

Market Mechanisms for Resource Adequacy and System Security: Framing the Issues

[FOR THE POLISH-GERMAN CAPACITY
MECHANISMS WORKSHOP, 26 MAY 2014]

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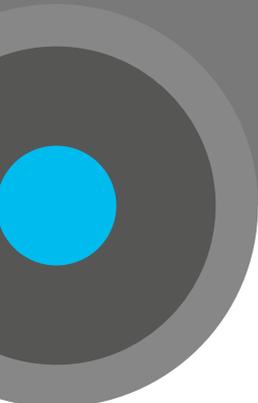


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[Supplemental information for PL/DE capacity markets conference:](#)

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Introduction

Delivering investment for a reliable power supply to consumers at a reasonable cost has always been a central objective of power market design, and various approaches to this challenge have been adopted in Europe and elsewhere. Where a competitive wholesale energy market has been adopted, as in Europe, energy prices are intended to be the primary driver of both short-term and long-term decisions by market actors. However, some stakeholders maintain that the energy market alone cannot or will not drive needed investment. In this view, a source of additional payments is needed to ensure that adequate capacity is available to maintain system reliability.

Today, the debate around market design and system adequacy in Poland, Germany, and Europe has heated up. It has been driven by several interlinked concerns: Is there adequate generation to meet demand over the next few years? How does the increasing penetration of variable renewable resources affect the calculus? What role should cross-border exchanges play in assessing resource availability? And lastly, are energy markets falling short of providing the short- and long- term price signals needed to maintain system reliability, and if so, what else is needed?

This paper provides an overview of the new challenges that system planners and market designers face and offers some thoughts about how to frame the discussion to move it forward.

Reliability in the 21st century

The central challenge facing electric system planners and operators is that of ensuring the availability of sufficient resources to meet demand for service at all times and at a reasonable cost. The traditional approach for doing so is forecasting demand across the planning horizon and acquiring the least-cost mix of baseload, intermediate, and peaking capacity to serve that demand. Over the last thirty years, forces of economic and technological change, and environmental and public health policy, have started to transform the energy landscape. As a result, the power sector has begun to transition to one whose mix of resources and means of operation will differ greatly from that of the last century. This is leading to a re-assessment of how to best ensure a reliable, least-cost power system.

In the 21st Century power system, the question of *reliability* will remain in the forefront. The nature of its solution must change, however, as the penetration of generating resources whose output is variable¹ increases.

Service reliability is established in two dimensions: an operational dimension (*system security*) in which a combination of available resources is deployed to match expected demand in real time at the lowest reasonable cost; and an investment dimension (*resource adequacy*) where investment is required to maintain, refresh, expand and transform the portfolio of resources so that resources will continue to be available as needed to meet expected future demand at the lowest reasonable cost. The growing reliance on variable renewable resources fundamentally transforms the system security dimension, placing greater emphasis on the ability of the balance of system resources to complement renewable production efficiently and reliably. While resource adequacy has never been only a matter of the quantity of resources, now more than ever the answer to the question “how much?” depends on the answer to the question “what type?”.

¹ The term “variable” used here refers to any generator whose ability to produce electricity – how much and when – is to a significant degree beyond the control of system operators. The technical term often used for this is “intermittent.”

Re-thinking system needs

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In order to frame the discussion around reliability, it is useful to anticipate system needs in the (not-so-distant) future, when the share of variable renewable resources will have increased significantly.

The operational needs of a system with high penetrations of variable renewable resources can best be revealed by forecasts of *net demand*, rather than the traditional focus on total (or gross) demand. Net demand is the difference between gross demand minus demand served by variable resources. Net demand forecasts can be used to quantify the gaps between the need for resource flexibility over investment timescales, and the capabilities of the current and prospective resource portfolio to meet that demand cost-effectively. In other words, net demand forecasts can be used to see if the system has, and will have, resources with the mix of operating characteristics needed to deliver least-cost reliability.

