NRG Energy, Inc. Comments on Phase 2 Renewable Integration and Market Product Review Discussion and Scoping Paper

Submitted By	Company	Date
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Process:

- NRG Energy, Inc. ("NRG") urges the CAISO to immediately begin implementing a market for the products that it is already procuring but not pricing. Further, the CAISO should define those products that it will need to integrate increasing amounts of renewable resources into its grid. A "no regrets" or "least regrets" approach will allow the CAISO to begin developing market products in parallel with developing a longer-term road map for creation of new products.

- The CAISO should proceed in three steps:

    1. The CAISO should aggressively seek to price already implemented *existing* (e.g., minimum on-line) constraints and constraints expected to be implemented in the near-term (e.g., the flexible ramping constraint) in its markets as soon as possible, or develop a transitional market payment for resources providing these services if these constraints cannot be priced in the near-term.

    2. The CAISO should, at the same time, develop a roadmap for *new* products.

    3. The CAISO must also begin discussions around important areas, such as long-term capacity compensation. .

Enhancements to Existing Market Design

- **Hourly Contingency-Only Election**. NRG supports allowing market participants to select "contingency-only" on an hourly, rather than a daily basis. This should add flexibility to the balancing energy stack by encouraging market participants to select "contingency-only" status only when necessary and not in all hours. However, the amount of flexibility and integration benefits would provide is not clear. This modification should not be prioritized ahead of other projects (such as pricing existing constraints) if doing so would take away resources from those projects.

- **Residual Unit Commitment** –

    - **Simultaneous RUC and IFM.** NRG supports simultaneous RUC and IFM.

    - **Pricing *all* constraints.** Pricing all operating constraints in the IFM should be the CAISO's top priority. This can be accomplished either

through incorporating capacity requirements into energy prices or through separately-procured capacity products. This would include capacity procured to meet MOCs, and in-basin inertia needed to arrest frequency decline or provide sufficient transfer capability into the LA Basin. Additionally, it could and should include things like frequency response and voltage support. Failing to price operational products in the CAISO's spot market will render those markets less and less relevant and seriously hamper the CAISO's ability to incorporate increasing levels of renewable penetration.

- **Full Hour-ahead settlement:** A full-settlement Hour-Ahead market could help address some current problems. Market participants and the CAISO are already seeing the impacts of having a HASP price that is based on different fundamentals than those assumed for the real-time market and is systematically lower than the real-time price. Moreover, the current HASP structure does not allow market participants to use convergence bids to converge the HASP and RT prices. Additionally, the current HASP process also does not allow more flexible resources to participate, but limits participation only to full-hour intertie resources. NRG supports the development of an Hour-Ahead market that would remedy these shortcomings.

  The CAISO offers that it need not implement a full hour-ahead market in order to provide a reference schedule from which real-time deviations will be measured. However, establishing a scheduling reference for some resource without an accompanying financial settlement would create an undue preference for those resources and affect market prices (both in the market in which the resources aren't required to participate as well as the real-time market).

New spot market products

- **Pay-for Performance Regulation**

  - NRG supports modifying CAISO market rules to encourage new technologies, including regulation and storage technologies. However, NRG does not see this effort as a priority at this time. As technologies prove their commercial viability, the CAISO should review its market rules for regulation at that time.

  - In regards to the inter-temporal opportunity cost of energy: A complicating factor in calculating the inter-temporal opportunity cost is deciding how to bound the time period. A storage resource's ability to arbitrage price differences (i.e., consume energy at a low price and produce it a higher price) is limited by its storage capability - the lower the storage capability, the shorter the reasonable inter-temporal time horizon.

  - In regards to the mileage/performance payment: Simply paying a mileage payment without a check on accuracy would create perverse incentives.

Moreover, simply foregoing a performance payment for failing to meet minimum performance standards may not be sufficient incentive to obtain the kind of performance that would allow the CAISO to reliably reduce the quantity of regulation it obtains.

- At the April 12 meeting, there was some discussion about the concept of "stacking" VERs - presumably in a time-serial fashion - to provide energy "persistence". Does "stacking" imply that an energy-limited resource is not dispatched for period T so it could be dispatched to provide regulation in period T+1? Would that "stacked" resource seek an inter-temporal opportunity cost payment for period T? If so, it seems that the cost of "stacking" resources to provide energy persistence could be a costly way to achieve persistence.

