California ISO
Shaping a Renewed Future

Energy Storage Interconnection Initiative

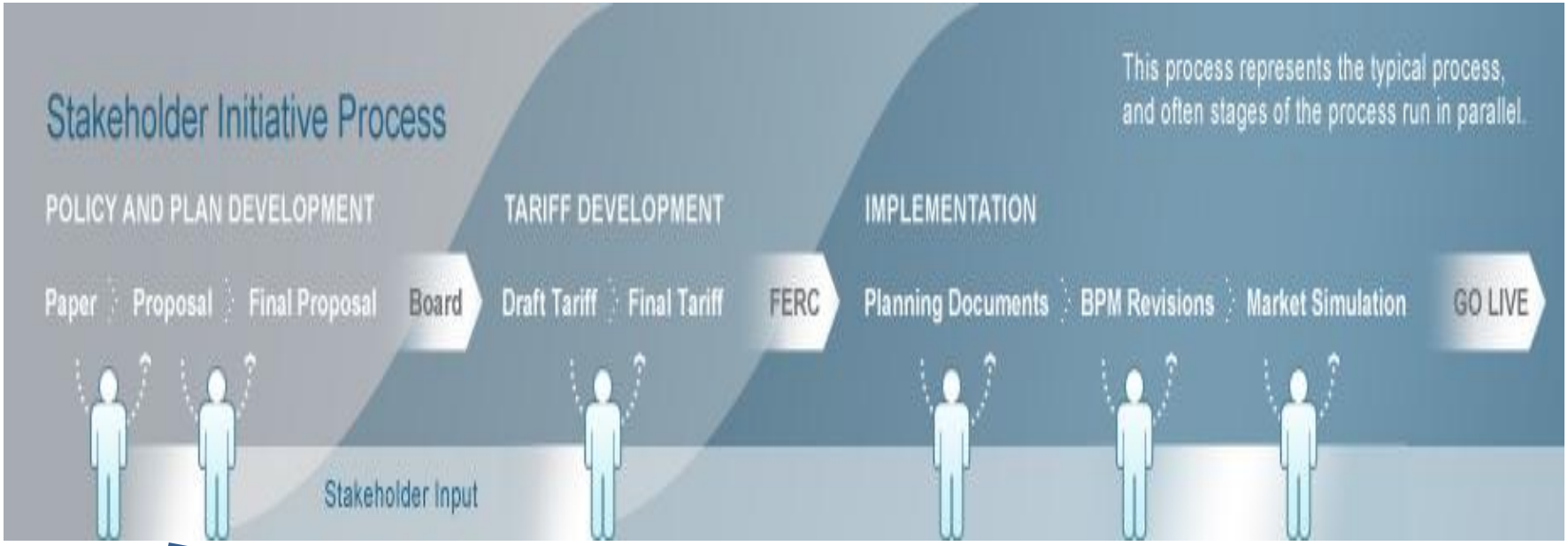
Stakeholder Meeting

August 13, 2014

Agenda

Time	Agenda Item	Speaker
10:00-10:05	Introduction, Stakeholder Process	Tom Cuccia
10:05-10:30	Background / Updates	Tom Flynn
10:30-11:30	Applying the GIDAP to Cluster 7	Tom Flynn / Songzhe Zhu
11:30-12:00	Review of existing processes for project modification	Debi Le Vine
12:00-1:00	Lunch break	
1:00-2:45	Resource adequacy-related interconnection issues	Karl Meeusen
2:45-3:00	Next Steps	Tom Cuccia

ISO Stakeholder Initiative Process



We Are Here

Stakeholder process schedule

Step	Date	Event
Round 1	June 24	Post issue paper & straw proposal
	July 1	Stakeholder web conference
	July 15	Stakeholder comments due
Round 2	August 13	Stakeholder meeting
	August 20	Stakeholder comments due
Round 3	September 16	Post paper #2
	September 23	Stakeholder web conference
	October 7	Stakeholder comments due
Board approval (only if needed)	November 13-14	ISO Board meeting

Background / Updates

Interest in storage is accelerating

- In October 2013, the CPUC adopted an energy storage procurement framework.
  - Established a target of 1,325 MW of energy storage to be procured by PG&E, SCE, and SDG&E by 2020, with installations required no later than the end of 2024.
- In April 2014, the ISO received interconnection requests for over 2,300 MW of energy storage in Queue Cluster 7.
  - 1,342 MW of stand-alone storage (27 projects).
  - 978 MW of storage combined with generation (12 projects).
  - Almost half of all projects in Queue Cluster 7 are storage related.

Progress has been made in the Energy Storage Interconnection Initiative

- Remains focused on ISO grid level interconnections.
  - Approach developed here may inform solutions for distribution connected storage.
- In anticipation of storage interconnection requests in Queue Cluster 7, ISO developed a framework under existing GIDAP rules for accommodating these storage interconnection requests.
  - Enables these projects to move forward while the broader spectrum of energy storage issues are identified and resolved.
  - Provides meaningful study results to these customers.