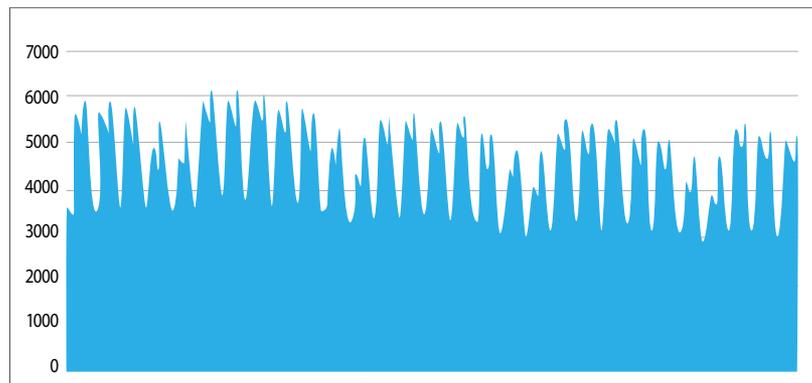
The variability and uncertainty associated with certain renewable resources is perceived as a challenge for investors in the balance of the supply portfolio. Consequently, the discussion turns to how to ensure a sufficient quantity of investment in firm resources. But optimizing decisions at investment timescales is no longer quite so simple. Simply buying “more of the same” can lead to se-

rious underutilization of assets and the need for a considerably larger amount of resource investment. The new investment challenge is not principally to do with the total quantity of resources but rather with a marked shift in the demand for some operational capabilities relative to others. The key differentiator is *resource flexibility*. Flexible resources can respond to system needs by ramping up, ramping down, and turning on and off quickly and often. If resources cannot respond efficiently to system needs, customers will pay the price in higher operating costs, unnecessary capital investment, and less reliability.

The increased need for flexibility is illustrated in the two figures below. These graphs show total (gross) and residual (net) demand at the level of the Danish system in the first two months of 2012, at a time when Denmark was generating the equivalent of approximately 25% of its annual demand from variable renewable sources.

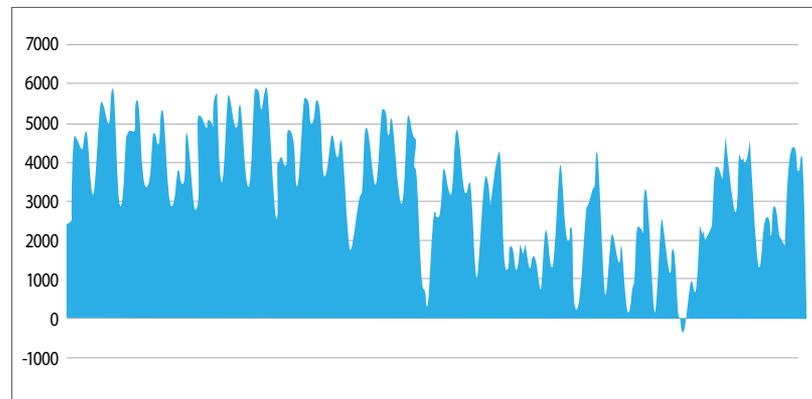
As these graphs demonstrate, the demand for the kind of resource flexibility traditionally associated with peaking and cycling plants is no longer either bounded or predictable but rather extends erratically across most of the non-renewable resource portfolio. Exactly how this affects resource investment—and disinvestment—depends on a number of things, including the feasibility, required

Figure : Denmark – Total Demand – First 8 week 2012



Source: energinet.dk

Figure : Denmark – Total Demand Minus Wind Power



Source: energinet.dk

investment, and the operating and maintenance costs needed to utilize existing resources more flexibly. But one thing is clear: a traditional mix of resource investments featuring a large tranche of inflexible baseload generation is poorly suited to provide system security

efficiently in the technical and economic environment we will see on the power grid in coming years. **Flexibility will be in greater demand, it will acquire greater value, and that value needs to be reflected properly in decisions at investment timescales.**

Capacity or capabilities?

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In a vertically integrated power sector, resource adequacy is addressed through the resource planning process. The least-cost mix of resources would be determined—including the types and amounts of resource capabilities needed—and they would be acquired, typically, through some mix of competitive bidding and utility construction. Recovery of prudently incurred costs would be assured by the regulatory process of revenue- and price-setting.