  - Is there a minimum required amount of stored energy for a given interval of time for a storage device to qualify to provide regulation service?

  Given the CAISO's development of the Regulation Energy Management product, in which the CAISO will re-dispatch the balancing energy market to ensure the regulating resource operates at a particular state of charge, the answer seems to be no.

  - In real-time, should resources awarded to provide regulation in subsequent intervals be disqualified from providing regulation in subsequent intervals if the resource's stored energy falls below a minimum energy threshold due to energy releases in previous intervals?

  Yes. A regulating resource should not provide regulating up capacity in an interval in which it cannot provide energy in that interval.

  - How would the ISO account for inter-temporal opportunity costs in the price of regulation energy for a storage device given the price could be different than the price of regulation energy provided by a conventional resource due to potential inter-temporal constraints applied only to storage?

  Unknown. As noted above, inter-temporal opportunity costs require a difficult conversation about how they should be bounded.

  - Does the fact that the ISO procures regulation up and regulation down as separate services have an impact on how the ISO would implement a performance payment?

  Not an intuitive one.

  - Are there minimum threshold performance standards to be eligible to receive a performance payment?

Yes, there should be, though NRG does not offer what those standards should be.

- Is there a correlation between fast ramping and accuracy? For instance, can a single fast ramping regulating resource be more accurate in satisfying ACE correction than several slower ramping regulating resources?

Speed of response is of dubious value if it does not correlate to accuracy. A fast ramping resource should supplant several slower moving resources IF it responds accurately to the CAISO's regulating signal (and that regulating signal is itself accurate).

- How would stakeholders define accuracy? Should physical constraints of certain resource types be considered in an accuracy adjustment? For example:

    - For a hydro generator, after sending out a "raise" MW command, the MW output will lower before moving up to the target level. This is a characteristic of a hydro generator.

    - A fast ramping rate does not always mean fast response over a short time period even though there may be a correlation. Time constants of certain resource types, e.g. turbines, play an important role in response times over short periods. Do such time constant constraints impact the ability of turbines to accurately follow an AGC signal?

Accuracy is a simple concept – the difference between the level at which the resource is operating and the level at which the CAISO wants the resource to operate. However, is there a cost to that accuracy if a fast and accurate energy-limited resource follows the CAISO's instructions but requires the CAISO to re-dispatch its balancing energy market to maintain a state of charge? How should that cost be treated?

- How might the ISO apply an accuracy adjustment?

Accuracy should be quantified by integrating the difference, over a time period, of the difference between the CAISO's regulating signal and the resource's output. However, turning this accuracy value into a meaningful accuracy adjustment will have to consider the time period, creating incentives for accurate movement without creating penalties for physical constraints (i.e., not punishing a resource for not doing what it cannot do).

- **Load-Following Reserve**

Load following reserve currently is a capacity service that the CAISO does not procure separately through its markets. Of the three procurement alternatives suggested by the CAISO, NRG believes (2) – purchasing load following reserve only in the HASP after the DA market outcome is known – would discriminate against long-start resources that could not provide this service in the HASP if not already committed in the DA. NRG does not have a position as to whether this service is best procured through the spot market or through longer-term (e.g., monthly or seasonal) forward auctions. NRG looks forward to further discussion on this topic.

- **System Inertia and Frequency Response**

The transfer capability into the LA Basin is a function of generating unit inertia within the LA Basin. This suggests the need for a more localized inertia product than system inertia, which supports system frequency response. The Southern California Import Transmission nomogram has been in place for years, but has not been integrated into the CAISO's market systems; NRG suggests that incorporating the SCIT nomogram into CAISO market systems in a way that values and compensates the capacity that ensures adequate in-basin imports should be a "first tier" priority for the Phase 2 effort.

The WECC has evaluated – but not yet implemented - a frequency response requirement criterion. If and when such a requirement is implemented, the CAISO should "marketize" that requirement (as it has already "marketized" its contingency reserve and regulation requirements).

