



Reactive Power and Financial Compensation

Draft Final Proposal

November 12, 2015

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1. Executive Summary

The California ISO (ISO) is pursuing this initiative to propose a requirement for asynchronous¹ resources to provide reactive power and voltage regulation. This approach will replace the current case-by-case project system impact study approach to assess whether asynchronous resources must have the ability to provide reactive power to safely and reliably interconnect to the transmission system.

Renewables are rapidly displacing the conventional generating facilities that have historically provided reactive power support to maintain voltage levels required for the efficient delivery of real power to serve electric load. Given the changes to the resource fleet that the ISO is experiencing, the current system impact study approach to assess reactive power capability needs, where resources are studied on a case-by-case basis, creates a risk that the actual system conditions could be far different than the conditions that were in effect when the ISO studied the project during the interconnection process.

Modifications to the current interconnection study approach to mitigate its shortcomings would require an increase in the overall study process timeline due to the need to study many more scenarios than is the current practice, and an increase in the cost of interconnection studies, neither of which is desired by project developers. Further, even if the ISO were to change the study scope, timeline and costs, there is still a very real possibility that unanticipated future electrical system changes will expose a scenario that was not studied during the interconnection process and reliable system operation is then threatened. As an alternative, the ISO is proposing to adopt, going forward, requirements for all asynchronous resources to provide the ability to provide reactive power and automatic voltage control. These requirements for asynchronous resources reflect a more reliable, efficient, and equitable approach than examining this issue through case-by-case project system impact studies. The ISO will apply this new policy beginning with interconnection customers in the first queue cluster in an interconnection request window following the effective date of the tariff revisions, which is expected to be in April 2016. The new policy will not apply to projects already in the ISO interconnection process.

In addition to requirements for asynchronous resources, the ISO has explored whether it is appropriate to develop a financial compensation structure for both the capability to provide reactive power and the provision of reactive power. The ISO currently compensates resources for the provision of reactive power outside of a standard required range when the ISO directs a resource to reduce its real power output to provide reactive power. The ISO believes that providing reactive power capability is a good utility practice, essential for generating and delivering real power to the grid, and resources have the opportunity to recover capital costs when they construct or retrofit their facilities. Additionally, most manufacturers now routinely include reactive power capability in the inverters used by asynchronous resources as standard equipment; therefore, this new policy creates minimal incremental capital costs for asynchronous resources. For these reasons, the ISO is not proposing to adopt a new capability (capacity type) payment for reactive power.

In previous proposals the ISO has discussed a potential new Exceptional Dispatch category and provision payment for “atypical” resources and unconventional situations, e.g., clutch resources and solar arrays at night. Stakeholder comments that were received in response to the previous ISO paper

¹ Asynchronous resource is a generator that does not use mechanical rotors that synchronize with system frequency.

raise many important considerations related to this aspect of the initiative, such as cost identification, eligibility and criteria for dispatch instruction, and compliance and verification of capabilities. The ISO and stakeholders will need to carefully explore these considerations. The ISO is concerned that the adequate development of this aspect of the initiative could risk delaying the timeline for the most critical and important purpose of the initiative, which is extending reactive power requirements to all asynchronous generators as soon as possible. The ISO intends for the requirements to be applied to the next interconnection cluster, in April 2016. For these reasons, the ISO is proposing to not continue to develop this element of the initiative at this time and will consider this aspect of this stakeholder initiative in a separate stakeholder initiative that will start in Q2 2016.

2. Stakeholder Comments and Changes to Proposal

2.1. Stakeholder Comments

The following summary provides an overview of the areas of stakeholder comments that were received in response to the October 8, 2015 Revised Straw Proposal. A more detailed description of stakeholder comments and ISO responses are included in Appendix A.

Stakeholders have commented on the technical requirements seeking clarification on certain aspects such as choice of point of control for providing reactive power support, equivalence of synchronous and asynchronous resource requirements, electrical compensation to the Point of Interconnection (POI), and studies of alternative solutions beyond the POI being included in the ISO's planning processes.

Stakeholders also provided feedback and comments on financial compensation issues such as the need for further study of reactive power needs and analysis of the relative costs of various options for meeting reactive power needs, capability payments, provision payments, inclusion of power purchase agreement and production tax credit costs in opportunity cost calculations, additional voltage support and reactive power ancillary services markets, and cost allocation.

2.2. Changes to Proposal

The ISO has made the following change from the last iteration of the proposal: In the revised straw proposal the ISO discussed a potential new Exceptional Dispatch category and provision compensation for atypical resources and unconventional situations, e.g., clutch resources and solar arrays at night. Stakeholder comments raised important related considerations which are also listed in Appendix A. This aspect of the initiative will require additional work to consider and address numerous details. The ISO believes that the development of this issue is important and will take longer than the proposed timeline for implementing the technical requirements. The ISO intends to avoid delaying the most critical and important purpose of the initiative: extending reactive power requirements to all asynchronous generators. For these reasons, the ISO is not proposing to include this element in this initiative and will include it in a separate stakeholder initiative in Q2 2016.

3. Plan for Stakeholder Engagement

The current schedule for this initiative is shown below.

Milestone	Date
Issue Paper posted	May 21, 2015
Stakeholder call on Issue Paper	May 28, 2015
Issue Paper comments due	June 11, 2015
Straw Proposal posted	August 13, 2015
Stakeholder meeting on Straw Proposal	August 20, 2015
Straw Proposal comments due	September 3, 2015
Revised Straw Proposal posted	October 8, 2015
Stakeholder call on Revised Straw Proposal	October 15, 2015
Revised Straw Proposal comments due	October 27, 2015
Draft Final Proposal posted	November 12, 2015
Stakeholder call on Draft Final Proposal	November 19, 2015
Draft Final Proposal comments due	December 3, 2015
Board of Governors meeting	February 3-4, 2016

4. Background

Since 2010, when the ISO previously proposed a requirement for asynchronous resources, the rapid expansion of asynchronous renewable resources has resulted in high ratios of asynchronous to synchronous generation during a portion of the operating day, especially on light demand days such as weekends and holidays. Renewables are rapidly displacing the conventional generating facilities that have historically provided reactive power support to maintain voltage levels required for the efficient and reliable delivery of real power to serve electric load.

Because synchronous generation resources are the primary source of reactive power on the transmission system, the proliferation of asynchronous resources in conjunction with the retirement of large synchronous generators is significantly changing the landscape of the interconnected power grid. As the need for and location of reactive power resources changes because of future additions of

asynchronous resources and previously unplanned requirements, it will become necessary for reliability for all interconnected resources to provide reactive power.

The following table shows the actual/expected increase in variable energy resources (VERs) through 2024.

Figure 1: Variable energy resources within ISO footprint through 2024 (MW)

	2011	2012	2013	2014²	2024³
Large Scale Solar PV	182	1,345	4,173	4,512	7,663
Small Solar PV ⁴					3,564
Solar Thermal	419	419	419	1,051	1,802
Wind	3,748	5,800	5,894	5,894	7,028
<i>Total</i>	4,349	7,564	10,486	11,457	20,057

The current case-by-case, system impact study approach to assess whether asynchronous resources must provide reactive capability has several shortcomings. First, system impact studies may not require that every project provide reactive power capability because it may conclude there will be sufficient reactive power on the transmission system due to the capabilities of existing generators equipped with reactive power capability. The case-by-case approach relies heavily on the assumptions of future conditions, which may not prove true and cannot account for unpredicted events, such as the premature closure of San Onofre Nuclear Generator Station. Once an asynchronous project is interconnected and is commercially operable, actual system conditions could be far different from the conditions assumed and studied. Planned and unplanned outages and a host of other operating scenarios not covered under in the initial study process may in fact actually cause needs for reactive power from those previously exempt generators.

A uniform reactive power requirement enhances the reactive capabilities on the system compared to an ad hoc approach based on site specific requirements determined during interconnection. Indeed, the North American Electric Reliability Council's (NERC's) Integration of Variable Energy Resource Task Force conducted a special reliability assessment that recommends that NERC consider revisions to reliability standards to ensure that all generators provide reactive support and maintain voltage schedules.⁵ Requiring all interconnecting resources to provide reactive capability will remedy the

² Values for 2011-2014 are from:

https://records.oa.caiso.com/sites/mqri/Records/Renewable%20Daily%20Watch/2014%20Renewable%20Watch/12-2014%20Renewable%20Reports/20141229_DailyRenewablesWatch.pdf

³ Values for 2024 are from:

http://www.caiso.com/Documents/Aug13_2014_InitialTestimony_ShuchengLiu_Phase1A_LTPP_R13-12-010.pdf (Table 9)

⁴ Less than 20 MW and connected to the ISO controlled grid.

⁵ NERC Specific Reliability Assessment: Interconnection Requirements for Variable Generation at 2-3:

http://www.nerc.com/files/2012_IVGTF_Task_1-3.pdf

shortcomings of the current approach and ensure reliable distribution of reactive power throughout the system.

For a full background including more detailed information on: current reactive power requirements, overview of technical issues, prior case studies, current interconnection study and transmission planning process procedures related to reactive power, and regulatory review background materials, please refer to Sections 4.1-4.6 of the ISO's August 13, 2015 Straw Proposal.⁶

5. Draft Final Proposal

5.1. Technical Requirements

5.1.1. Proposed asynchronous resource requirements timing

The ISO proposes to adopt a uniform requirement for asynchronous resources to provide reactive power capability and voltage regulation. This primarily includes wind, solar, and inverter-based storage facilities. The ISO proposes to apply these new rules on a going-forward basis to those resources that interconnect through the Generation Interconnection Delivery Application Process (GIDAP).⁷

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. The ISO is planning for this to occur in April 2016, to be effective for resources entering the queue during Cluster 9 and beyond.