ISO made its Order 792 compliance filing 8/4/14

- Among other things, Order 792 directed transmission providers to specifically define electric storage devices as generating facilities that can take advantage of generator interconnection procedures.
- ISO incorporated the tariff revisions set forth in Order 792 into the definition of the term Generating Facility in appendix A of the ISO tariff (also appendices EE and FF).

Generating Facility shall mean the Interconnection Customer's Electric Generating Unit(s) used for the production and/or storage for later injection of electricity identified in the Interconnection Customer's Interconnection Request, but shall not include the Interconnection Customer's Interconnection Facilities.

Are changes to the GIDAP needed?

- Thus far, no changes to the GIDAP have been identified as necessary to accommodate storage interconnection to the ISO grid.
  - Need for any changes to pro forma interconnection agreement to address charging functions still under consideration.
- To the extent this initiative identifies needed changes, we have been targeting the November 2014 ISO Board meeting for approval of any needed tariff changes.
- If stakeholders believe changes to the GIDAP are needed to accommodate energy storage interconnection to the ISO grid, ISO requests that stakeholders describe these in their August 20 comments.

Energy Storage Roadmap

- Separate from this interconnection initiative, ISO is partnering with CPUC and CEC on the development of an energy storage roadmap to address the much broader spectrum of energy storage issues.
- Objective is to understand needed policy and regulatory actions to facilitate expansion of energy storage in California.
- Will serve to enhance understanding of challenges and barriers for energy storage.
- Two stakeholder workshops will be held with the first scheduled for September 4 at the ISO.
- Publication of final roadmap by the end of the year.

Applying the GIDAP to Cluster 7 energy storage projects

General approach

- Existing GIDAP rules can accommodate Cluster 7 storage projects that want to be treated as generators for both aspects of their operation.
  - A generator that produces positive output during discharge mode and negative output during charging mode.
  - Must respond to ISO dispatch instructions, including curtailment to manage congestion, during both charging and discharging modes.
- This approach may be used for stand-alone storage and storage combined with a generator, but not storage combined with load.

Payments and charges applicable to demand

- This approach of treating both the discharging and charging modes under a generator construct is being used for purposes of the interconnection process.
- This approach is not intended to determine what payments and charges beyond the interconnection process should be applicable to the charging mode.
- The determination of whether energy storage charging should be treated as demand for cost responsibility purposes is beyond the scope of this initiative.

Requests for flexibility to charge at any time

- GIDAP will not be utilized to assess requests to obtain a higher level of service for charging mode – i.e., comparable to firm load service.
- GIDAP study process and cost responsibility framework does not apply to firm load.
- The interconnection customer must seek such firm load service from the PTO through means other than the GIDAP.
- Study scope and costs for firm load are a matter between the customer and the PTO.
- ISO does not support including unrestricted charging load in load forecasts as part of the grid expansion process.

Reliability studies

Discharging mode

- Studied at maximum net output MW specified in the interconnection request.
- Peak and off-peak are studied.
  - Energy storage facilities, together with other generating facilities in the electrical vicinity, are typically dispatched at maximum output level to stress the transmission system.
- Study results will provide information regarding potential overload issues under assumed conditions.
  - Includes network upgrade requirements (i.e., RNUs).

Reliability studies (continued)

Charging mode

- Studied at maximum steady-state charging rate.
- Peak or partial-peak, and off-peak are studied.
  - Depending on the circumstances of the energy storage facility, a worst case scenario between peak and partial-peak will be studied.
  - For example, storage located inside a load pocket and providing regulation is likely to charge during the peak hours (for this case charging during peak is the worst case condition).
  - As another example, storage to relieve over-generation situations are more likely to charge during partial-peak hours.
  - Other generating facilities in the electrical vicinity are typically dispatched at output levels lower than the maximum to stress the transmission system.

Reliability studies (continued)

Charging mode (continued)

- Study results will provide information regarding potential overload issues under assumed conditions.
  - Network upgrades, if any, will be identified for reliable interconnection. May include SPS.
  - It is unlikely for any such requirements to be identified that are in addition to or beyond the RNUs required for discharge mode.
  - Network upgrades to relieve operational limitations will not be identified if congestion management is the appropriate mitigation measure.

Deliverability studies

- For system and local RA qualification.
- Only considers discharging mode.
- Maximum positive output tested for deliverability is the four-hour capacity (i.e., storage capability in MWh divided by four).
- Given existing resource adequacy rules, the conventional approach will be used of studying the four-hour capacity at summer peak conditions.
- Off-peak conditions are also assessed for storage located in a wind generation area.