- **Flexible Ramping Constraint**

NRG is greatly concerned about implementing the flexi-ramp requirement in CAISO systems without creating a means to value and compensate capacity that provides this service. While it is better to procure a needed service through the CAISO's markets than through exceptional dispatch, it is little better (and potentially worse for non-RA capacity) to procure that service through the markets without properly valuing and compensating it. Again, NRG urges the CAISO to deal with ways to value and compensate this capacity as a "first tier" issue in Phase 2.

- **Reflecting Constraints in Market Prices**

NRG strongly supports efforts to reflect operational constraints (such as MOCs, flexible ramping capability, and local inertia) in market prices as a "first tier" effort in Phase 2.

On page 13 of the CAISO's discussion paper, the CAISO implies that it may not be worth designing a mechanism to price the constraint unless the constraint is regularly binding at high capacity levels. NRG disagrees. The CAISO is already acquiring capacity to meet MOCs but such procurement is not priced. While it is important to take a long view in this Phase 2 process, and to consider the development of products

that may not yet exist, the CAISO should urgently focus on establishing prices for the services it is already taking.

The CAISO should develop a mechanism that reflects operational constraints in a way that impacts market pricing. While a constraint may not be regularly binding under current conditions, it may become frequently binding under different conditions. If the CAISO waits until constraints became regularly binding to take action, it arguably should have never implemented its nodal market, as the amount of intra-zonal congestion declined substantially in the years prior to MRTU's implementation. Rather than taking a "whack-a-mole" approach to market design, the CAISO must seek in Phase 2 to implement markets that reflect the value of and provide compensation for all of the operational products it requires.

Allocation of Integration Costs

This is a difficult topic which NRG sees from multiple perspectives. The following comments outline NRG's initial position on this matter, a position subject to further refinement. At the offset, NRG notes that it is both a large conventional and renewable generation owner. We are a leading developer of both fossil-fueled and solar facilities in California. We also own wind facilities in other markets.

In general, NRG believes that integration costs should be allocated on a cost causation basis, *i.e.*, in a manner that best creates incentives to manage the activity (e.g., variability) that is creating the need for the integration services. Simply smearing integration costs to load (or to all supply) does not create the proper incentives to invest in technologies that reduce variability (e.g., adding storage or some other form of inertia to solar facilities or feathering capability to wind-powered generating units), renders the cost of renewable integration opaque (and therefore, less easily managed) and will not help achieve California's ambitious renewable portfolio standard in a least-cost manner. These cost causation principles should be a foundation for allocating integration costs, whether such costs are ultimately allocated to load, to generation, or to both.

While allocating integration costs on a cost-causation basis would create the best incentives and framework for managing those costs, allocating integration costs on a cost-causation basis is a complex undertaking. NRG agrees with SCE that using the term "load following" to describe reserves that are held to manage variability caused by both load and supply fluctuations is imprecise. If costs are to be allocated on a cost-causation basis, deviations from schedule (or some other kind of reference) must be measured both for demand and supply, and the resulting costs allocated more equitably and precisely.

Another factor that will have to be considered is whether power purchase agreements allow parties to pass integration costs to their counterparties.

NRG agrees that the allocation of integration costs must extend to variable imports. At this time, NRG is not aware of any factor that would cause variable imports to be treated differently from variable in-area resources.

Below are additional more detailed initial comments:

1. Which specific integration costs should be allocated to VER?

- The CAISO should make every effort to price the product needed to integrate renewable resources. These priced products are necessary to provide the appropriate price signals and determine the increased costs of VER integration. Establishing product prices will (i) allow VERs to tailor their production towards minimizing those integration costs; (ii) encourage the development of VERs technologies that minimize integration costs; and (iii) provide VERs incentives to bilaterally contract with "firming" resources in order to avoid incurring integration costs. In short – without a full suite of products, it is impossible to fairly allocate integration costs to any specific VER resource.

2. How should the relative cost shares charged to demand versus charged directly to VER be determined? For example, if VER should be charged for a portion of the cost of ancillary services, what methodology would be appropriate and fair for measuring the incremental impact of VER on this cost?

- The CAISO could adopt a "but for" test for determining the allocation of integration costs. It should consider adopting a technology-specific reference renewable unit at various places on the CAISO grid, and then examine the extent to which the reference unit's variability must be managed. Once the CAISO determines the rough but-for cost of each technology, stakeholders can make informed decisions over how to allocate those costs.