The ISO proposes to exempt all 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. This exemption includes resources that are currently in the interconnection queue that have entered the queue prior to Cluster 9 and may not yet have negotiated or executed an interconnection agreement. However, the ISO proposes that any generating units that are replaced or repowered must meet these new requirements.

With respect to a unit repowered with existing turbines that remain, or are simply refurbished, in an otherwise repowered project the ISO proposes that if a generating unit is undergoing a repowering or refurbishing that does not require the unit to go through the interconnection queue again, then the unit will not be subject to the new reactive power requirements. Repowering or refurbishing units that includes new turbines or any other changes that would require reentry through the interconnection

⁶ http://www.caiso.com/Documents/StrawProposal_ReactivePowerRequirements_FinancialCompensation.pdf

⁷ New interconnection requests to the ISO grid are governed by the GIDAP, ISO Tariff Appendix DD.

http://www.caiso.com/Documents/AppendixDD_GeneratorInterconnection_DeliverabilityAllocationProcess_asof_Jun12_2015.pdf

queue, or that constitutes a material modification under the interconnection rules, will be subject to these new requirements.⁸

5.1.2. Proposed requirements for asynchronous generating facilities

The ISO proposes to establish asynchronous requirements that are effectively equivalent to the current synchronous requirements, consistent with FERC Order 661a. Because asynchronous units typically use different technology to provide reactive power, the requirements will not be identical.

- a) An Asynchronous Generating Facility shall have an over-excited (lagging) reactive power producing capability to achieve a real time net power factor from 0.95 lagging up to unity power factor at the POI, up to the Generating Facility's maximum real power capability.
- b) An Asynchronous Generating Facility shall have an under-excited (leading) reactive power absorbing capability to achieve a real time net power factor from 0.95 leading up to unity power factor at the POI, up to 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 real time maximum real power capability at the POI, up to the Generating Facility's maximum real power capability, as specified in Figure 3.
- d) Asynchronous Generating Facilities may meet the power factor range requirement at the POI 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 maximum real power capability with controllable external static or dynamic reactive support equipment.

5.1.3. 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 .95 per unit and unity power at the POI. Likewise, the Asynchronous Generating Facility shall have the capability to absorb reactive power at .95 leading for voltage levels between unity power factor and 1.05 per unit at the POI.

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

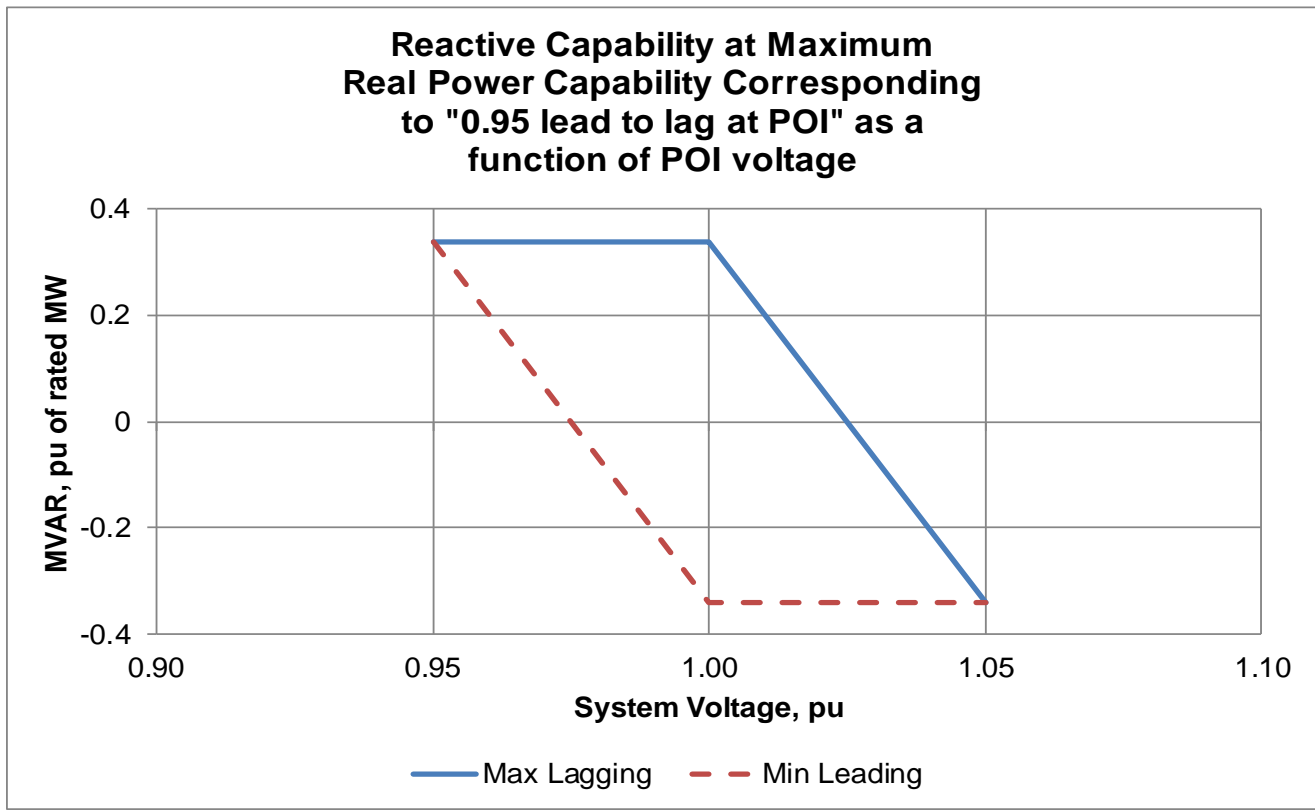
⁸ A Material Modification is defined in ISO Tariff Appendix A as "modification that has a material impact on the cost or timing of any Interconnection Request or any other valid interconnection request with a later queue priority date."

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 POI 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 POI. Regulating voltage to a point other than the POI shall not change the Asynchronous Generating Facility's net power factor requirements. Any regulation point other than the POI must provide the required reactive capability electrically compensated to the POI.
- 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 POI. Regulating voltage to a point other than the POI shall not change the Asynchronous Generating Facility's net power factor requirements. Any regulation point other than the POI must provide the required reactive capability electrically compensated to the POI.

The Interconnection Customer shall not disable voltage regulation controls, without the permission of the ISO, while the Asynchronous Generating Facility is in operation.

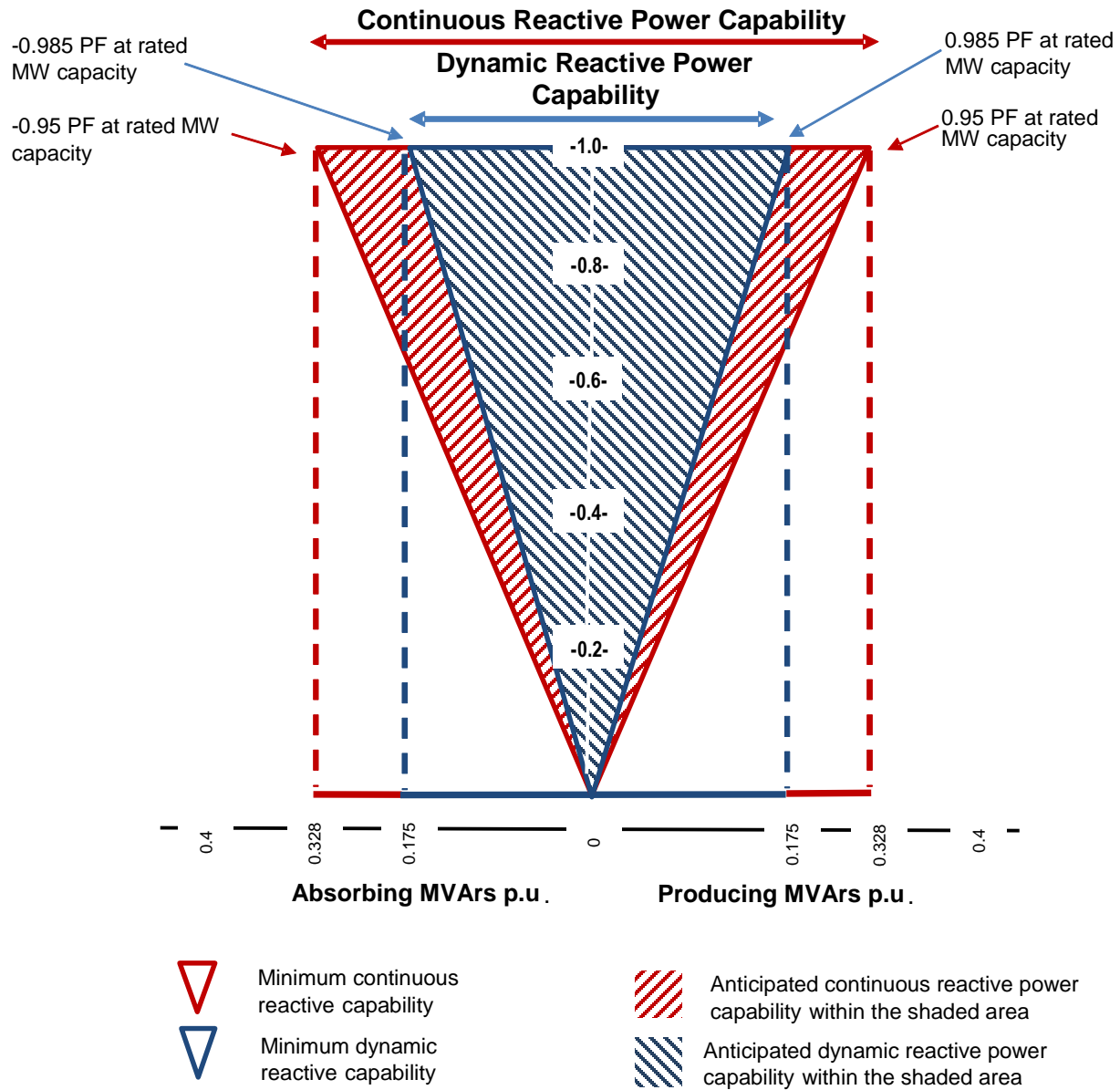
Figure 2: Proposed reactive power capability at different voltage levels



Note: The figure above specifies that when the real power output is at its maximum capability, the Asynchronous Generating Facility shall have the capability to provide reactive power at 0.95 lagging when voltage levels are between 0.95 per unit and 1 per unit at the POI. The capability to provide reactive power decreases as the voltage at the POI exceeds 1 per unit.