Where generation and supply are competitively provided, decisions about when to invest, how much to invest and what to invest in are, in principle, left to the market. A very active debate is under way in many parts of Europe and North America about whether to rely solely on energy markets or to adopt some combination of energy and capacity markets. Energy markets are capable of internalizing the value of investment in greater resource flexibility, just as they are capable of internalizing the value of investment in new capacity resources, but in both cases they rely on the expression of “scarcity value” in pricing to do so. That is, as demand approaches and then exceeds the limits of conventional supply resources, the value of energy increases, reflecting a combination of supply scarcity and the value to consumers of uninterrupted service (“value of lost load”).² In a properly functioning energy

market, this scarcity value should be sufficient to ensure that adequate resources are available on the system.

However, in many markets scarcity value is suppressed through administrative interventions or poor market implementation, distorting the value of investment not just in resource capacity but also in resource operational flexibility. In this case, some form of supplemental mechanism in support of investment may be appropriate.

The European Commission recently provided guidance on this issue³ (paraphrasing):

- 1 A properly functioning energy market can deliver the investment needed to ensure reliable service and should be given the opportunity to do so.
- 2 In parallel member state authorities should regularly conduct an “objective, facts-based” assessment of “generation adequacy...fully taking account of developments at regional and Union level” as required under the Electricity Security of Supply Directive.
- 3 If a concern with resource adequacy arises the causes should be identified and, where possible, remedied.
- 4 If, despite compliance with the foregoing,

² Until we can enable more active involvement of customers in purchasing decisions, the security constraints employed by system operators tends to serve as a proxy for the value of lost load; system operators in the more advanced energy markets are translating these security constraints into real-time scarcity pricing in the energy and balancing markets.

³ *Generation Adequacy in the internal electricity market - guidance on public interventions* (5 Nov 2013)

legitimate concerns over resource adequacy remain, a decision can be taken to intervene in support of investment; if so, the form of intervention should be one that “least distorts cross-border trade and the proper functioning of the internal energy market.”

In discussing item 2 (resource adequacy assessments), the Commission added that “the rules contained in the Electricity Security of Supply Directive and its transposition and implementation may be insufficient to tackle the challenges of the future in a fully satisfactory way.” This appears to be a clear reference to the growing need to consider resource attributes beyond simple quantity when assessing “generation adequacy.”

The North American Electric Reliability Corporation, long considered a leading authority on power system reliability, has been explicit on this point, including the following⁴:

Measuring Performance rather than the Commodity

The traditional measure of resource adequacy is to track operating reserves. A simplified calculation for reserves is Balancing Authority’s generating capability minus customer demand....There are [multiple] underlying problems with determining adequacy by measuring

reserves as a commodity rather than [by their] performance....Not all Balancing Authorities need the same amount and type of Operating Reserves....Even if a Balancing Authority has adequate reserves, it may fail or be unable to deploy them when needed.

That this is undoubtedly the case is borne out repeatedly in power system experience. To choose just one example, data from ERCOT (the independent system operator of the Texas wholesale power market) show that between spring 2006 and autumn 2011 there were nearly two dozen supply-driven “reliability events” of which over 75% occurred outside of the peak demand season and nearly half occurred during non-peak hours. In fact, the great majority of reliability events occur during periods when total installed firm generating capacity comfortably exceeds total demand.

In short, intervening in the market to support capacity indiscriminately without also addressing the fact that the same “missing” scarcity value also distorts the relative value of more flexible capacity will not ensure resource adequacy. On the contrary, as the share of variable renewable production increases it will only reinforce the mismatch between the inflexibility of the current portfolio and what will be needed to ensure cost-effective system security going forward.

⁴ NERC, *Balancing and Frequency Control* (26 Jan 2011), pages 40-41

Lessons from experience

The evolution of capacity markets in North America is instructive. After the creation of competitive wholesale markets for generation in New England and PJM in the late 1990s, questions about the ability of those markets to ensure long-term resource adequacy arose.⁵ Were they sending sufficient price signals and providing reasonable revenue streams to support needed investment?

In the mid 2000s both markets began to experience a spate of threatened and actual plant retirements as overbuilding and weaker-than-expected demand led to wholesale prices that were insufficient to sustain investment. Concern grew that the energy markets as they existed at that time were unable to cope with the locational reliability issues and other challenges posed by a sudden withdrawal of so much generation. In response to this challenge, both regions ultimately adopted mechanisms called, generically, forward capacity markets.