- The differences of ancillary services must be considered. For example, it was suggested at the April 12 meeting that the cost of contingency reserve could be allocated to the resource whose size drives the "single largest contingency" requirement. However, while the size of a resource may drive the *size* of the CAISO's contingency reserve procurement (or, may not, depending on whether the requirement is the SLC or determined as percentages of hydro and thermal generation), the fundamental *purpose* of contingency reserve is to ensure continuity of service to load. Consequently, allocating the cost of contingency reserve to load, not generation, seems in line with cost-causation principles. Conversely, the purpose of regulation is to ensure compliance with control performance requirements. If specific new products to manage the increased variability of VERs are implemented, the cost of these products should be allocated to VERs in a manner proportional to their variability.

3. Should cost allocation be based simply on resource categories (e.g., technology, PMax), or should it be based on measured performance of each resource during the hours the costs are incurred?

- Assessing costs based on technology without accounting for performance (i.e., the contribution that resource makes towards creating the need for integration

services) would make little sense, unless the variability performance of the resource (and the accompanying need for integration services) can be so clearly tied to the technology that there would be no possibility of getting it wrong.

4. If measured performance is the basis for cost allocation, should these costs then be allocated to all resources, regardless of resource type, that exhibit the same performance to a lesser degree?

- Yes.

5. Should allocation of integration costs be limited to the operational and spot market areas, or should we also consider allocating some of the integration costs through the generation interconnection procedures (GIP)?

- Allocating costs through the GIP would require that there is such an unambiguous, unchanging relationship between variability and technology that operational performance would add little further distinction. However, integration needs could be driven by factors other than technology (e.g., the performance of a PV plant in one location will not be the same as an identical plant in another location). It would seem difficult to account for these other factors in assessing integration costs through the GIP.

Modifications to Intra-Day Settlements

- Full Hour-Ahead market – discussed above.

- **15–minute real-time market:** A 15-minute market, applied to all resources, not just VERs, would allow all resources to better manage variability. However, as the CAISO notes, we have seen the seams and preferences that result when CAISO markets do not align with WECC practices. Obvious question about such an intra-hour market would be: when are the imbalance reference schedules established? Is that process consistent for all resources? For example, while imbalance reference schedules for VERs would be better the closer to real-time they are established, is it equitable to allow some resources to establish reference schedules just before the operating hour but require other resources to establish reference schedules the day before?

- **Uneconomic priority for VERs** – The possibility for subdividing self-schedules into two types -e.g., conventional and renewable - and adjusting one set of self-schedules prior to adjusting the other set of self-schedules without any economic signal for allocating the adjustment or for the failure to make an adjustment, would, on its face, seem to discourage providing operating flexibility. Moreover, non-priced adjustment priorities would produce opaque, if not irrational, market results.

Longer term procurement issues

- **Forward Capacity Market**. NRG supports a forward capacity market. Policy must-take VERs will depress the energy price, but the CAISO will still need the persistence and flexibility of the thermal fleet to reliably manage variability. The capacity market would provide a transparent capacity price signal, as well as a means to settle forward capacity imbalances closer to the delivery period.

- **Forward Reserve Market**. NRG understands the ISO-New England forward reserve market has proved a success, and looks forward to further discussions about this kind of structure.

Other issues:

- NRG still looks forward to a larger discussion regarding the role of CAISO markets in encouraging investment in new resources and in retrofitting existing resources to provide the operational characteristics valuable to renewable integration. NRG believes well-designed spot markets would provide meaningful price signals for investment in new and maintenance or enhancement of existing resources. However, in a hybrid market in which some resources must depend heavily, if not exclusively, on CAISO market revenues for financial viability but other resources are completely insulated from CAISO market prices, the role of CAISO market prices is far from clear.

- NRG also looks forward to a larger discussion about the meaning and purpose of forward schedules and settlements. If Phase 2 is intended to be a full discussion about identifying the need for and properly pricing and procuring certain operational attributes, those attributes include the ability the change output, forward certainty, speed and accuracy of response, ability to sustain energy production, inertia (not just for arresting frequency decline, but, in the case of the Southern California Import Transmission nomogram, to ensure transfer capability into the LA Basin), voltage support, and others.