Likewise, the Asynchronous Generating Facility shall have the capability to absorb reactive power at 0.95 leading when voltage levels are between unity power factor and 1.05 per unit at the POI. The capability to absorb reactive power decreases as the voltage at the POI drops below unity power factor.

Figure 3: Proposed reactive power capability for asynchronous resources



Note: In the figure above, the red and blue isosceles triangles show the expected reactive capability of the Asynchronous Generating Facility at the POI. At maximum real power capability of the Facility, the expected dynamic reactive capability should be between 0.985 lagging to 0.985 leading. Also, at maximum real power capability, the overall expected continuous reactive capability should be between 0.95 lagging to 0.95 leading. As shown, as the real power output decreases both the dynamic and continuous reactive capabilities also decrease. For example, a 100 MW plant, operating at 100 MW is expected to provide 32.8 MVARs (.95 lag) and absorb 32.8 MVARs (.95 lead). The same plant operating at 40 MW is expected to provide 13.14 MVARs (.95 lag) and absorb 13.14 MVARs (.95 lead) at the POI. The following formula reflects the calculation of the requirement at varying output levels:

$$MVARs = MW * \tan(\cos^{-1}(.95))$$

5.2. Financial Compensation

5.2.1. Summary

Through this initiative the ISO has explored mechanisms to compensate resources for the capability and provision of reactive power. The ISO currently compensates resources for the provision of reactive power outside of a standard required range when resources need to reduce their real power output to provide reactive power outside that range. The ISO will continue current payments to resources for the provision of reactive power outside of the standard required range.

The ISO previously considered through this initiative the development of a financial compensation structure for reactive power capability. The ISO is not proposing any form of payment for reactive power capability. The ISO reiterates that requiring reactive power capability from all resources is considered a good utility practice. Resources have opportunities to price the costs of reactive power capability into the bilateral contracting process.

The ISO had previously discussed creating a new Exceptional Dispatch category and compensation mechanism for the purposes of utilizing and compensating clutch resources and other special cases that provide reactive power support. The ISO has determined that further details must be worked out that will preclude the ISO from fully developing this aspect of the proposal in time for the intended approval and implementation of the broader requirements for asynchronous resources. For this reason, the ISO is suspending further work on this element of the initiative to avoid any delays and will revisit these special case needs in a separate initiative that is currently planned to start in Q2 2016.

5.2.2. Capability Payments

As explained above, the focus of this initiative initially was to extend the technical requirements for reactive power to all asynchronous resources and discontinuing the case-by-case studies practice. The ISO subsequently augmented the initiative to consider financial compensation and explore the potential for additional alternative methods of compensation for reactive power. One area that was explored was the appropriateness of developing a financial compensation structure for reactive power capability. While some other regions make capability payments, there are also regions where transmission providers make no payments for reactive power capability. These regions conclude that requiring capability for such operation is a requirement under good utility practice and a necessary condition for conducting normal business.⁹ Similarly, the ISO is not proposing any form of payment for reactive power capability through this initiative.

The ISO continues to believe that providing reactive power constitutes good utility practice. Reactive power capability and voltage support requirements are necessary for the reliable operation of the transmission system, and support the delivery of real power from generation to loads, which allows those resources to participate in the ISO markets. In Order 2003, FERC adopted a standard power

⁹ See Entergy Services, Inc., 113 FERC ¶ 61,040 (2005); Southwest Power Pool, Inc., 119 FERC ¶ 61,199 (2007), reh'g denied 121 FERC ¶ 61,196 (2007) (SPP); Bonneville Power Administration, 120 FERC ¶ 61,211 (2007) (Bonneville), reh'g denied 125 FERC ¶ 61,273 (2008); E.ON. U.S. LLC, 124 FERC ¶ 61,131 (2008).

factor requirement of 0.95 leading to 0.95 lagging for large synchronous generators “because it is a common practice in some NERC regions.”¹⁰ At the time, NERC advocated that FERC require power factor capabilities to be within a range required by good utility practice. The ISO’s current tariff follows this approach.

Order 2003 also provided that an RTO or ISO may propose variations from this policy to address regional needs. FERC has addressed various rules relative to the payment for reactive power capability, but FERC has not adopted a requirement that ISO/RTOs implement payments for the capability to provide reactive support. Given the ISO’s understanding that resources have the opportunity to capitalize fixed costs, including the cost of reactive power capability, when they construct their facilities, there does not appear to be a valid reason to create a separate administrative payment stream from the ISO to resources for the capability to provide reactive support.

Some stakeholders have indicated that they do not agree with the ISO’s premise and have stated they believe that good utility practice must also come with associated cost recovery. The ISO agrees that resources should have the opportunity for appropriate cost recovery. As noted above and further explained in Section 5.2.1, the ISO continues to compensate resources, as previously approved by FERC, for the provision of reactive power outside of the standard required range when resources need to reduce their real power output to provide reactive power support. This compensation for a resource’s opportunity costs of providing reactive support allows them cost recovery for the variable costs of actually providing reactive power. Further cost recovery for fixed costs is commonly dealt with in resources bilateral contracting and other procurement negotiations. The ISO has documented the stakeholder comments on capability payments which are detailed in Appendix A. The ISO does not propose capability/capacity payments through this initiative.

5.2.3. Provision Payments

The ISO currently compensates resources for the provision of reactive power outside of the standard lead/lag requirements. This initiative does not change this existing tariff provision. Payments under this approach are calculated based on a resource’s opportunity costs. When resources are called upon under Exceptional Dispatch instruction for voltage support to reduce their real power output to move outside of the standard range as specified under the ISO Tariff, Section 11.10.1.4, such resources would be eligible for this provision payment compensation. Further details on the current provision payment structure for voltage support were discussed in the Straw Proposal.¹¹

Through this effort the ISO explored potential enhancements to payment compensation mechanisms for the provision of reactive power. The ISO has investigated the potential for more market based procurement and compensation for voltage support. The ISO also sought stakeholder feedback on methods to enhance its provision payments and received limited feedback in that area. After investigating alternative approaches the ISO was unable to identify any appropriate and feasible additional enhancements to the current provision payments. For these reasons, the ISO proposes to

¹⁰ See Standardization of Generator Interconnection Agreements and Procedures 104 FERC ¶ 61,103 (2003) (“Order 2003”) at P 542 <http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=9746398>

¹¹ Reactive Power Requirements and Financial Compensation Straw Proposal at 29-30.

http://www.caiso.com/Documents/StrawProposal_ReactivePowerRequirements_FinancialCompensation.pdf

continue the provision payments for voltage support in their current form of compensation as has already been approved by FERC for the provision of reactive power outside of the standard lead/lag requirements.

5.2.4. Previously Proposed Exceptional Dispatch Category

In the revised straw proposal the ISO introduced a potential new Exceptional Dispatch category and provision compensation for “atypical” resources and unconventional situations, for instance, clutch resources and solar arrays night. Stakeholder comments raise many important considerations related to this aspect of the initiative, such as cost identification, eligibility and criteria for dispatch instruction, and compliance and verification of capabilities. The ISO believes that this aspect of the initiative still has numerous details to work through and needs to be further developed.

There are a number of outstanding items that must be carefully considered to provide appropriate solutions and the ISO needs more time to determine appropriate approaches for these issues. For instance, some stakeholders point out the proposed asynchronous requirements for reactive power only require resources to provide the capability for reactive support at real power output levels above zero, as detailed in Section 5.1.2. It is important to carefully explore which resources would be eligible and required to respond to ISO Exceptional Dispatch instructions. Additionally, if resources are capable of this unconventional reactive power support, the ISO would need a method of identifying those capabilities and the willingness or requirement of particular resources to respond to ISO instruction.

The ISO also needs to identify and verify what costs would be incurred by which atypical resource types in these certain operating configurations to accurately calculate payments. Alternatively, the ISO could develop some other payment methodology that might more appropriately cover resource’s costs for this provision of this unconventional reactive support. Inverter-based storage resources have also identified that they would be capable of provision of reactive power without also producing real power and wish to be considered. Storage resources note that the ISO would need to assure a detailed accounting of costs related to the pricing and timing of real power absorbed and utilized by inverter-based storage devices to provide unconventional reactive support and it would be necessary to properly account for their costs of that type of reactive power provision.

The ISO believes that these type of resources may be useful sources of reactive power. The ISO is concerned that the necessary development of this aspect of the proposal will take longer than the proposed timeline for implementing the technical requirements for asynchronous resources. The ISO intends to avoid delaying the most critical and important purpose of the initiative; extending reactive power requirements to all asynchronous generators as soon as possible. For these reasons, the ISO is no longer proposing to further develop this element of this initiative at this time. This topic will be addressed in a separate stakeholder initiative in Q2 2016. The ISO appreciates the valuable feedback that has been provided by stakeholders.

