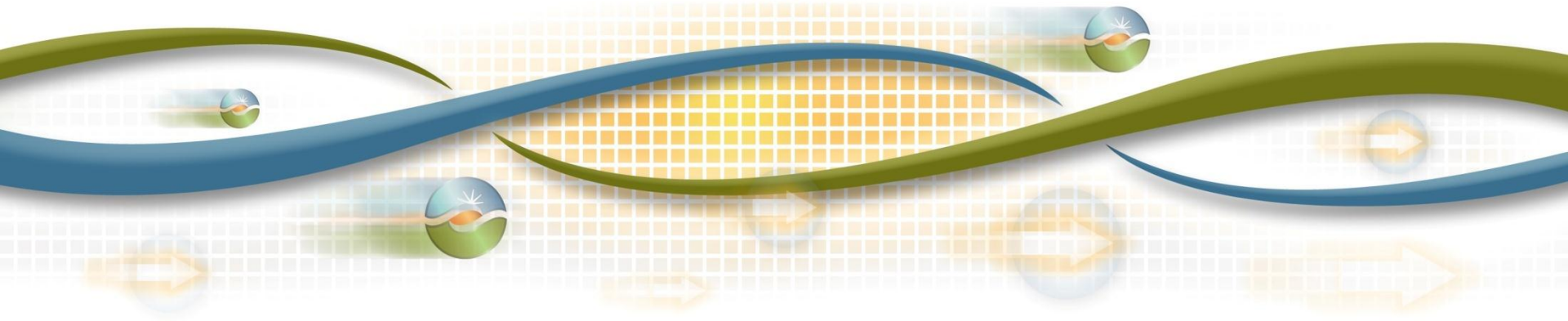


Reactive Power Requirements and Financial Compensation

Straw Proposal Stakeholder Meeting

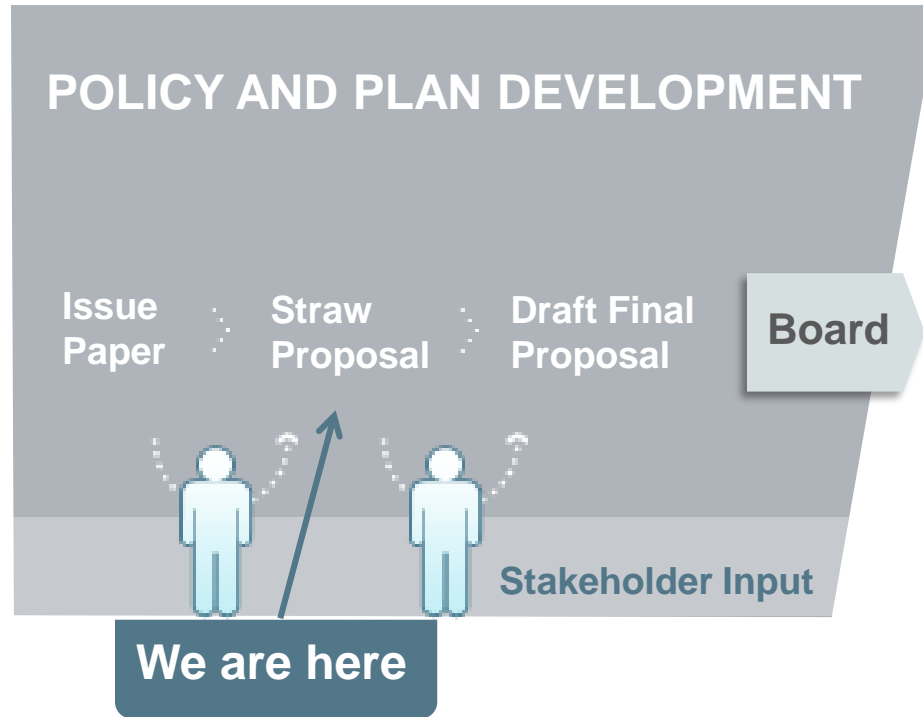
August 20, 2015



August 20, 2015 stakeholder meeting agenda

Time	Topic	Presenter
10:00-10:05	Introduction	Kim Perez
10:05-10:20	Updated schedule and SH comments	Chris Devon
10:20-10:45	Technical requirements	Clyde Loutan
10:45-11:00	Effective Date	Chris Devon
11:00-11:45	Financial compensation	Chris Devon
11:45-12:30	Lunch	
12:30-1:30	Financial compensation (continued)	Chris Devon

