

Resource Adequacy Policy for Known Storage Resource Characteristics (Non-Linearity)

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Principles & Rationales

- **There is a minimum level of availability that all RA Resources must be able to provide.**
 - This allows a common view on the fundamental RA service, regardless of resource type (thermal, demand response, storage, etc.)
- **Resources that demonstrate their ability to provide this level of availability should not be penalized.**
 - Hold all resources to a common RA service obligation
 - Resources with similar operating characteristics are treated similarly
- **Long-standing RA policy at the CPUC provides that resources must be *capable of providing RA capacity* for four consecutive hours on three consecutive days.**
 - Historically, this has meant that the resource is physically capable (there are no known resource characteristics preventing potential performance)
 - There is a progressively worse impact on electric load over 3-day heat waves as buildings with high thermal mass retain heat over night

Discuss: Is this reasonable, or is it objectionable in some way?

Storage Performance Examples

Resource Physically Capable of Operating at 90 MW for Four Consecutive Hours

Resource Characteristic	Value	Note
Pmax (MW)	100	
Maximum Continuous Energy Limit (MWh)	400	
Discharge Foldback Region (MWh)	40	<i>In the last 40 MWh, resource has an instantaneous discharge limitation</i>
Discharge SOC Unencumbered by Foldback (MWh)	360	<i>Amount of SOC not subject to an instantaneous discharge limitation</i>
Qualified Capacity (MW) / NQC	90	<i>The discharge quantity that can be sustained for 4 consecutive hours</i>
Upper Operating Limit when in foldback (MW)	20	<i>Resource cannot discharge at more than 20 MW instantaneously when in foldback</i>

Discuss

After this resource exhausts 360 MWh, it has an instantaneous power output capability of 20 MW

QC reasonably established at 90 MW to account for this ***known resource characteristic***

Example 1

Resource Physically Capable of Operating at 90 MW for Four Consecutive Hours

Resource Characteristic	Value	Note
Pmax (MW)	100	
Maximum Continuous Energy Limit (MWh)	400	
Discharge Foldback Region (MWh)	40	<i>In the last 40 MWh, resource has an instantaneous discharge limitation</i>
Discharge SOC Unencumbered by Foldback (MWh)	360	<i>Amount of SOC not subject to an instantaneous discharge limitation</i>
Qualified Capacity (MW) / Shown RA	90	<i>The discharge quantity that can be sustained for 4 consecutive hours</i>
Upper Operating Limit when in foldback (MW)	20	<i>Resource cannot discharge at more than 20 MW instantaneously when in foldback</i>

CAISO Dispatches the Resource for 4 Consecutive Hours at NQC During the Assessment Hours

Hour:	Availability Assessment Hours								
	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21
Bid (MW)	100	100	100	100	100	100	100	100	20
Dispatched (MW)	0	0	0	0	90	90	90	90	0
SOC (MWh)	400	400	400	400	400	310	220	130	40
Upper Operating Limit (MW)	100	100	100	100	100	100	100	100	20
Outage	No	No	No	No	No	No	No	No	Foldback
RAAIM Penatly	No	No	No	No	No	No	No	No	Yes

Discuss: Unavoidable Penalty After Providing Full RA Service Obligation

Example 2

Resource Physically Capable of Operating at 90 MW for Four Consecutive Hours

Resource Characteristic	Value	Note
Pmax (MW)	100	
Maximum Continuous Energy Limit (MWh)	400	
Discharge Foldback Region (MWh)	40	<i>In the last 40 MWh, resource has an instantaneous discharge limitation</i>
Discharge SOC Unencumbered by Foldback (MWh)	360	<i>Amount of SOC not subject to an instantaneous discharge limitation</i>
Qualified Capacity (MW) / Shown RA	90	<i>The discharge quantity that can be sustained for 4 consecutive hours</i>
Upper Operating Limit when in foldback (MW)	20	<i>Resource cannot discharge at more than 20 MW instantaneously when in foldback</i>