5.3. Cost Allocation

The ISO proposes to maintain the current cost allocation for payments for the provision of reactive power. In this initiative the ISO is not proposing any changes to the provision of reactive power and the current cost allocation method has been found to be just and reasonable by FERC.

The current cost allocation for provision of reactive power outside the standard required range is established under current tariff Section 11.10.1.4.¹² These cost allocation provisions for voltage support assign costs to loads and exports. Because the ISO is not proposing any changes to the current provision payments the ISO is not proposing any changes to this cost allocation treatment.

Stakeholders have previously requested that the ISO consider assigning costs related to the provision of reactive power to generators because having enough reactive power capability is in the best interest of all resources and loads so the cost of reactive power support should be allocated among all generation as well, not just to load. The ISO notes that the current provision payments are not allocated to generation resources currently because it is not possible to accurately identify if and when specific generators are causing needs for reactive power themselves due to the fluctuating levels of load and output by generators and the variable nature of the topology of the system.

To create a mechanism to identify cost causation by particular individual generation is not as simple as a metering solution; it would require detailed technical studies looking at a multitude of operating scenarios. The costs of developing such a mechanism would be excessive when compared to the reactive power provision payments themselves.

The ISO is also not proposing any new compensation mechanisms at this time.

Considering these factors, and noting that the relative magnitude of the total amount of provision payments paid by the ISO is minimal, the ISO does not believe it makes sense to revisit the cost allocation methodology for these provision payments at this time.

6. Next Steps

The ISO will discuss this revised straw proposal with stakeholders during a conference call on November 19, 2015. Stakeholders are welcome to submit written comments by December 3, 2015 to InitiativeComments@caiso.com. Stakeholders should submit their written comments using the template that has been posted to the web page for this initiative at: <http://www.caiso.com/informed/Pages/StakeholderProcesses/ReactivePowerRequirements-FinancialCompensation.aspx>.

¹² CAISO Tariff: Section 11. http://www.caiso.com/Documents/Section11_CAISSettlementsAndBilling_Jan1_2015.pdf

Appendix A: Stakeholder Comments and ISO Responses Matrix

Topic	Stakeholder	Stakeholder Comment	ISO Response
Studies for Reactive Power Needs	CalPeak and Malaga	<p>CAISO has yet to produce a study of what reactive power resources are needed and how they can be obtained at least cost. CalPeak agrees with the Large Scale Solar Association recommendation that the CAISO do a study of future reactive power needs.</p> <p>CalPeak and Malaga made a more modest request for “historic reactive power production and consumption data to better inform the stakeholders.</p> <p>The CAISO has rejected all of these requests and appears poised to impose new requirements on all asynchronous generators without evidence that reactive power is needed from these generators and regardless of whether or not there are more cost-effective ways to ensure that the CAISO has adequate reactive power resources.</p> <p>The limited information that CalPeak and Malaga have concerning relative costs suggests that forcing all asynchronous generators to meet its proposed new requirements would be a very expensive way to secure new sources of reactive power in the aggregate, especially when considering potentially limited marginal utility at locations of many asynchronous generators.</p> <p>FERC cites estimates that the costs are in the range of 3- 5% of the total capital cost of the typical wind turbine project. For solar PV projects, FERC cites estimates of roughly 2% of the overall project cost. By contrast, the onetime cost for CalPeak to modify its existing peaking plants to operate as synchronous condensers is minimal since only a software change is required. It is likely that other existing generators in areas with greater reactive power needs can also provide reactive power for relatively small additional investments.</p> <p>The CAISO should do what it can to compare the costs of different potential sources of</p>	<p>The ISO conducted outreach with inverter manufacturers such as General Electric and Siemens to learn more. The ISO found:</p> <p>Approximately 5 percent of total plant cost is attributable to inverters and associated equipment (e.g., transformer, controller). This is a sunk cost because all asynchronous resources must have inverters. Given the sunk costs, the incremental costs for adding reactive power capabilities are less.</p> <p>Reactive power capability is now a standard feature of inverters used in both wind and solar PV applications and there is no additional cost for reactive power capability. Typically, these inverters can provide 0.95 leading and lagging power factor at full real power output at the Point of Interconnection. Based on these observations, the ISO believes the additional incremental costs due to a uniform requirement would be minimal.¹³</p> <p>The incremental costs that will be imposed on resources are minimal, and nearly 75% of asynchronous resources are already being required to install capability for reactive power under the current case-by-case interconnection study process. These new requirements are intended to capture the remaining asynchronous resources. The ISO does not believe that a comparison of the costs for special modifications to existing resources or other sources is necessary.</p>

¹³ Reactive Power and Financial Compensation Issue Paper, May 22, 2015.

http://www.caiso.com/Documents/IssuePaper_ReactivePowerRequirements_FinancialCompensation.pdf

Topic	Stakeholder	Stakeholder Comment	ISO Response
		<p>reactive power before it imposes the cost of meeting new requirements on wind and solar generators (and on the customers who will ultimately pay for the power these generators produce).</p>	
Financial Compensation	CalPeak and Malaga	<p>Even if the CAISO believes it cannot wait to impose requirements on new wind and solar generators regardless of the costs, the CAISO needs to take a hard look at its rules for providing financial compensation for existing generators since providing such compensation may well be more cost effective than having to secure reactive power through other means. For example, the CAISO recently approved several new projects to provide reactive support through its transmission planning process at a substantial cost.</p>	<p>The ISO believes that the uniform requirements that have been proposed for new asynchronous resources present a minimal incremental cost. The Transmission Planning Process (TPP) will identify needed transmission assets to support the voltage needs of the system in cases that the resources in a particular area are not sufficient.</p>
Financial Compensation & Environmental Impact	CalPeak and Malaga	<p>The CAISO should also study whether incentives should be provided to encourage the use of more reactive power for environmental reasons. At the present time the CAISO is often in a position where, in order to maintain voltage support, it must call upon generators to run to produce real power when all it really needs is reactive power. If the CAISO could instead call upon resources for only the reactive power it really needs, there would be environmental benefits for two reasons:</p> <ol style="list-style-type: none"> 1. First, when fossil-fuel fired generators switch from producing real power to synchronous condenser mode they have substantially reduced air emissions since synchronous condensers do not burn fuel to provide reactive power. 2. Second, when generators switch from producing real power to providing only reactive power they free up transmission capacity, which is generally in load centers, so it is possible to import more power from renewable resources. If the switch occurs when there are over-generation conditions, this can also avoid curtailment of renewable resources. 	<p>The ISO agrees there are potential environmental benefits as has been explained in the CalPeak and Malaga comments. The ISO has previously proposed a new Exceptional Dispatch category that would allow operators to call upon resources to operate in synchronous condenser mode. The details of this effort still need to be further developed and the ISO will address issues raised here, including the potential environmental benefits, in a separate stakeholder initiative that will start in Q2 2016.</p>

Topic	Stakeholder	Stakeholder Comment	ISO Response
Financial Compensation	CalPeak and Malaga	<p>Although more work is needed to justify the CAISO’s imposition of new requirements on asynchronous generators, the CAISO can make progress on ensuring that it has adequate reactive power resources by refocusing this proceeding on putting in place reasonable financial compensation rules for existing resources that can provide reactive power.</p>	<p>The ISO has stated previously that uniform requirements on new asynchronous resources impose minimal incremental costs. The combination of uniform requirements on resources and the TPP will ensure that adequate reactive power support is available to the system.</p>
Financial Compensation	CalPeak and Malaga	<p>Putting in place rules for financial compensation for reactive power resources is a fast way to procure additional reactive power. Existing facilities can be easily modified to provide additional reactive power, but imposing requirements on new asynchronous generators will have no impact until they are built many years from now.</p> <ul style="list-style-type: none"> • Financial compensation rules which secure more reactive support from existing resources could make it unnecessary to impose requirements to supply reactive power on asynchronous generators. • Financial compensation rules which secure more reactive support from existing resources could help avoid the need for expensive new infrastructure projects funded through the transmission planning process to address voltage issues and costly RMR contracts. • Financial compensation rules can provide incentives to encourage development of reactive power resources that have environmental benefits. 	<p>The ISO’s standard interconnection studies currently identify nearly 75% of interconnecting asynchronous resources as needing to provide reactive power capabilities. The purpose of the uniform requirements for all new asynchronous resources is to replace the current case-by-case study process that may not identify needs in all situations and is not time or cost effective to enhance further.</p> <p>The ISO believes that until the new requirements start to be effective and all resources are required to have capabilities, the needs for reactive power will be adequately met through the current case-by-case studies and the TPP.</p>
Financial Compensation	CalPeak and Malaga	<p>Under the current provisions of the CAISO tariff generators operating in the required range can be required to provide reactive power without compensation, which is particularly problematic for uncontracted resources.</p> <p>The CAISO can also request that generators provide voltage support outside the required range, but the only compensation available is for a generator’s opportunity cost, i.e. what the generator would otherwise have earned for selling real power.</p> <p>In short, the tariff provides no assurance that a generator will receive compensation for the costs it incurs in providing reactive power or that</p>	<p>The ISO disagrees with the statement that it is problematic that generators operating in the required range can be required to provide reactive power without compensation. Provision of reactive power within the required range does not require resources to reduce their real power output so there are no variable costs to be compensated for providing reactive power within the required range.</p> <p>The ISO’s position is that opportunity cost based payments for resources providing reactive power outside the standard range is appropriate</p>