These “traditional” capacity mechanisms were designed to secure commitments for the quantity of capacity needed to exceed projected peak demand by a set margin. Each one is somewhat different but in both cases the RTO determines,

through a complicated planning process, how much capacity will be needed three years in the future (the *forward period*) to satisfy resource adequacy standards. Auctions are held, in which all resources, new and existing, wishing to receive capacity payments are allowed to bid. All capacity resources that clear in the auctions are paid the clearing price (the price bid by the last resource cleared, denominated in \$/kW-month or kW-year) for their capacity, if it is available when needed, in that specified future year (the *contract year*).⁶ This is then repeated annually or semi-annually with the value of capacity reset at each auction. Both markets accept bids for imports across interconnectors with other regions, and both markets have actively incorporated dispatchable demand response (and to a lesser extent energy efficiency) as capacity resources with considerable success. Both markets have enjoyed some measure of success with reserve margins remaining healthy, successful demand-side resource participation keeping clearing prices lower than expected, and new investment in capacity resources taking place.

However these mechanisms reward all resources the same, so long as they fulfill their commitment to be available when called

⁵ ISO New England is the regional transmission organization (RTO) that operates the grid and market operations for the six-state New England region (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut), with a peak load of approximately 32 GW. PJM is the RTO that manages the wholesale electricity market in all or parts of 13 mid-Atlantic and Midwestern states and the District of Columbia, with a peak load of approximately 150 GW.

⁶ This description is necessarily a simplification. There are nuances to the mechanics of the auctions, which include, for instance, pricing options that winning bidders are given. But these details don't affect the points made here.

upon. Bids are based on price but not on operational characteristics. This narrow approach has emerged as a problem on several fronts. Capacity revenues have been seen as extending the lives of some surplus resources that otherwise would have retired, suppressing energy prices, and they have entrenched the position of the existing mix of capacity resources without regard to its fitness for the operational needs of a rapidly changing energy resource mix. Both markets have recently experienced serious reliability challenges despite both markets enjoying very healthy planning margins, leading to concerns that these market mechanisms and the costs associated with them, while successful at supporting investment in capacity, are not valuing all of the capabilities needed to ensure resource adequacy.

In response, both market operators have moved recently to address these concerns. ISO New England, having identified the need for greater resource flexibility and responsiveness as a strategic priority, has tabled several proposals for differentiating payments to capacity resources. More interestingly, both have taken several steps recently to reinforce the principle role the energy and ancillary ser-

vices markets play in compensating resources for investment in capacity and flexibility.

The lessons, in both cases, appear to be that investment in the required amount of capacity does not necessarily equal resource adequacy, and that the energy and ancillary services markets are better suited to valuing the complex attributes that contribute to resource adequacy and need to be given a fuller opportunity to fill that role.

Meanwhile the Texas market, with a peak load of approximately 64 GW, has maintained an energy-only structure since its inception but has been engaged in a very public debate over the past two years about resource adequacy concerns. Having studied their own resource situation and the experience to date with capacity markets elsewhere in North America, the Public Utility Commission of Texas recently decided to postpone indefinitely any decision to adopt a capacity market despite the fact that Texas will need significant investment in new resources over the next 2-4 years. They have moved strongly to improve scarcity pricing in their energy and services markets and to aggressively expand the role of demand response in both markets.

Getting a clear picture

A **capacity** mechanism sets forth an administratively mandated level of resources based on administrative assumptions about future demand. It begins with assumptions about how much capacity will be available and how much will be enough. These are based on a resource adequacy standard (usually expressed in terms of the statistically expected duration of service interruption over a given period of time) and a methodology for determining whether or not the quantity and capabilities of the resources available comply with the standard. The decision to intervene in the market to alter the rate of investment is an excellent point at which to examine whether the resource adequacy standard being applied and the assessment methodology being used are in fact producing answers that make technical, economic and political sense for all stakeholders. Indeed, the guidance given by the Commission includes the requirement that authorities regularly conduct an “objective, facts-based” assessment of resource adequacy.