ISO policy initiative stakeholder process



Stakeholder process schedule update

Milestone	Date
Straw Proposal posted	Aug 13, 2015
Stakeholder meeting on Straw Proposal	Aug 20, 2015
Straw Proposal comments due	Sep 3, 2015
Revised Straw Proposal posted	Sep 22, 2015
Stakeholder call on Revised Straw Proposal	Oct 1, 2015
Revised Straw Proposal comments due	Oct 15, 2015
Draft Final Proposal posted	Nov 9, 2015
Stakeholder call on Draft Final Proposal	Nov 19, 2015
Draft Final Proposal comments due	Dec 3, 2015
Board of Governors meeting	Feb 3-4, 2016

Overview of comments: May 22, 2015 Issue Paper

- Stakeholder responses included comments on both technical requirements and financial compensation
- Requested clarification on some technical requirements
 - Equivalency for synchronous and asynchronous resources
 - Point of measurement requirements
 - Response time requirements
 - Inverter sizing limits
- Replies varied on financial compensation issues
 - Some parties support capability payments, while others oppose
 - Most that support capability payments prefer safe harbor approach
 - General support for continued provision payments

TECHNICAL REQUIREMENTS

Clyde Loutan

Proposed asynchronous resource requirements

- Proposal would establish uniform requirement for asynchronous resources to provide reactive power capability and voltage regulation
 - Sets asynchronous requirements comparable to current synchronous requirements
 - Consistent with FERC Order 661a
 - Asynchronous resources use different technology and point of measurement so requirements will not be identical numerically
 - Due to point of measurements they will be roughly equivalent

Proposed requirements equivalency

- Proposed power factor requirements for both types of resources appear as different values
 - Current synchronous requirements: 0.90 lag (producing VARs) and 0.95 lead (absorbing VARs), measured at the generator terminals
 - Proposed asynchronous requirements: 0.95 lag (producing VARs) and 0.95 lead (absorbing VARs), measured at the Point of Interconnection (POI)

Proposed requirements equivalency

- Reactive capability of variable generation resources is specified for transmission interconnections at POI
 - “A synchronous generator with reactive capability of 0.9 lag (over-excited) and 0.95 lead (under-excited) (measured at the generator terminals) connected to the transmission system through a step-up transformer with leakage reactance of 14 percent (on the generator MVA base) can provide 0.95 lag/lead at the POI.” *(2012 NERC Specific Reliability Assessment: Interconnection Requirements for Variable Generation at pg.19-21)*
- 0.95 lead/lag requirement for asynchronous resources at POI is generally equivalent to the ISO’s current 0.90 lag/0.95 lead requirement at generator terminals for synchronous resources

Asynchronous POI measurement requirement

- Stakeholders assert ISO should consider additional options as to where to measure reactive power in addition to POI, such as generator terminal or inverter terminal
- ISO proposal is consistent with FERC Order 661a, which states voltage requirements should be measured at POI
- The ISO's proposal allows a developer to control reactive power at a point other than the POI but the reactive power must be adjusted to the point of POI
 - To address hunting issues
- ISO jurisdiction starts at POI so any point prior to that is inconsistent with interconnection construct

Asynchronous response time requirements

- Some stakeholders suggest that imposing a one-cycle response requirement would be an unreasonable burden with minimal to no benefit
- ISO is proposing that the response time requirements for asynchronous resources be consistent with response time for synchronous resources (typically within 1 second)

Asynchronous inverter sizing limits

- Propose that resources inverter configuration may not increase project's net capacity
- Inverter may not be increased by more than greater of: ten percent (10%); or three (3) MWs, provided resource installs an approved controlled mechanism
- Stakeholders expressed concern that limitation would prohibit a project from meeting 0.95 lead/lag reactive power requirement if resource voluntarily provides reactive power
- Inverter sizing limitation is already in place under Section 6.5.4.1 of BPM for Generator Management for Material Modification Assessment requests

Asynchronous inverter sizing limits

- At its full MW output, a generator that increased inverter capacity by only 5.2% could meet the proposed power factor capability requirements
- This is easily within the 10% limit and resources should not have issues related to producing full MW output while still providing maximum reactive power support

EFFECTIVE DATE

Chris Devon

Effective date proposal

- ISO proposes applying this new policy for asynchronous resources beginning with interconnection customers in Cluster 9 (planned for April 2016)
- ISO proposes to apply the uniform requirements to projects with interconnection agreements tendered for execution, or not substantially negotiated, on or after the effective date of the ISO's tariff revisions

Effective date considerations

- Other regions have implemented similar requirements and utilized a cutoff date, including PJM most recently
- Cutoff approach may provide greater certainty for resources in interconnection process for purposes of design and contracting
- Do stakeholders prefer a targeted cluster, or a cutoff date?
- What factors or considerations should the ISO keep in mind?