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		<p>it will receive adequate incentive for providing reactive power capability.</p>	<p>compensation and FERC has approved this current tariff provision.</p> <p>The ISO believes that requiring capability under good utility practice is adequate incentive to provide reactive power support. Further, reactive power capability allows resources the ability to deliver real power on the network and participate in the market.</p>
Financial Compensation	CalPeak and Malaga	<p>For many years generators and other stakeholders have attempted to get the CAISO to revise its tariff to provide adequate financial compensation for voltage support and FERC has supported these efforts. Shortly after the CAISO was formed, it indicated that it would be developing a competitive procurement process for voltage support, but since it had not produced a plan by 2005, FERC ordered the CAISO “to submit its proposed structure and timeline for implementing competitive procurement of Voltage Support.”</p> <p>It is not clear whether the CAISO has abandoned its plans for developing a market-based mechanism for procurement of voltage support, but it is clear that providing some way to provide financial compensation for reactive power support is long overdue.</p>	<p>The ISO has previously explored the market based procurement of voltage support. This is infeasible due to localized nature of reactive power and market power concerns, as noted in previous iterations of this initiative.</p> <p>The ISO already has in place tariff provisions that provide compensation for the provision of reactive power outside of the standard required range, when resources incur costs to provide those services.</p>
Financial Compensation	CalPeak and Malaga	<p>The CAISO indicates that it believes it is unnecessary to pay for reactive power within the required range since providing it is merely “good utility practice.” It is unfortunate that the CAISO believes that it is appropriate for it to continue to take reactive power within the required range without paying for it. What the CAISO should be worried about is not whether generators exercise “good utility practice” but whether taking reactive power without providing compensation is “good ISO practice.”</p> <p>The CAISO’s position that providing reactive power in the required range is merely “good utility practice” runs counter to the recommendations of FERC staff.</p>	<p>As stated previously, there are no variable costs associated with the provision of reactive power within the required range so the ISO believes it is not appropriate to make payments in those situations.</p> <p>The ISO does compensate resources for the provision of reactive power outside of the required range, when resources would be reducing their real power output and incurring opportunity costs. The current provision payment structure is similar to other provision payments in other regions.</p>

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Financial Compensation	CalPeak and Malaga	<p>The CAISO Revised Straw Proposal does not discuss an important defect in the current tariff provisions relating to financial compensation for reactive power - for generators that are not providing reactive power within the required range, the tariff provides only for payment of opportunity costs, i.e. the cost of not producing real power in order to provide reactive power.</p> <p>Providing compensation only for opportunity costs means there is no assurance of compensation for providing reactive power in most situations. For example, generators that provide power outside the required range will not be paid if their bids would not clear the market and, in any case, would not be paid for actual costs incurred in providing the reactive power. In addition, reactive power resources that do not produce real power, such as dedicated synchronous condensers, are not entitled to payments unless they are compensated under an RMR agreement</p>	<p>Section 11.10.1.4 specifies that the total payments for Voltage Support shall be the sum of the opportunity costs of limiting energy output to enable reactive energy production in response to an ISO instruction.</p> <p>The opportunity cost is calculated based on the product of the energy amount that would have cleared the market at the price of the Resource-Specific Settlement Interval LMP minus the higher of the Energy Bid price or the Default Energy Bid price.</p> <p>If resources incorporate their costs into their Energy Bids and are called on to provide reactive power support outside of the required range, they would in fact be compensated for their costs incurred, regardless of if their bids cleared the market or not. If a resource did not clear the market they would not be dispatched to provide real power and would not be required to provide reactive power.</p>
Financial Compensation	CalPeak and Malaga	<p>In prior comments CalPeak and Malaga have advocated for using a Default Energy price or a negotiated rate to provide compensation for reactive power. This is appropriate since it is necessary to co-optimize real and reactive power and use of the Default Energy Price would come close to making a generator indifferent when asked to switch from providing real power to providing reactive power. The CAISO will need for synchronous generators to be indifferent with respect to whether they are called upon to produce real or reactive power in order for the CAISO to be able to maintain voltage support while minimizing air emissions and freeing up transmission capacity for electricity produced from renewable resources. Finally, it would be easy to use the Default Energy Price since this price is already calculated as part of the settlement process.</p>	<p>Reactive power and Voltage support are not market products or ancillary services and are not co-optimized with real power. It is not possible for the ISO to co-optimize real and reactive power due to the fact that it is infeasible to create a market for reactive power due to market power concerns and localized nature of attempting a market based procurement of reactive power.</p> <p>The ISO believes that synchronous generators are currently indifferent to providing reactive power support versus real power due to the fact that they do not have to forego the production of any real power to provide reactive support within the required range. The ISO believes that the opportunity cost payments for the provision of reactive power outside the required range continues to be appropriate.</p>

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New Exceptional Dispatch Category	CalPeak and Malaga	<p>The CAISO's proposal to create a new "Reactive Power Exceptional Dispatch" category is ambiguous in many important ways.</p> <p>CalPeak and Malaga believe that even if the CAISO clarifies its proposal for a new category of Exception Dispatch, using an Exceptional Dispatch mechanism will never be an optimal way to provide compensation for reactive services. The current CAISO tariff provisions relating to Exceptional Dispatch for voltage support were only approved as interim measures needed to provide some compensation to generators called upon to provide emergency services to maintain reliability, not the CAISO's promised market-based mechanism for procuring voltage support. Thus, rather than create a new Reactive Power Exceptional Dispatch category, it would be preferable to modify the provisions of the CAISO tariff which relate to voltage support to create a new ancillary service category - "Voltage Support and Reactive Power Services." The purpose of creating this new category would be to put in place rules which ensure that the CAISO procures adequate reactive power resources.</p>	<p>The ISO has previously explored a market based approach to voltage support and deemed that approach infeasible.</p> <p>The ISO does not receive reactive power support primarily through Exceptional Dispatch. The majority of reactive power support that is provided by generation resources is directed by ISO operations to provide reactive support within the standard required range. The Exceptional Dispatch provisions are only used in instances where the assets in the area cannot adequately provide the necessary reactive power support within the standard required range which occurs infrequently.</p> <p>The ISO proposed a potential new Exceptional Dispatch category, but this aspect of the initiative still has numerous details to work through and needs to be further developed and this aspect and others for "atypical" resources will be addressed in a separate future stakeholder initiative.</p>
Voltage Support and Reactive Power Market	CalPeak and Malaga	<p>There are already a few relevant rules for providing voltage support in the CAISO tariff. See, e.g., CAISO Tariff Section 8.4.2 (ancillary service control standard for providing voltage support), 8.4.1.3 (requirement that provider has automatic voltage regulators), 8.9.4.2 (testing). On the whole, however, many changes will be required to the tariff to create a new "Reactive Power Services" category. The tariff (and associated business practice manual) should make it clear what resources are eligible, how resources are to register, what performance requirements must be met, a testing process, payment rules, and penalties for failure to perform.</p>	<p>At this time the ISO does not intend to create a new "Reactive Power Services" category. The ISO believes that uniform requirements for reactive power capability and the other tools currently available to the ISO are sufficient to meet system needs. The issues associated with the market based procurement of reactive power and voltage support have been described in the proposals to date and currently do not include the creation of new administrative or market based categories as suggested.</p>
Timing/ Implementation	CalWEA and AWEA	<p>CalWEA and AWEA acknowledge and support CAISO's clarifications that universal application of a reactive power requirement would apply only to Cluster 9 and beyond. However, CAISO goes on to state: "The ISO proposes that any</p>	<p>The ISO reiterates that generating units that are replaced or repowered must meet these new requirements. To specifically address the issue raised regarding a unit repower with existing</p>

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		<p>generating units that are replaced or repowered must meet these new requirements.”</p> <p>While CalWEA and AWEA generally agree with the intent of the above requirement for existing asynchronous generators, we seek clarification on the following critical, yet unclarified, points:</p> <ul style="list-style-type: none"> • The requirements should not apply to any existing asynchronous generator that is requesting an incremental increase or no increase in capacity or energy output using existing or refurbished hardware. • While the requirement should apply to projects that plan to repower with new turbines, it should not apply to existing turbines that remain (or are simply refurbished) in an otherwise repowered project (turbines remaining at the same capacity with essentially the same technology). 	<p>turbines that remain (or are simply refurbished) in an otherwise repowered project; If a generating unit is undergoing a repowering or refurbishing that does not constitute a material modification, then the unit will not be subject to the new reactive power requirements.</p> <p>Eventually, all units will need to be retired, repowered, or refurbished, and if a unit is undergoing repowering, at that time, should the unit choose install new replacement turbines, the unit would be required to meet minimum power factor requirements. To do so, all that would be required would be setting the plant control system to control VAR output or absorption.</p>
Technical Requirements	CalWEA and AWEA	<p>The earlier Revised Straw Proposal seems to unequivocally state that the choice of voltage control will be with the asynchronous generator, as requested by the wind industry, the proposal later takes that choice away from the generator by making the selection of voltage control point subject to CAISO and PTO permission. We recommend that this discrepancy on choice be resolved in favor of the generator.</p>	<p>Resource owners will be able to decide what area they control from, provided they compensate to the POI. The ISO did not intend to convey that the PTO and ISO would decide where resources would choose control from.</p>
Technical Requirements	CalWEA and AWEA	<p>Furthermore, CAISO goes on to require that “all resources must be electrically compensated to the POI.” The wind industry understands the need for this requirement but also believes that it could be interpreted in a multitude of ways and asks the CAISO to offer significantly more clarity on “compensated to the POI.”</p> <p>In regard to reactive power compensation to the POI, CalWEA and AWEA support the proposal by the Large-scale Solar Association (LSA) that asynchronous generators be allowed to opt for the same reactive power requirements that are applicable to synchronous generators whereby the generator is required to offer 0.9 lagging to 0.95 leading power factor at its terminals.</p>	<p>The ISO clarifies that “compensated to the POI” should mean that the resources may choose the point(s) on their system at which they install equipment to control voltages, but they must compensate electrically to the POI in a manner that will provide the required reactive power support at the POI, as detailed in the technical requirements section.</p> <p>The ISO previously addressed the issue of equivalency of the synchronous versus asynchronous requirements in the revised straw proposal. The ISO notes that allowing asynchronous resources to comply with the existing synchronous requirements may not be compliant with FERC Order 661a in</p>