Any such assessment should begin with a critical evaluation of the standard being applied. There is a tendency to fall back on standards that were used in the old central planning system. For instance, in many parts of North America the system was planned against an expectation of “one day in ten years” of service disruption due to supply

issues, or 2.4 hours per year. France has recently proposed a similar standard of 3 hours per year. There are well-documented concerns with the use of these standards. First, they are historical rules of thumb that were used as benchmarks by central planners and regulators, not (as proposed in various capacity mechanisms) absolute floors. Second, they are vaguely constructed and open to multiple interpretations. Third, they bear no obvious relationship to what most economists consider to be the value customers place on avoiding interruption of service. Fourth, they impose a standard for supply reliability that is orders of magnitude more restrictive than the standard implied for the transmission and distribution system, so that for the average customer the difference between meeting the supply standard and missing it by a wide margin would literally be imperceptible, lost in the noise of disruptions caused by transmission and distribution system failures. For all of these reasons a critical examination of the prevailing resource adequacy standard makes good sense. If the energy market is not inciting new investment, it may not be because of failure in the energy market. It may be because the investment assumed to be needed is actually beyond what an efficient market would support given the actual value of uninterrupted service. This not necessarily wrong, but it may indicate that a narrower mechanism is warranted.

Once the standard is well understood, the methodology for assessing compliance with the standard needs to be critically examined. The Commission's guidance sets out some clear requirements in this respect. Adequacy assessments must:

- Take into account the cross-border dimension of electricity markets and be coordinated with neighbouring Member States.
- Be consistent with ENTSO-E's EU wide generation adequacy assessment and the methodologies used therein;
- Be based on widespread consultation with stakeholders
- Include reliable data on the development of variable wind and solar, including in neighbouring systems, and analyse the amount as well as the quality of generation capacity needed to back up those variable sources of generation in the system;
- Properly integrate the potential for demand side management and a realistic time hori-

zon for it to materialize in order to avoid stranded investments in generation;

- Take full account of the impact of national and Union policy on energy and on the environment on electricity infrastructure, supply and demand
- Take existing overcapacity and the economic crisis into account in your assessment and avoid that inefficient plants are kept in operation through public support

In March 2014 the Council of European Regulators released the results of a survey⁷ of European national regulatory authorities that revealed a surprising lack of consistency among member states on many of these aspects of their assessment methodology, and in most cases there was little or no evidence that member states were in compliance with several of these requirements.

As has become clear in various debates about market design, the decision as to what sort of intervention, if any, is appropriate depends critically on establishing a clear line of sight to the standard and assessment methodology being employed.

⁷ CEER, *Assessment of electricity generation adequacy in European countries (3 March 2014)*

The right tool for the job

AS has already been discussed, in 21st Century power systems it is the interplay of the gross demand and net demand forecasts that will provide the basis for estimating both the level of firm capacity needed for resource adequacy and the mix of resource capabilities that can most efficiently deliver the desired level of system security. Further analysis will reveal the value to the system of additional flexibility. Is more flexibility less costly than its alternative, e.g., renewables curtailment or more back-up generation? The goal of a capabilities market is to find the optimal balance between greater resource flexibility and least cost.

The development of mechanisms to provide the flexibility services that power systems of the 21st Century will need will advance along different paths in different regions. This will reflect many factors: does the market face an urgent need to invest in new resources; what are the immediate needs for capabilities services that aren't being met; how mature and how capable are the existing market institutions and processes? The reality is that few markets have the time or the institutional capacity to set as their primary objective a market that will deliver exactly the amount of flexibility needed, for not a penny more than it's worth. Short of such an ideal market there are several simplified approaches that can be considered: (1) enhanced services

market mechanisms, (2) apportioned forward capacity mechanisms; and (3) strategic reserves.

Enhanced Services Market Mechanisms

One approach is to create a long-term service market to procure the target mix of resource capabilities derived from the net demand forecast. This market is essentially an investment scale adaptation of existing ancillary services mechanisms, with new services added as necessary. Capabilities of interest would most likely include traditional system operator functions such as ten-minute spinning and non-spinning reserves and perhaps a thirty-minute operating reserve. Obligations to secure such services would likely remain with the system operator. The market would also include less traditional balancing functions, which are at least as important but more difficult to specify. These may include short-cycle stop-start and aggressive dispatch or ramping options, parameters meant to reflect how fast and how frequently, across multiple scheduling intervals, a resource can be turned off and on, as well as the up-ramp and down-ramp rates and ranges.