Review of existing processes for project modification

Project modification processes

- Developers may want to modify existing projects to add storage.
- Two existing processes are available for requesting project modification:
  - Modification request process (aka “MMA”) for projects in the queue.
  - Independent study behind-the-meter expansion process for projects that have achieved COD.
- ISO is applying these existing processes on a case-by-case basis in response to requests received.
- This experience will help identify any changes that may be needed (not intending to propose any changes to either process at this time).

Resource adequacy-related interconnection issues

Overview of resource adequacy issues

Interconnection context:

- Alignment of ISO deliverability study methodology with RA counting rules.

Discussion topics:

- What is EFC and how is it determined?
- EFC and NQC (bundled vs unbundled)
- An alternative interconnection option
- Assessing the ability of a storage resource to charge

Qualification for system or local RA

- Based on current methodologies for determining QC and NQC.
- QC is equal to the maximum output sustainable for 4 hours per existing CPUC counting rules.
- NQC determination: ISO modeling assumptions used align with the CPUC QC counting rules.
- ISO deliverability study methodology is aligned with current CPUC rules.

Determining a storage resource's effective flexible capacity (EFC)

- Conventional resources providing flexible RA capacity requires EFC be less than or equal to NQC.
- Storage resources may count capacity value for both its discharging and charging mode.
  - Under current CPUC rules, EFC is the greater of NQC and (NQC – $Pmin_{RA}$).
  - For storage, $Pmin_{RA}$ is a negative MW value at which the facility is capable of charging for 1.5 or more uninterrupted hours.
- Storage resources may count for a larger MW amount of flexible capacity than it might as system or local RA.
  - EFC is the difference between the NQC and $Pmin_{RA}$ (for storage it is the sum due to subtraction of a negative value).

Determination of EFC for storage resources

- CPUC EFC calculation for a storage facility is made by adding the flexibility value of its charging mode ($Pmin_{RA}$) over 1.5 hours to its discharge value (NQC).
- ISO's FRACMOO proposal only considers the change in output a resource can provide over 3 hours.
  - No distinction between charging or discharging.

Consideration of a storage resource addressing a flexible capacity need

- A storage resource may have an EFC amount that reflects both its charging and discharging modes.
- It may be most beneficial to the system to use this capacity to
  - raise the “belly of the duck” by charging when solar energy on the grid is plentiful, and
  - then to support the upward ramp by discharging as net load increases in later afternoon.
- Thus the EFC value of the resource may be fully utilized for system benefits without the resource having to deliver energy during peak load conditions.

Qualifying for flexible capacity

- Under current CPUC rules, a facility must be qualified for system or local RA in order to provide flexible RA.
- Implication for ISO deliverability studies:
  - Study the resource for deliverability for system and local RA (as is done today), and
  - Perform whatever additional study is needed regarding its flexibility.
- ISO may need to modify a resource's $Pmin_{RA}$ due to transmission constraints
  - A methodology would need to be developed for this.

Connection between system/local RA and flex RA

- CPUC RA decision states that flexible capacity must remain "bundled" with system/local capacity for procurement purposes.
  - Resources that wish to sell EFC must also already qualify to sell RA.
- Question: Might "unbundling" flexible capacity from system/local offer alternative interconnection options?
  - May want to consider options for storage resources that will be used only during off-peak hours for flexibility (rather than at peak as if it were providing system/local RA).
- "Unbundling" could allow a facility to provide flexible capacity without necessarily providing system or local RA as well.

An potential alternative interconnection option

- A storage resource might provide flexible capacity without having to deliver at peak system conditions.
  - Requires that flex RA be “unbundled” from system/local RA.
- This may suggest an alternative interconnection study path for flexible-only status.
  - Might there be storage resources with characteristics and business model that may align with “flexible-only” status?
- In contrast, if no “unbundling” then a storage resource would need to obtain full capacity deliverability status through GIDAP in order to provide flexible capacity.

Additional considerations

- Additional study methodologies may need to be considered for storage facilities that only provide regulation energy management (REM).
  - CPUC rules do not currently allow for REM flexible capacity resources.

Charging considerations for RA resources

- SCE concern: In order to be able to discharge to provide its full RA value, a storage resource must be able to fully charge at some time during each 24-hour day.
  - SCE suggests that the interconnection study process should test to ensure that this is possible (i.e., a “charging deliverability assessment”).
- ISO position: Charging mode of a storage resource is analogous to a conventional generator acquiring needed fuel on a daily basis (this is consistent with treatment of storage under the generator construct).
  - The ISO does not try to address availability of fuel in interconnection studies.

Next steps

Date	Milestone
August 20	Stakeholder comments due

- Please comment on information presented and discussed during the August 13 stakeholder meeting.
- Please use the comment template provided.
- Submit to EnergyStorage@CAISO.COM no later than 5pm on Wednesday, August 20.