Topic	Stakeholder	Stakeholder Comment	ISO Response
			cases where the asynchronous resource is located distant from the POI.
Technical Requirements	CalWEA and AWEA	Finally, rather than further elaborating on its technically superior proposal in their Straw Proposal that would allow one or more interconnecting asynchronous generators to collectively offer reactive support, particularly for beyond-the-POI voltage regulation potentially by installing reactive support equipment at such points, CAISO fails to mention that proposal at all in its Revised Straw Proposal. CalWEA and AWEA encourage CAISO to include and further flesh out this specific provision of the prior CAISO proposal as we believe that it will improve the technical capability and reduce the cost of providing the required reactive support.	The ISO has not provided additional details on how multiple resources could collaborate to collectively meet requirements because of confidentiality concerns related to interconnection requests by different developers, so developers would have to work out collective solutions between themselves. This is beyond the jurisdiction of the ISO. To meet the requirements with beyond-the-POI devices, developers can propose projects in the TPP or seek to negotiate non-conforming arrangements with PTOs, but that does not alter the proposed interconnection requirement.
Financial Compensation	CalWEA and AWEA	CalWEA and AWEA are truly dismayed with CAISO's total backtracking on cost compensation for reactive power capability. CalWEA and AWEA continue to believe that reactive power capability support is similar to any other service offered by a generator in support of network reliability and, hence, its cost should be treated as part of the Reliability Network Upgrade (RNU) cost leading to its compensation under the same rules that apply to RNU cost (including the applicable cap) as part of the interconnection process. Explicit accounting for the reactive power capability cost in this fashion is not only accurate, fair and equitable, but also will lead to better optimization of resource procurement.	<p>The ISO is not "backtracking" on cost compensation as suggested by this comment. The ISO has never proposed a capability/capacity payment. In the issue paper for this initiative, the ISO stated that it would explore the topic of capability payments. None of the ISO's formal proposal iterations have contained a capability payment element. That topic was floated for discussion in the early stage of this initiative and the ISO received considerable feedback on it from many stakeholders, many with opposite views on this topic.</p> <p>The ISO does not agree that the technical requirements the ISO is seeking would impose unreasonable costs on asynchronous resources. Resources have the opportunity to capitalize their costs when constructed and the ISO does not believe any of these costs should be treated as RNU costs.</p>

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Financial Compensation	CalWEA and AWEA	Reactive Power Capability Payment: This payment should cover the cost of retrofitting the generating facility to meet the reactive power and voltage control capability specified by the Revised Straw Proposal beyond the reactive support capability that would be naturally provided by the asynchronous generator as part of supplying its real power.	The ISO has previously stated that it does not propose any capability payment for reactive power because it is a good utility practice. For further discussion please refer to Section 5.2.2.
Financial Compensation	CalWEA and AWEA	Reactive Power Provision Payment: This payment should principally cover the opportunity cost to the asynchronous generator for withholding real power generation in order to provide the requested reactive power, which corresponds to lost revenue based on the PPA price and lost PTC, if any, rather than the generator's LMP. Only in this fashion would the true economic opportunity cost be captured for the asynchronous generator and properly incentivize the provision of reactive power.	The ISO's position is that resources should include any PPA or PTC costs in their bids to be properly captured under the provision payment structure. The ISO market is intended to address this issue by allowing resources to include these costs in their bids.
DERs	CalWEA and AWEA	CalWEA and AWEA would like to repeat the following additional point regarding the application of these rules to the wholesale distribution interconnection process (WDAT interconnection) administered by the PTOs, particularly Distributed Energy Resources (DERs). As we noted before, the best location to provide reactive capability is closest to where the reactive power is required. WDAT resources and particularly DERs are normally installed closest to the load centers where reactive power needs are the highest. In addition, DERs generally draw their reactive power needs from the grid. Hence, supplying reactive power support at the location of WDAT resources and particularly DERs would be highly desirable. Furthermore, WDAT projects, including DERs, are normally studied as part of the same cluster studies that are used for transmission-interconnected projects. Hence, it only makes sense that the universal reactive power requirement be simultaneously applied to both transmission and distribution interconnection processes.	As noted in the revised straw proposal; The ISO's proposal applies to resources interconnecting to the ISO grid. Distributed Energy Resources should meet any applicable distribution interconnection requirements. The CPUC's proposed decision (R.11-09-011) on revisions to Rule 21 requires the installation of smart inverters on DER. One of the requirements of the smart inverters is to provide voltage control.
Financial Compensation – Provision	CDWR	CDWR supports the concept of provisional payments, but not base level capability payments. This initiative has focused on which, when, where, and why asynchronous resources	The ISO is not proposing any further forms of provision payments and intends to continue the development of the previously proposed

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Payment Cost Allocation		<p>should or should not be paid for providing reactive power. However, an equally important topic to discuss is who should pay for the additional reactive power payments. Currently, the CAISO proposes to continue to allocate provisional reactive power payments to measured demand – loads and exports. CDWR believes this is unfair because it is discriminatory, irrational, and is largely a result of historical practices that are no longer applicable or appropriate in today's California energy market. CDWR asks the CAISO to more equitably allocate provisional reactive power payments.</p>	<p>Exceptional Dispatch category for reactive power from atypical resources in a separate stakeholder initiative that will start in Q2 2016.</p> <p>The magnitude of current provision payments to resources exceptionally dispatched outside of the standard required range is minimal. To adjust the currently approved cost allocation methodology for these limited payments would require creating additional studies and analytical systems at additional costs that the ISO believes deem the effort unjustified.</p>
Financial Compensation – Provision Payment Cost Allocation	CDWR	<p>CDWR asks the CAISO to evaluate and explain in the next proposal why it is not following most of its own cost allocation principles as it pertains to reactive power.</p> <p>CDWR understands that the CAISO's Cost Allocation Principles are just principles and are not hard set rules. However, based on the spirit of these principles and the universal importance of reactive power capability, CDWR feels that continuing to allocate provisional reactive power payments only to measured demand is irrational and discriminatory. CDWR asks the CAISO to equally consider this new allocation methodology as much as they are considering the new proposed settlement methodologies proposed in this initiative.</p>	<p>As noted above in its response to the previous CDWR comment, the ISO is suspending further work on the provision of reactive power by "atypical" resources.</p> <p>Further, see section 5.3 of the proposal, wherein the ISO discusses cost allocation, and explains that the ISO does not feel it is warranted to depart from the FERC approved method for allocating the cost of provision payments. This initiative is not changing the current compensation or cost allocation for the provision of reactive power.</p>
New Exceptional Dispatch Category	CESA	<p>Typically, these costs include fuel and other operational costs. Fuel costs can be gleaned through indexes, bids, and other sources. For energy storage, mitigated or default bid costs will need to consider both the costs of power used for charging, as well as efficiency losses.</p> <p>The CAISO should detail its bid-cost recovery structure for energy storage resources, particularly how it will calculate 'spent fuel costs'. This calculation will need efficiency loss considerations, additional non-metered costs that could result when delivering reactive power, and also assumptions about fuel costs. For instance, if an energy storage device was charged partly with cheap power and partly with</p>	<p>The ISO believes that this exceptional dispatch category aspect of the initiative still has numerous details to work through and needs to be further developed. Stakeholder comments such as these from CESA raise many important considerations related to this aspect of the initiative, including the accounting of costs related to real power consumed by inverter-based storage devices.</p> <p>The ISO is concerned that the necessary development of this aspect will take longer than the proposed</p>

Topic	Stakeholder	Stakeholder Comment	ISO Response
		<p>expensive power, should the deemed fuel costs be derived from the expensive power or the cheap power? Or an average? These accounting issues, e.g. LIFO or FIFO, should be governed by market design principles and should always ensure reasonable cost-recovery.</p> <p>Lastly, CESA recommends the CAISO include energy storage system EDs on the bulleted list of candidates for the new ED category on page 13 of the proposal.</p>	<p>timeline for implementing the technical requirements.</p> <p>The ISO has detailed the areas that need to be more carefully considered in Section 5.2.4. For these reasons, the ISO is suspending further work on this aspect of the initiative and will address these issues in a separate stakeholder initiative in Q2 2016.</p>
Timing/ Implementa- tion	LSA	<p>LSA recommends that the CAISO retain the current proposed Effective Date, which would implement the new requirements with Cluster 9, and clarify that timeline for Independent Study Projects (ISPs) and Fast-Track Projects (FTPs). The CAISO should further clarify that: (1) the effective date would be April 30, 2016 (Cluster 9 application window close); and (2) the new requirements would also apply to any Independent Study Process (ISP) or Fast Track (FT) Interconnection Requests (IRs) submitted after that date.</p> <p>The CAISO should not impose the new requirements on earlier-queued projects where GIAs were not tendered or “substantially negotiated” before the rules are effective, or where the project has not yet been awarded a PPA, as suggested by the SDG&E. By the time the GIA is tendered or substantially negotiated, the developer may have already bid the project.</p>	<p>The ISO is proposing that these technical requirements would be applicable to the next interconnection cluster, starting April 1, 2016. The ISO similarly intends that effective date of the requirements as applied to ISPs and FTPs be April 1, 2016 (Cluster 9 application window open).</p> <p>The ISO does not propose to impose the new requirements on earlier-queued projects where GIAs were not tendered or “substantially negotiated” before the rules are effective, or where the project has not yet been awarded a PPA.</p>
Technical Requirements	LSA	<p>LSA recommends that the CAISO incorporate collective compliance options into the regular interconnection-study process.</p> <p>The Proposal says that the CAISO might identify such opportunities before the POI if it “observes” that several generators in a cluster study have the same POI. The CAISO should clearly know whether such generators in the same cluster have the same POI, so such options should be considered in all studies as appropriate.</p>	<p>The ISO is not proposing any changes to the transmission planning process or interconnection studies process under this proposal. This request is beyond the scope of our standard interconnection process. Generators can propose projects such as these in the TPP.</p>