For both traditional ancillary services as well as these less traditional balancing services, their value could be set by periodic "forward"

auctions and paid to all new and existing resources capable of providing them. As with existing capacity mechanisms, the “forward period” (the lead time before the service must commence) as well as the “commitment period” (the period of time over which winning bidders receive the cleared market payment for the service) would need to be designed with nominal investment lead times and investment horizons in mind.

An enhanced services market mechanism, and in particular establishing separate market mechanisms for non-traditional balancing services, is conceived primarily to operate in the absence of a capacity mechanism. However, it is possible (if a bit cumbersome) to envision this solution operating alongside a capacity mechanism, if desired. This may be the case if market stakeholders would prefer to keep the capacity mechanism strictly focused on resource adequacy concerns.

In either case, with or without a capacity mechanism, this approach would seek to realign the mix of system resources by providing those resources with the desired capabilities access to a stable, long-term revenue stream that is unavailable to less flexible resources. This would afford more flexible resources a competitive advantage in the energy and (if applicable) capacity markets. Where a capacity market exists, the effect

would be to reduce the market value of undifferentiated firm capacity.

Examples of how such enhanced services might be defined and procured can be found in the California ISO’s proposed Flexible Ramping Product and the Midwest ISO’s proposed Ramp Capability Product. In both of these cases the mechanisms have, for now, been conceived as short-term market mechanisms. That said, extending the terms over which they operate is entirely feasible should these markets opt for an enhanced services model for ensuring long-term access to increased resource flexibility.

More traditional ancillary services markets are likewise typically short-term in nature, but there are some exceptions. ISO New England has a one-year-forward operating reserves market. And in Great Britain, the system operator (National Grid) has until recently procured short-term operating reserves (“STOR”) via auction for commitment periods of up to 15 years. Great Britain’s approach has the benefit of decoupling the long-term procurement of system services from processes designed around firm production capacity, allowing greater flexibility in targeting specific services (e.g., energy storage). For this same reason it may take longer to see the desired impact on the pattern of supply-side investments: Until these services



markets establish a track record, investors may be slow to incorporate the relevant capabilities into long-term resource investment plans. They may require a more immediate motive to do so, such as the apportioned capacity mechanism described below. Pursuing an enhanced services market may, therefore, be more appropriate for markets where there is no perceived urgency to invest in a significant amount of new firm supply resources. Nonetheless, this approach represents a viable option for regions experiencing a growing share of variable renewables where creating a separate forward capacity payment mechanism may not be desirable.

Apportioned Forward Capacity Mechanisms

An alternative approach, in markets where capacity mechanisms have been deployed or are under active consideration, involves simply apportioning the capacity mechanism into tranches based on the target mix of resource capabilities derived from the net demand forecast. This option leverages whatever resource adequacy mechanism is in place by breaking the total quantity of firm resources required into successive tranches based on specified resource attributes. All firm resources, including qualifying demand-response and end-use energy efficiency resources, would bid into the

highest-value tranche for which they could qualify. The most flexible tranche of firm resources is cleared first, followed by the next most flexible tranche, and so on. The least flexible firm resource tranche would be cleared last at whatever residual quantity of resource requirement remains unfilled.

The demand curves for each tranche would reflect the relative values of the resources specified, with the clearing price for each successive tranche also expected to be lower than the last. The final tranche would be expected to clear at a very low price in both relative and absolute terms. The desired realignment among resources would be driven by the size of each tranche, with value set by the relationship between the size of the tranche and the supply and costs of appropriate resources.

A good example of how an apportioned forward capacity mechanism might be deployed in practice can be found in the proposal by PJM to include “operational reliability metrics” in the original design filed in August 2005 for PJM’s current forward capacity market. PJM specified four categories of resources—dispatchable (i.e., rampable), flexible cycling (i.e., fast and frequent stop-start), supplemental reserves, and everything else—and proposed to clear the capacity market in stages based on the desired quantities of each

type of resource. PJM has subsequently instigated short-term markets targeted at these capabilities but has yet to revisit formally the possibility of an investment timescale market mechanism.

