Opening Statement
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Michael Hogan
Regulatory Assistance Project

Introduction

Two critical success factors in energy and services markets – particularly with more variable supply – are demand participation in the markets and accurate real-time shortage pricing. Until these are manifest intervention, usually in the form of price caps and capacity markets, may be desired to mitigate market power and deliver administratively set reliability outcomes. The same conditions driving the case for adopting capacity interventions also mean that flexible resources that could more efficiently provide the operational flexibility increasingly required in the resource mix may not be adequately compensated for doing so. Thus capacity markets must value not just capacity but the optimal mix of capabilities to ensure reliability at least cost.

With that as an introduction, the following are my responses to the questions posed to panelists:

1. What are the main challenges facing centralized capacity markets today or that can be anticipated going forward? Are the current centralized capacity market designs able to effectively manage those challenges? If not, what change in current design elements should be pursued going forward?

The US power system is evolving into one with large and growing shares of low-carbon supply. A large portion of that low-carbon supply will come from variable (or "intermittent") supply resources. The growing role for renewable supply in the power sector is justified based on a range of public policy objectives, including not only environmental concerns but also on public health, economic development and security of supply grounds. This will happen, perhaps more slowly in some markets than others, but it will happen. Markets that derive a significant share[1] of electricity supply from variable resources will see a dramatic increase in the value of resource flexibility,[2] value that in many, perhaps most cases is not adequately expressed in the way prices are currently formed in energy, ancillary services and (where they exist) capacity markets.

Some have argued that while there may be a rationale for adopting a discrete market-based intervention for firm capacity there is no comparable rationale for incorporating operational criteria into resource adequacy mechanisms like capacity markets and, furthermore, that doing so will somehow degrade the performance of capacity markets in ensuring least-cost resource adequacy. In fact, the very market design flaws giving rise to the conditions driving

[1] What is "significant" will vary based on a number of factors, including the size of the balancing area and the mix of primary resources, but experience to date suggests variable production beyond 10-15% of annual energy production constitutes a significant threshold.
[2] "Resource flexibility" here refers to conventional system services such as regulation, spinning and non-spinning reserves, as well as evolving services such as "fast-ramping" and frequent stop-start cycling capabilities.

the adoption of capacity markets are equally problematic for the proper valuation of investments in operational flexibility. Briefly, these include limitations on participation by demand in energy and services markets; flaws in the formation of pricing, particularly scarcity pricing in many current energy and ancillary services markets; and (closely related to these) political intervention in markets to cap prices in response to concerns about extreme volatility and abuse of market power. Each of these market design flaws directly affects the ability of *flexible* resources to be paid fully for the particular value they provide to the system; historically this may not have been a significant problem, but it will become increasingly problematic as (as noted for instance in NREL's 2012 *Renewable Energy Futures* study)[3] the role of flexible thermal resources shifts more to one of providing reserves and other system services and less one of producing energy. One can debate whether these issues can be resolved to the extent that administrative interventions like capacity markets are no longer required, but in the meantime – looking forward rather than backward – the case for adopting capacity markets will increasingly be only as strong as the case for differentiating the value of capacity resources (both supply- and demand-side) based on the operational capabilities they can provide to the system.

Indeed this reality is already in evidence in ISO New England, though at the moment it is driven not primarily by the growth in renewables but by growing dependence on natural gas plants and the particular variability in fuel supply and transportation arrangements on which they rely. (ISO New England has made it clear that they see similar challenges arising as the share of variable renewable supply grows on the system.) ISO New England has come forward with various proposals to address these concerns – all have in common that they would drive greater value to those resources participating in capacity markets that are capable of responding to changing system needs and less value to those that cannot.

As has been demonstrated by study after study (and as discussed at length in our papers *Beyond Capacity Markets* and *What Lies "Beyond Capacity Markets"?*),[4] the power system of the future is one in which the traditional approach to assessing "resource adequacy" in isolation from "system security" is no longer a least-cost approach. While reliability standards can be met via the more traditional approaches to resource planning that inform the design of current capacity markets, the costs and risks of ensuring reliability will be greatly reduced by ensuring that market designs properly value investments in the added operational flexibility that some resource options can provide.

2. In order to achieve resource adequacy goals, should centralized capacity markets be expected to meet specific reliability and operational system needs (i.e., accommodating new and emerging technologies such as variable energy resources, distributed resources, or demand-side resources)? If so, how should capacity markets be designed to procure resources with specific operational attributes and what should those attributes be?

As discussed in the answer to Question 1, centralized capacity markets in future will need to value different capacity resources differently depending on their ability (or lack thereof) to provide critical operational capabilities at least cost. In our paper *What Lies "Beyond Capacity Markets"?* we propose several different approaches, including (where a capacity

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[3] National Renewable Energy Laboratory. (2012). *Renewable Electricity Futures Study*. Hand, M.M.; Baldwin, S.; DeMeo, E.; Reilly, J.M.; Mai, T.; Arent, D.; Porro, G.; Meshek, M.; Sandor, D. eds. 4 vols. NREL/TP-6A20-52409. Golden, CO: National Renewable Energy Laboratory. Retrieved from http://www.nrel.gov/analysis/re_futures/.

