, an advantage of the current individual project approach is that generating facilities may not be required to provide as great a power factor range at locations at which the network's reactive power requirements are smaller. Imposing a uniform and wide ranging power factor range for all installation will increase costs where such power factor range is not needed.

Providing dynamic reactive power control at full rated power output

Incremental cost

Based on these observations, the ISO believes the additional costs, if any, due to a uniform requirement would likely be de minimis. The ISO invites stakeholder comment on this issue. (IPSP at 22)

The CAISO proposes to require (1) dynamic reactive power control across the power factor range 0.985 lead to 0.985 lag and (2) reactive power capability across the range 0.95 lead to 0.95 lag – both at the generating resource’s full rated real power output.

Being able to provide reactive power while maintaining full rated power output requires “oversizing” the inverters. An inverter that is sized to provide rated MW output at unity power factor must be upsized in order to provide the ability to absorb or produce reactive power while still maintaining full real power output. This additional capability comes at a cost. Further, this capability to provide reactive power simultaneous with providing full real power output is also a function of temperature – the higher the operating temperature, the more oversized the inverters must be to accomplish this. While inverters can increasingly provide reactive power, the ability to provide reactive power while simultaneously providing full rated real power may necessitate installing additional inverters to increase the kVA rating of the generating facility. This would impose an incremental cost.

This “oversizing” cost, if incurred, may not be the only additional incremental cost needed to meet the CAISO’s requirements. The CAISO has proposed to require voltage/reactive power control through an automatic voltage regulator (AVR). At the same time, the CAISO has observed that “[R]eactive power capability is now a standard feature of inverters used by asynchronous resources and therefore this approach creates virtually no incremental capital costs for interconnection customers.” (IPSP at 4). While reactive power capability may be an increasingly standard feature of inverters (albeit a feature that the inverter manufacturers have raised their prices to include), providing automatic voltage regulation control requires equipment beyond just the inverters. This equipment involves an incremental cost beyond the cost of the inverters.

One specification that the CAISO has not provided is the required response time – how long a facility has to be able to adjust its reactive power output to match the CAISO’s desired output.

Automatically controlling voltage at the point of interconnection

The CAISO has proposed to require the asynchronous generator to “...*automatically control the net reactive power of the Asynchronous Generating Facility to regulate the Point of Interconnection scheduled voltage assigned by the Participating TO or ISO.*” The point of CAISO interconnection for remote solar PV facilities may be physically distant from the generator site. This physical and electrical distance may introduce signal delay which, in turn, may introduce significant challenges (e.g., hunting) in providing automatic voltage regulation at the point of interconnection. Even if the point of interconnection is not distant, “tuning” the automatic voltage regulator to properly coordinate the control of hundreds of inverters, each with their own communications delay, is not a trivial task, and will likely add time and expense to the commissioning process. AVR can also be

facilitated adding a STATCON, but this involves significant additional expense. In sum, requiring AVR capability may impose significant additional cost to the facility and may also complicate the plant's commissioning.

Applicability

The ISO proposes to apply these new rules on a going-forward basis to those resources that interconnect through the GIDAP. The ISO believes that the appropriate balance between harmonizing reactive power requirements and existing customer expectations is to apply this new policy beginning with interconnection customers in the first queue cluster having an interconnection request window following the effective date of the tariff revisions. Thus, the ISO is proposing to exempt projects already in the ISO interconnection process and existing individual generating units of an asynchronous generating facility that are, or have been, interconnected to the ISO controlled grid at the same location from these new requirements for the remaining life of the existing generating unit. The ISO proposes, however, that generating units that are replaced or repowered, must meet these new requirements. (IPSP at 23-23)

NRG supports the CAISO's position that these new continuous reactive power control requirements should not be imposed on existing asynchronous resources. Further, NRG seeks confirmation that, in situations in which the owner of an asynchronous facility seeks to expand an asynchronous generating facility, the new reactive power requirements proposed would apply only to the incremental facilities being added and not to the existing asynchronous generators.

The CAISO should also recognize that, even if the new asynchronous generators are required to provide continuous reactive power control, it may be necessary to upgrade the plant's communication and control systems to provide the required reactive power control, which can add significant cost.

Finally, the CAISO should not impose a continuous reactive power control requirement on replacement inverters (i.e., inverters installed to replace inverters that have failed), or at least should not impose a reactive power requirement beyond what the original inverters were required to provide.

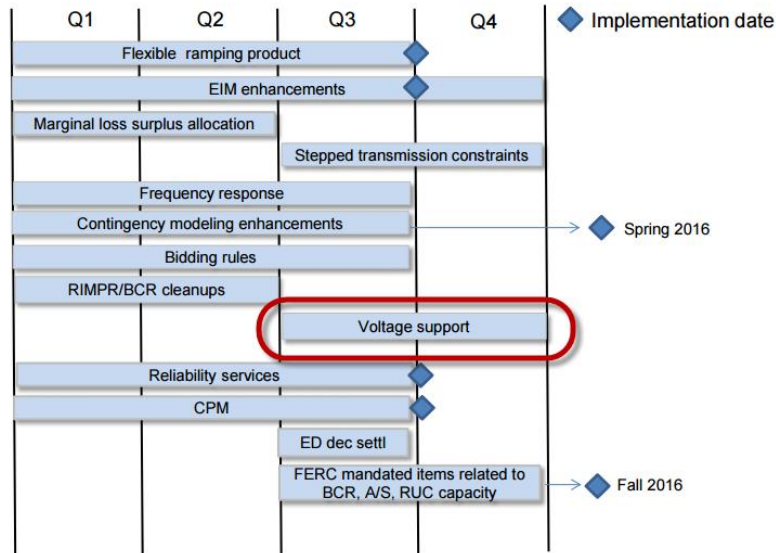
Compensation

The issue of imposing a uniform requirement for reactive power control on asynchronous resources cannot be divorced from another completely related issue that the CAISO has not yet begun to address despite being under FERC orders dating back to 2005¹ to do so – the issue of providing compensation for reactive power.

On February 5, the CAISO presented to its Board of Governors a "2015 policy development base roadmap" that indicated the CAISO would finally deal with the issue of reactive power/voltage support compensation in Q3/Q4 2015:

¹ See, e.g., 143 FERC ¶ 61,228 at P. 20; 112 FERC ¶61,350.

2015 policy development base roadmap



Source: *Briefing on 2015 Policy Development Roadmap*, available at <http://www.caiso.com/Documents/BriefingPolicyDevelopmentRoadmap-Presentation-Feb2015.pdf> (emphasis added)

The issue of the CAISO providing compensation for providing reactive power should be dealt with before the issue of imposing a uniform reactive power control requirement on asynchronous generating resources is finalized. NRG urges the CAISO to defer this stakeholder process seeking to impose uniform reactive power control requirements on asynchronous generators until the issue of providing suitable compensation for reactive power support has been resolved. If the CAISO moves forward with this asynchronous reactive power initiative before launching the voltage support procurement stakeholder process, it must commit to launching that initiative by the schedule listed in the Board briefing.

NRG does not intend to pre-judge how the voltage support procurement stakeholder process will turn out. However, with the CAISO now proposing to extend reactive power control requirements beyond synchronous machines, the time is more than ripe to engage in this long-overdue conversation.