Topic	Stakeholder	Stakeholder Comment	ISO Response
Technical Requirements	LSA	<p>LSA recommends that the CAISO clarify that compliance at locations before the POI are the option of the developer, as long as compensation to the POI is verified.</p> <p>The Proposal states that generators can meet the standards at locations behind the POI as long as there is compensation to the POI. The CAISO clarified on the most recent stakeholder call that this option will be available to developers, subject only to verification that the required support will be provided at the POI, i.e., case-by-case CAISO/PTO approval is not required. LSA asks that this important point be included in the next proposal version.</p>	<p>The ISO agrees the proposal defers to resource developers to decide where to locate control devices as long as the requirements are met at the POI, through electrically compensating to the POI.</p> <p>The ISO/PTO would not approve designs of resource specifications per say, but the interconnection requirements state that the resource developers must design their facilities to provide the required amount of reactive support, electrically compensated to the POI.</p>
Technical Requirements	LSA	<p>LSA recommends that the CAISO allow asynchronous generators the option to meet the power-factor requirements applicable to either synchronous or asynchronous generators.</p> <p>There was a fairly extensive discussion on the last conference call between LSA, CalWEA, and the CAISO about the continuing difference between the different (though “equivalent”) power-factor requirements for synchronous and asynchronous generators. The synchronous generator standard has a wider power-factor range (more stringent requirement), but the requirement can be met at the generator terminals, with no compensation to the POI required.</p> <p>LSA agrees that the asynchronous-generator power-factor requirement would probably be easier for most asynchronous generators to meet; however, some might find the synchronous-generator requirement more optimal. Allowing asynchronous generators the option to meet either requirement would address some difficulties that asynchronous generators may encounter in complying with the new standards, e.g., the much-discussed situation with projects having long gen-ties (harder to compensate to the POI), which are more common for asynchronous generators (more likely to locate in remote areas). Asynchronous generators should not have to meet higher effective standards than</p>	<p>The ISO addressed the issue of equivalency of the synchronous vs asynchronous requirements previously in the revised straw proposal. The ISO notes that allowing asynchronous resources to comply with the existing synchronous requirements may not be compliant with FERC Order 661a in cases where the asynchronous resource is located distant from the POI.</p>

Topic	Stakeholder	Stakeholder Comment	ISO Response
		<p>synchronous generators would at the same location.</p>	
<p>Technical Requirements</p>	<p>LSA</p>	<p>LSA recommends that the CAISO consider investments at the PTO substation or beyond in the regular interconnection study process, for individual projects or on a collective basis.</p> <p>CalWEA asked the CAISO on the most recent conference call if generators could have the option to fund equipment on the PTO side of the interconnection (e.g., at the PTO substation) to allow the generator to meet the requirements.</p> <p>The equipment would be under CAISO/PTO control and could be operated whenever those entities deem necessary (not only when needed for the specific generator to meet the requirements). While there could be impediments (e.g., lack of room at the substation), this option would also help generators with long gen-ties (see above). The CAISO said on the call that it would consider including this option, where the arrangement can be worked out between the developer and the PTO.</p> <p>SDG&E suggested that developers indicate their interest in such arrangements at the interconnection Scoping Meeting (or otherwise as early as possible in the study process), so the arrangement can be examined and assessed in the interconnection studies and included in the GIA. However, LSA believes that this option should instead be a regular consideration in the interconnection-study process, and not considered only if the developer states an interest. These studies should identify the most cost effective interconnection methods, and it should be possible to include this analysis without impacting the study timelines.</p> <p>LSA recommends that the CAISO clarify that the TPP will consider PTO investments in situations where some resources with a common POI are required to meet the standards but others are not.</p>	<p>The ISO is not proposing any changes to the transmission planning process or interconnection studies process under this proposal. This request is beyond the scope of our standard interconnection process.</p> <p>Generators can propose projects such as these in the TPP.</p>

Topic	Stakeholder	Stakeholder Comment	ISO Response
		<p>On the most recent conference call, the CAISO said that it also might consider PTO investment beyond the POI in the TPP or curtail generators without reactive capability in such situations. The CAISO should consider these situations routinely in the TPP and, where PTO-level investments would be cost-effective or otherwise desirable, approve such investments.</p>	
Financial Compensation	LSA	<p>Modify the Provision Payment opportunity-cost payment provisions:</p> <p>Base opportunity-cost compensation when resources are dispatched outside the required range on Power Purchase Agreement (PPA) payments.</p> <p>LSA requests that the CAISO reconsider its position in the Proposal that it will continue to base Provision Payments under the tariff on Locational Marginal Prices (LMPs), where a unit is dispatched to provide reactive power/voltage support outside the required range and must reduce real-power production to comply. Instead, Provision Payments should be based on PPA compensation, and the compensation should be paid directly to the generators, instead of their SCs.</p> <p>As LSA has explained, since variable generation costs are virtually zero, the opportunity cost of foregone real-power output is mainly lost PPA payments and is not related to the LMP. Most PPAs for asynchronous generators contain per-MWh payments only, so fixed costs as well as variable costs are recovered in energy payments; thus, the generator will under-recover its fixed costs if the energy is not produced. The CAISO has expressed concerns about “interpreting” PPAs, to which it is not a party.</p> <p>As LSA has suggested, the CAISO could delegate this task to Potomac Economics (Potomac), as part of the latter’s scope of work in determining Default Energy Bids (DEBs). 5 Determining DEBs presumably requires Potomac to routinely interpret others’ contracts, such as natural gas take-or-pay arrangements, as well as analyzing other complex data on</p>	<p>The ISO’s position is that resources should include any PPA or PTC costs in their bids to be properly captured under the provision payment structure. The ISO market is set up to address this issue by allowing resources to include these costs in their bids.</p> <p>Resources that have contracts allowing SCs to bid on their behalf should work out including those costs in their bids with their scheduling coordinator to address this concern.</p>

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		<p>conventional-generation operations (e.g., Multi-Stage Generator transitions). Most PPAs contain very simple per-MWh payment structures that will require very little “interpretation” from Potomac experts. Effectively, this would simply be an additional DEB determination by Potomac, and not a very difficult one at that.</p> <p>The CAISO responded to this suggestion on the latest conference call by suggesting that asynchronous generators simply bid their PPA prices into the market, and that they address payment issues with their SCs. This was clearly not a feasible suggestion, since (as the CAISO is well aware): (1) virtually all PPAs for asynchronous generation require the Buyer to be the SC and allow that entity to schedule/bid the project in any manner it chooses, i.e., the generators do not have any influence over such bids; and (2) this is not a negotiable provision.</p>	
New Exceptional Dispatch Category	LSA	LSA requests that the CAISO clarify that solar resources operating at low or zero levels do not have any obligation to provide reactive support beyond the proposed requirements. The proposed standard requires reactive capability at +0.95 when the resource is at maximum output, but the VAR output/absorption requirement declines when the resource is producing at lower levels, presumably to zero if the output is zero. Compliance beyond the requirements should be voluntary.	The ISO notes these LSA concerns in the body of the proposal under Section 5.2.4. Through a separate stakeholder initiative in Q2 2016, the ISO will extend development of this proposed exceptional dispatch category to further develop important details such as how to address this issue.
Financial Compensation	NRG	NRG continues to oppose the CAISO’s position to not provide capability payments. The CAISO is fundamentally abdicating its responsibility to provide compensation and create robust markets for critical services needed to maintain grid reliability by assuming those costs are being recovered through some other mechanism. Should the CAISO not change its position on this matter, NRG will oppose this position when filed at FERC.	The ISO continues to believe that providing reactive power constitutes good utility practice. Voltage support requirements are necessary for the reliable operation of the transmission system, and support the delivery of real power from generation to loads, which allows those resources to participate in the ISO markets. The ISO is not proposing a capability payment for reactive power.
Financial Compensation	NRG	NRG appreciates the CAISO’s direction to begin thinking about compensation for reactive power from “unconventional resources” that are not producing real power (e.g., conventional	The ISO believes that this exceptional dispatch category aspect of the initiative still has numerous details to work through and needs to be further