[4] Hogan, M. & Gottstein, M. (2012). *What Lies "Beyond Capacity Markets"?.* Montpelier, VT: Regulatory Assistance Project. Retrieved from www.raponline.org/document/download/id/6041

market already exists) apportioning the auctioning of capacity into sequential tranches where resources with specifically desired operational attributes are procured first, followed by subsequent tranches for less valuable capacity until the auction's limiting criteria have been reached. ISO New England proposed a similar approach in March 2012 (as did PJM in 2005), but they have since proposed a more direct, bonus-and-penalty-based administrative intervention into their Forward Capacity Market. We believe that a broad signal of investment preferences via sequential apportionment combined with improvements in the effectiveness of underlying energy and services market price formation would be a more efficient, more equitable and more sustainable approach. Elements of this approach might be seen in PJM's recent decisions to (i) adopt an operating reserve demand curve, (ii) include demand response bids in the formation of shortage pricing and (iii) trifurcate its demand response auction into sequential procurement of resources from most to least responsive.

Beyond the question of operational capability, it would be inappropriate to differentiate between existing and new capacity, though as provided in certain markets it may be appropriate to offer options (such as somewhat longer commitment periods) to new resources that would not be available to existing resources.[5] It would also be inappropriate to discriminate between sources of firm capacity simply based on the particular technology or resource.[6] A market for firm capacity has to be a market for capacity that is firm in order to deliver efficient resource adequacy solutions. As has been demonstrated in several markets, this also means that *any* resource capable of avoiding involuntary curtailment of load must be allowed to participate on equal footing with all other such resources. This includes demand response as well as energy efficiency measures. Function is all-important. More work is required to ensure that all firm-capacity-equivalent demand response and energy efficiency resources are readily able to participate in such markets. Performance standards for demand-side resources must not arbitrarily be set higher than those for supply-side resources, and care must be taken to ensure that market rules do not arbitrarily discourage investment in otherwise competitive demand-side resources.[7]

3. Going forward, should centralized capacity markets be designed to meet additional or different goals than those established to date?

As real-time market price signals improve and demand response becomes more well established as a significant factor in the markets (in part as a result of the opportunity to participate in capacity markets but also as a result of recent and ongoing advancements in the cost and performance of information and communication technologies allowing customers more options for engagement with markets), the case for centralized capacity markets of any kind may become more marginal; in any case the approach to determining what constitutes "resource adequacy" will need to be revisited. Historically, and at the moment, regulators and politicians stand in for customers in setting reliability standards (in

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[5] For example, ISONE allows new resources clearing the FCM the option to enter into commitment periods of up to five years, whereas existing resources are limited to one-year commitment periods.
[6] It is unfortunate that capacity markets, in serving their stated function, may in some cases extend the lives, at least in the short term, of "old dirty" resources. While we accept that all viable capacity should be considered when assessing resource adequacy, FERC may wish to consider, depending on the surrounding policy context, market designs that, for instance, relegate some resources to a lower ranking in a tiered market structure by virtue of their emissions profiles unless they are uniquely capable of providing the system with some specifically identified operational capabilities.
[7] Efforts to facilitate participation by demand-side resources should not be used to circumvent other important policy objectives. ISO New England's recent decision to prohibit "dirty BUGs" (back-up generators whose emission profiles exceed what is permitted for supply-side generators) except in system emergencies is a good example of striking a practical balance in this regard.

the form of target loss-of-load expectations, target planning margins and the value of lost load, or "VoLL" implied by these targets). As others have pointed out, the VoLL implied by current administrative standards can range from $65,000/MWh to $350,000/MWh or more depending on the particular standard and how it is interpreted. This is many times greater than the value most economists have suggested that all but a very tiny percentage of customer loads would pay to avoid an interruption in service. (A 2013 London Economics study for the British Government's Office of Gas and Electricity Markets, for instance, estimated the average on-peak VoLL for residential and SME customers to be a bit less than £17,000/MWh.)[8] This is compounded by the fact that customers realize virtually no benefit from this added measure of insurance since the reliability of their service is dictated by the much lower effective reliability standard for the transmission and distribution systems.

It is tempting to suggest that customers have been overpaying for "resource adequacy" for a long time, but in the absence of real demand participation it would be presumptuous to second-guess the regulators and elected officials who are tasked with the important role of safeguarding customers' interests. Nonetheless, as demand is increasingly able to participate in the decision as to whether the all-in cost of an increment of production is higher or lower than the value of an increment of load, it will be appropriate to re-examine periodically the role of central administrative proxies for the value of lost load. It is entirely possible that the actual quantity of firm capacity needed to provide an "adequate" supply of resources will be less than was previously believed.

Even under close-to-ideal circumstances it may well be prudent to plan for yet an additional margin of firm resources over and above the level of investment a well-functioning energy and services market can be expected to deliver. It is perhaps unrealistic to expect that risks of, for instance, market failure, policy failure or political interference in markets will ever be reduced sufficiently to do otherwise. (Though it is worth noting that recent disputes over issues such as the MOPR demonstrate that capacity markets themselves will encounter many of the same challenges.) The value of this administratively imposed margin for error, or insurance premium if you will, would represent money that is truly "missing" from a functioning market, and for this reason some form of capacity market may well be an enduring feature of competitive wholesale power markets. However this must not become an excuse for failure to address the effectiveness of the energy and services markets in driving value to those resources of greatest value to a rapidly evolving power system.

This is a much more important issue where a large share of supply comes from variable renewables, since the maintenance of artificially high standards for the required quantity of firm capacity will be particularly burdensome in such a system in many ways, expense and land use being only the most obvious. This is perhaps just a different way of looking at the value that more active demand participation in the market will have in the future electricity system.

[8] London Economics (July 2013), *The Value of Lost Load (VoLL) for Electricity in Great Britain: Final report for OFGEM and DECC*, retrieved 9 Sept 2013 from https://www.ofgem.gov.uk/publications-and-updates/electricity-balancing-significant-code-review-draft-policy-decision