It is important to keep in mind that capacity mechanisms are not intended to provide additional revenues to system resources over and above what they would expect to earn in a properly functioning energy-only market. Rather they are designed to substitute a more stable, predictable stream of payments for capacity in place of a portion of the more variable, less predictable revenues that would otherwise have been earned through the sale of energy. With that in mind, the apportioned approach to capacity mechanisms described here allows market operators to differentiate the value of capacity payment streams available to system resources based on a set of critical operational capabilities. As a result, more flexible resources can realize a higher proportion of their earnings from stable, long-term, predictable capacity (or “capability”) revenues, which should afford them an overall competitive advantage over less flexible resources in the energy, capacity and ancillary services markets.

This approach avoids the trap of segregating capacity resources based on criteria that have no tangible reliability rationale (e.g., new vs.

existing resources, or “strategic reserves” vs. all other firm capacity). Such measures inevitably distort wholesale energy markets and, perhaps more importantly, most often fail to track the resource attributes that will increasingly be needed to deliver least-cost reliability as shares of variable production rise.

Instead, a capacity mechanism that is apportioned in a manner similar to that described here, or as proposed by PJM in 2005 and by ISO New England in May 2012, properly rewards all firm capacity for its contribution to meeting resource adequacy requirements, but *only for the undifferentiated value of firm capacity*. Firm resources that contribute additional operational reliability benefits to the system—whether they be new or existing, supply- or demand-side resources—have the opportunity to clear the market first and earn higher capacity payments. In so doing, they drive less flexible resources to the margin and reduce the revenues such resources are likely to receive via the capacity mechanism. In addition, by allowing all resources to participate, this approach encourages investors to seek out additional, low-cost flexibility from existing supply resources and from demand-side options.

This approach has the benefit of relative simplicity in those cases where a capacity mechanism is in place or under development. It



also offers a more natural vehicle for valuing and deploying those non-traditional capabilities described under the enhanced services option by creating an auction process in which “whole resources” may compete. However, the approach offers less flexibility in tailoring specific services and provides less opportunity for mid-course corrections. It also may not obviate the need for the system operator to adopt separate long-term mechanisms for certain more traditional ancillary services. But in many markets this approach will represent a more straightforward vehicle for increasing the flexibility of the non-renewable resource portfolio.

Strategic Reserves

As discussed above, the resource adequacy standard adopted, and the planning reserve margin required to meet that standard, may require more investment in capacity than an efficient market, reflecting real consumer preferences, would actually bring forward. There may be valid reasons for imposing such a standard, but there are important implications of doing so that should be taken into account when considering various capacity mechanisms. Adopting a market-wide capacity mechanism designed to lock in this higher level of capacity would have the effect of

institutionalizing surplus production capacity, resulting in a permanent suppression of energy prices and forcing consumers to pay more for all capacity in the market than it’s actually worth to them. For these reasons it is worth considering a more targeted mechanism referred to as a “strategic reserve.”

A strategic reserve mechanism targets the space between the capacity required to deliver an efficient reliability solution, and the capacity required to meet the reliability standard imposed by authorities. A proper strategic reserve consists of capacity that, because it is surplus to what would be an efficient level of production capacity, is prohibited from participating in the energy market. The reserve would be called upon in the event that the energy market failed to clear, presumably because energy prices reached an administratively set ceiling. It is intended to provide this added level of assurance without distorting the energy market and adversely affecting investment in market resources. To achieve this goal, the strike price for the strategic reserve should be as close as possible to a level that reflects the actual value of lost load for consumers in the market.⁸

The strategic reserve option is not mutually exclusive of adopting a capacity mechanism

⁸ See fn. 2.

intended to deliver an efficient reliability solution in the wholesale energy market. Such mechanisms should continue to be market-wide and should continue to differentiate capacity resources based on their operational capabilities. But the strategic reserve option avoids the problems that can arise in applying such market-wide mechanisms based on a resource adequacy standard that is, for whatever reason, well in excess of what an

efficient market solution would produce. More specifically, a strategic reserve avoids structural distortion of the energy market. Given the crucial role the energy market will continue to play in paying for needed investment, regardless of whether or not a market-wide capacity mechanism is adopted, it is extremely important that such structural distortion be avoided if at all possible.



Poland and Germany

Today there is an active debate over resource adequacy and system security in both Poland and Germany. While both countries have different resource mixes and different immediate and longer-term challenges, both are considering power market reform to meet

system needs, including the role that a capacity mechanism might play. Yet, as this paper has pointed out, a “vanilla” capacity mechanism that does not differentiate among resource capabilities may not deliver the “right kind” of investment, and at lowest cost.