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		<p>combustion turbines fitted with clutches to be able to provide reactive power without heat in the machine, and smart inverters on solar resources being able to provide reactive power while the sun is not shining). While NRG appreciates the CAISO's focus on these emerging sources of reactive power, using extra-market Exceptional Dispatch to provide compensation to resources that are likely to be an increasingly large source of reactive power does not align with a core CAISO principle, namely, creating meaningful markets and price signals for the reliability services the CAISO needs to reliably operate the grid.</p> <p>With that said, while NRG does not support using Exceptional Dispatch as the means for compensating any reliability service, should the CAISO use Exceptional Dispatch as an interim compensation method, the CAISO should include O&M costs in the compensation for that service. While operation as a synchronous condenser without heat in the machine does not contribute as much to the need for future maintenance as operating the machine with heat in it contributes to the need for future maintenance, the O&M costs for a rotating machine are not zero.</p>	<p>developed. The ISO is no longer proposing to develop this exceptional dispatch category at this time and will address these issues in a separate stakeholder initiative in Q2 2016.</p> <p>Stakeholder comments such as these from NRG raise important considerations related to this aspect of the initiative, including the need to potentially address reactive power from unconventional resources in a manner other than through exceptional dispatch. The ISO will explore these comments as it considers how to best address these needs.</p>
New Exceptional Dispatch Category	PG&E	<p>PG&E seeks more detail and clarity about the recently introduced "Reactive Power Exceptional Dispatch" function. PG&E supports the general concept of "making whole" resources so that the resources are financially indifferent to responding to provide reactive power support and are therefore willing to operate in this mode. However, CAISO should provide the final list of cost elements and detailed examples of how it would work in practice, for stakeholders to fully understand this new exceptional dispatch function. In addition, PG&E requests that CAISO provide reactive power set points (not voltage set points) to resources in those conditions. This is crucially important when multiple resources are clustered in a close by proximity to each other. PG&E is concerned hunting issues could arise if CAISO chooses to use voltage set points.</p>	<p>The ISO believes that this exceptional dispatch category aspect of the initiative still has numerous details to work through and needs to be further developed. PG&E raises important considerations related to this aspect of the initiative, including the need to provide reactive power set points versus voltage set points.</p> <p>As discussed above in other responses, the ISO will further develop this topic in a separate stakeholder initiative that will start in Q2 2016..</p>

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Financial Compensation – Provision Payment Cost Allocation	PG&E	PG&E believes the CAISO’s methodology should be revised if the costs are significant in future. PG&E appreciates CAISO’s explanation (related to cost allocation) that “load is not the only driver of reactive power needs”. PG&E acknowledges that it is difficult to calculate generation resources contribution at any given time. However, if the level of reactive Power compensation costs is elevated significantly in future, the cost allocation methodology should be revised. PG&E recommends CAISO revisit cost allocation.	The ISO appreciates PG&E’s recommendation and will consider the need to revisit cost allocation should the magnitude of provision payments reach suitable levels to justify that reevaluation.
New Exceptional Dispatch Category	SCE	During the October 15, 2015 stakeholder call, the CAISO stated that an ED for the provision of reactive power would be based solely upon the effectiveness of the resource in satisfying the identified need. SCE notes that section 34.11 of the CAISO tariff lists the criteria to be used to determine the resource that will receive an ED. Notably, section 34.11 of the tariff states, “In applying these selection criteria, the goal of the CAISO will be to issue Exceptional Dispatches on a least-cost basis to resources that will be effective in meeting the reliability needs underlying the Exceptional Dispatch” (emphasis added). SCE believes that similar criteria for the issuance of an ED with respect to reactive power should be established, and similarly, the CAISO should issue such a dispatch in a least-cost manner consistent with meeting the reliability needs of the system.	<p>The ISO believes that this exceptional dispatch category aspect of the initiative still has numerous details to work through and needs to be further developed. SCE raises important considerations related to this aspect of the initiative, including the need to investigate how to determine criteria for choosing units to instruct under exceptional dispatch and attempting to identify least-cost resources in these unconventional situations.</p> <p>As discussed above in other responses, the ISO will further develop this topic in a separate stakeholder initiative that will start in Q2 2016.</p>
New Exceptional Dispatch Category	SDG&E	The new Exceptional Dispatch (ED) category seems reasonable. If resources have special characteristics to provide reactive power necessary to the system, there should be some accounting mechanism in place to recover costs in low/no real power output situations, and, thus, low to no traditional opportunity cost calculation. SDG&E would like the CAISO to better detail how CAISO will identify these resources which can be Exceptionally Dispatched. CAISO mentioned all needed information is in the master file but we are not completely confident this is the case. SDG&E is wondering if CAISO has any sense of how often these exceptional dispatches may occur. Also, has CAISO considered setting an administrative fee as a	<p>The ISO believes that this exceptional dispatch category aspect of the initiative still has numerous details to work through and needs to be further developed. SDG&E raises important considerations related to this aspect of the initiative, including the need to investigate the potential for using an administrative fee for compensation and ensuring that resources are adequately compensated so the ISO can count on their availability for these services.</p> <p>As discussed above in other responses, the ISO will further develop this topic in</p>

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		<p>compensation mechanism? This would be a simpler more transparent method of payment as opposed to convoluted special payment calculations for these out of market dispatches. Additionally, only paying actual costs (or worse, not completely having costs covered if the ED calculation is not robust) very well may not provide the incentive needed for these 'special' characteristics to make themselves available to provide reactive power. With an administrative fee, generators may apply to recover costs above ED compensation if they find they have been undercompensated. SDG&E is not convinced the proposed compensation mechanism and Page 2 of 2 calculation will make special characteristics available for exceptional dispatch of reactive power.</p>	<p>a separate stakeholder initiative that will start in Q2 2016.</p>
New Exceptional Dispatch Category	Six Cities	<p>The Six Cities understand that the ISO is proposing to establish the compensation for this category based on the costs to provide the reactive power in response to a dispatch order, including the costs of real power consumed to produce the reactive power and start-up and minimum load costs (including fuel, variable operations and maintenance, and other opportunity costs). (See Revised Straw Proposal at 13.) However, the proposal to create a new Exceptional Dispatch category requires additional key details, and the Cities thus neither support nor oppose the proposal at this time, because the proposal raises a number of questions.</p>	<p>The ISO believes that this exceptional dispatch category aspect of the initiative still has numerous details to work through and needs to be further developed. Six Cities raises a number of important questions related to this aspect of the initiative, including the need to identify the duration and magnitude of costs of these potential exceptional dispatches.</p> <p>As discussed above in other responses, the ISO will further develop this topic in a separate stakeholder initiative that will start in Q2 2016.</p>
Financial Compensation	WPTF	<p>The ISO's explanation on why they removed all capability payments is insufficient. The ISO has removed all capability payments from the proposal. In general, WPTF finds both of these explanations insufficient to fully understand the ISO's reasoning. "Good utility practice" is not synonymous with "no cost recovery." In fact, it is well understood that cost recovery is an essential part of good utility practice or it would be impossible for the practice to be efficiently achieved in the long-term. WPTF requests further clarity in the next draft on how generators will be able to achieve (at a minimum) cost recovery for providing reactive power capability to the grid.</p>	<p>The ISO agrees that resources should have the opportunity for appropriate cost recovery. As explained in Section 5.2.1, the ISO continues to compensate resources for the provision of reactive power outside of the standard required range when resources need to reduce their real power output to provide reactive power support. This compensation for a resource's opportunity costs of providing reactive support allows them cost recovery for the variable costs of actually providing reactive power. Cost recovery for fixed costs, which is not guaranteed in a</p>

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			<p>competitive market, is addressed through a combination of a resource’s energy market revenues and long-term purchase power agreements, given market rules, expected market conditions, and reliability requirements.</p>
<p>Financial Compensation</p>	<p>WPTF</p>	<p>The ability to value reactive power capability costs will be increasingly important as the ISO integrates an increasing amount of renewable generation. The increase in renewable generation in the next decade- primarily solar- will lead to changes in the need for reactive power during off-peak periods and evening hours. Eventually, the ISO will be faced with increasing circumstances where renewable resources cannot provide sufficient reactive power in local areas without investment into reactive power equipment. This could be, for example, because solar resources cannot provide reactive power during dark, evening hours or because the renewable resources in the area were interconnected prior to the new requirement. The ISO would then have to decide the most economical solution to meet the local reactive power need. It is unclear to WPTF whether the ISO has the studies or procurement authority in place to effectively and efficiently do so.</p> <p>The ISO is proposing a blanket requirement on all future asynchronous resources to address unforeseen needs due to the increase in renewable generation on the grid. The ISO also has the ability to procure reactive power capability through Reliability Must Run (RMR) contracts. These tools alone may not be sufficient to ensure efficient procurement of reactive power. Even if the ISO adapts both transmission and generation planning studies in order to identify the reactive power need, without an established capability payment to compare costs across resources, the ISO will not have a mechanism for evaluating and procuring different options.</p> <p>WPTF believes the Market Surveillance Committee discussion that took place on October 20, 2015 began to delve into these issues and WPTF is interested in whether the</p>	<p>The ISO disagrees that there is a potential gap in studies and procurement ability as well as reactive power services. The intent of this initiative was to discontinue the more inefficient and inaccurate case-by-case reactive power studies in place under the current interconnection process. The ISO does not intend to increase studies for reactive power needs and procurement under this initiative. The ISO believes that extending these technical requirements to all asynchronous resources, in combination with the other options currently available to the ISO, and the TPP, will adequately meet system reactive power needs.</p> <p>The ISO discussed the reactive power initiative with the Market Surveillance Committee at its October 20, 2015 meeting. The Market Surveillance Committee will be preparing an Opinion on this initiative and there is a stakeholder process for development of the Opinion that stakeholders are encouraged to participate in.</p>

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		ISO agrees that there is a potential gap in studies and procurement ability as well as reactive power services.	
Financial Compensation	WPTF	WPTF cannot support the current proposal without additional justification. WPTF asks that the ISO at a minimum further vet the proposal with the MSC and provide additional justification for removing the capability payment component of the proposal. We also reiterate our comments provided on September 3, 2015 supporting the safe harbor compensation approach and noting the different between RA contract and interconnection requirements and compensation.	The ISO has provided significant justification for extending the requirements to asynchronous resources. While WPTF disagrees with the ISO's direction on financial compensation, the ISO fully explored several options surrounding financial compensation and believes that it is not appropriate to include a capability payment component for the reasons described in the proposal.