FINANCIAL COMPENSATION

Chris Devon

Financial compensation background

- Some ISO/RTOs provide financial compensation for the capability and/or provision of reactive power
- Type of payments and cost recovery methods vary by region
- Payments for reactive power can be similar to real power in that there are potentially two types of revenue streams
- Roughly equivalent to capacity and energy payments for real power in some markets

Financial compensation background

(continued)

- Provision payments cover a resource's variable costs for providing reactive power
- Capability payments used in some markets cover fixed costs of a resource's equipment installed for capability to provide reactive power
- Some regions pay both types of payments, while others only pay for the provision due to
 - Market design
 - Resource adequacy constructs
 - Utility contracting and procurement practices

Financial compensation background

(continued)

- Differences in market structures and business practices among ISO/RTO regions support different approaches to compensation for reactive power
- ISO/RTOs with centralized capacity market constructs may also need specific reactive power capability payments
- Eastern RTOs that administer centralized capacity markets only procure capacity for real power, separate from reactive power capability

Financial compensation background

(continued)

- ISO does not administer a centralized capacity market, instead LSEs participate in Resource Adequacy program
- Stakeholders indicated that LSEs' contracts with most resources cover reactive power capability costs
- Generally, contracts account for overall costs of doing business, including requirements under the current tariff

Capability payment proposal

- ISO does not propose to provide a capability payment to existing resources because the costs of the associated equipment are already covered under contracts
- Extending requirements to asynchronous resources should not present a significant incremental cost
- ISO proposes to make capability payments available only to new resources that can demonstrate that the costs of the associated equipment is not covered under a power purchase agreement

Capability payment proposal (continued)

- For eligible new resources, ISO will develop an appropriate capability payment methodology, still TBD:
 - AEP
 - Safe harbor

Provision payment proposal

- ISO already has tariff provisions that provide for compensation for the provision of reactive power for resources dispatched outside required standard range
- All resources (existing or “new”) would be eligible for this compensation if dispatched outside required standard range
- ISO is not currently proposing any changes to existing provision payment methodology
- Open to suggestions for methods or adjustments to provision payment methodology to provide a more market based approach

Current provision payments

- Section 11.10.1.4: total payments for Voltage Support shall be the sum of the opportunity costs of limiting energy output to enable reactive energy production
- 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

Resources with non-typical reactive power capabilities

- Issue paper and stakeholder comments have raised some special circumstances in which certain resources can provide valuable reactive power support
- Some resources/situations may warrant different considerations
- ISO is exploring potential additional provision payments or other compensation mechanisms for those resources and unique situations

“Fast switching” clutches and low/no output VERs

- Resources with some unique characteristics or in certain situations may provide the ISO with needed reactive power support:
 - **“Fast switching” resources** able to switch between providing real power and reactive power very quickly, also known as “clutch” resources
 - **Asynchronous resources** able to provide reactive power support, even during times of **low or no output**, such as wind resources at low output, solar resources under cloud or at night
- These resources would not have an opportunity cost since they are “out of the money” in the energy market optimization but are still providing a service to the ISO

Payment options for special cases

- One option may be to provide an alternative type of provision payment to incentivize responses by these resources when they would not otherwise receive any compensation under the current provision payments
 - For example; allowing resources in these situations to apply a Default Energy Bid (DEB) value that allows for calculation of some payment for MVAR support under the current provision payment structure, even though the resources are not producing real power MWs.

Feedback on special cases payments

- “Fast switching” clutch resources and VERs at low/no output have useful abilities to provide reactive power in situations they would not be rewarded under the current methodology
- May be appropriate to enhance their ability to recover variable costs and incentivize response
- ISO is seeking additional feedback on an appropriate mechanism or revisions to current provision payments for these unique situations

Financial compensation cost allocation

- Appropriate to keep current cost allocation for current provision payments consistent
- Propose to allocate any compensation payments that are granted to eligible new resources in a manner consistent with the current provision payment cost allocation methodology: *pro rata* to load and exports
- Proposed capability payment mechanism will be limited in scope and it is reasonable to allocate these costs similarly to the current provision payments

Next steps

- Stakeholders are asked to submit written comments by **September 3, 2015** to InitiativeComments@caiso.com
- Revised Straw Proposal will be posted on September 22, 2015