Poland The current discussion regarding capacity mechanisms in Poland has roots in a challenging investment environment and concern over a capacity deficit between 2016-2020. While Poland currently has a capacity surplus, continued investment challenges may lead to problems when old, depreciated Polish coal plants start to go offline. Today, low energy prices, combined with the declining competitiveness of Polish coal have led investors to broadly steer clear of investments in new coal. Rising carbon prices over time will further raise the cost of coal relative to other resources. Looking ahead, the question is what the new resource mix that replaces retiring power plants will look like, and whether the energy market as currently structured can deliver timely investment and ensure the full range of capabilities needed to maintain system reliability.

Germany The German power market is in the midst of a dramatic transformation. Germany has a considerable oversupply of generation due to a combination of reduced demand (due to the financial crisis and successful end-use efficiency programs), the completion of a number of fossil-fired plants initiated just prior to the economic crisis, and the installation of a large quantity of renewable generation pursuant to the Renewable Energy Sources Act (EEG). This has in turn led to a collapse in wholesale energy prices. In response to persistently low wholesale prices many plant owners have announced or threatened plant closures. Natural gas plants have been particularly affected due to the relatively high price of gas relative to coal and lignite. At the same time market participants are working to adjust to the operation of a system with much larger shares of variable production. Finally, the German

Poland While coal dominates the Polish power mix today, future investment will lead to a broader portfolio of resources. This may include new coal and nuclear power, though the prices of both coal and nuclear are too high to support new investment today. It will undoubtedly include a greater share of renewable energy, as the capital costs of renewable energy continue to fall and European policies to support renewable energy are extended. It may also include more natural gas, depending on the price of natural gas and security concerns. To the extent that markets and policies are shaped to support demand-side resources, these also have the potential to play a significant role.

A capacity mechanism (or other capability mechanism), if any, should be structured in a way that delivers the right mix of resources, including those on the supply and demand side. The danger of a “vanilla” capacity market that rewards capacity without regard for additional system attributes is quite real. Such a mechanism risks supporting overinvestment in traditional resources while failing to target the resources necessary to balance a system with an increasing share of renewable energy.

Germany government is moving ahead with a commitment to retire all of Germany’s nuclear plants by 2022.

Despite the fact that there is no immediate concern with resource adequacy, the impending threat of a large withdrawal of capacity from the market over the coming ten years has raised questions about the management of reliability going forward. There has been considerable discussion about the possibility of adopting some sort of capacity mechanism. This discussion has been made more complex by the need to understand clearly the impact of the growing share of variable production. It is too soon to say how this matter will be resolved. The recent trend has been away from any sort of market-wide capacity market, with any intervention more likely taking the shape of some sort of strategic reserve. Capacity must and will be withdrawn from the market. The challenge will be to ensure that the resources left are those best suited to deliver least-cost system security as the share of renewables continues to grow.

²⁹ | O’Sullivan, Marlene; Edler, Dietmar; Peter, Bickel; Lehr, Ulrike; Peter, Frank; Sakowski, Fabian. *Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2012, 2013*; www.unendlich-viel-energie.de, Erneuerbare-Energien-Arbeitsplätze in den Bundesländern, 2012; www.statista.de, *Anzahl der Unternehmen der Erneuerbaren-Energien-Branche nach Bundesland im Jahr 2012, 2012*.

Conclusion

In considering solutions to system reliability, both Poland and Germany will benefit from an examination of how resource adequacy and system security are defined. Both will need to consider whether new or adapted market mechanisms are needed to ensure reliability at lowest overall cost to consumers. And they will need to identify the most appropriate mechanism for the task. As European energy markets become increasingly integrated, it is also essential to consider the role that broader power systems can play in helping to meet reliability, including how the German and Polish power systems can com-

plement each other to meet system demands at lower cost than “going it alone.”

This paper sets forth a number of considerations to stimulate discussion within Poland and Germany on system reliability and market mechanisms. It aims to expand the discussion beyond capacity markets, and to focus the dialogue on system needs first, and targeted mechanisms second. We hope that by framing the discussion, the paper can drive productive discussions within Poland and Germany, as well as dialogue on areas for cooperation with each other, and with other European Member States.



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