CAISO Dispatches the Resource for 4 Consecutive Hours at NQC Prior to Assessment Hours

Hour:						Availability Assessment Hours				
	HE13	HE14	HE15	HE16		HE17	HE18	HE19	HE20	HE21
Bid (MW)	100	100	100	100		20	20	20	20	20
Dispatched (MW)	90	90	90	90		0	0	0	0	0
SOC (MWh)	400	310	220	130		40	40	40	40	40
Upper Operating Limit (MW)	100	100	100	100		20	20	20	20	20
Outage	No	No	No	No		Foldback	Foldback	Foldback	Foldback	Foldback
RAAIM Penatly	No	No	No	No		Yes	Yes	Yes	Yes	Yes

Discuss: Unavoidable Penalty After Providing Full RA Service Obligation

Example 3

Resource Physically Capable of Operating at 90 MW for Four Consecutive Hours

Resource Characteristic	Value	Note
Pmax (MW)	100	
Maximum Continuous Energy Limit (MWh)	400	
Discharge Foldback Region (MWh)	40	<i>In the last 40 MWh, resource has an instantaneous discharge limitation</i>
Discharge SOC Unencumbered by Foldback (MWh)	360	<i>Amount of SOC not subject to an instantaneous discharge limitation</i>
Qualified Capacity (MW) / Shown RA	90	<i>The discharge quantity that can be sustained for 4 consecutive hours</i>
Upper Operating Limit when in foldback (MW)	20	<i>Resource cannot discharge at more than 20 MW instantaneously when in foldback</i>

CAISO Flexibly Dispatches the Resource Higher than NQC (Grid Really Needs It), Mostly During the Assessment Hours

Hour:	Availability Assessment Hours								
	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21
Bid (MW)	100	100	100	100	100	100	100	20	20
Dispatched (MW)	0	0	0	60	100	100	100	0	0
SOC (MWh)	400	400	400	400	340	240	140	40	40
Upper Operating Limit (MW)	100	100	100	100	100	100	100	20	20
Outage	No	No	No	No	No	No	No	Foldback	Foldback
RAAIM Penatly	No	No	No	No	No	No	No	Yes	Yes

Discuss: Unavoidable Penalty After Providing Full RA Service Obligation, and allowing CAISO to flexibly use the resource when it was most needed on the day

Observations

- **If Qualified Capacity is calculated correctly, known resource characteristics have already been captured in the accreditation**
- **There is no instance in which a legitimate foldback *outage* limits the resource further than was already accounted for in the Qualified Capacity**
 - Resource is physically capable of continuously discharging 90 MW for a consecutive 4-hour period, its actual use depends on how CAISO drives it
- **CAISO flexibly operates the resource according to real system conditions, yet the resource receives penalties**
 - Penalties are punitive and adversely impact bidding incentives, and therefore would limit CAISO's flexible use of these resources as well as its access to foldback energy
- **The RA must-offer obligation requires the full physical capability be bid in, so penalties are assured on days where CAISO needs the energy the most**

Proposed Policy Statements

- Non-linearity is a known resource characteristic that is accounted for through RA accreditation.
- CAISO's resource model is currently lacking in its ability to represent non-linearity in the market software, causing storage operators to be required to use *outages* to accurately represent full physical capabilities to CAISO.
- Non-linearity outages do not impact the ability of storage resources to meet their fundamental RA service obligations (they remain physically capable of providing 4 consecutive hours of discharge at QC).
- Operating during non-linearity should not be penalized in RAAIM.

Policy Implementation

- Implement updates to NGR resource model to appropriately model non-linearity, allowing the resource characteristic to be directly modeled without requiring an outage
- In the interim, clarify that storage resources should use the **Technical Limitations Not In Market Model** nature-of-work field when entering bona fide non-linearity outages until CAISO implements enhancements to the NGR resource model.
- This outage type is currently RAIM-exempt and therefore would effectuate the policy intent to not penalize storage resources offering available energy while operating in their non-linearity region.