The Electricity Journal 30 (2017) 55–61

Contents lists available at ScienceDirect

The Electricity Journal

journal homepage: www.elsevier.com/locate/electr

Follow the missing money: Ensuring reliability at least cost to consumers in the transition to a low-carbon power system

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ARTICLE INFO

Article history:
Available online 18 January 2017

Keywords:
Market design
Reliability
Flexibility
Capacity markets
Scarcity pricing

ABSTRACT

Electricity markets must ensure reliability, deliver value for money, unleash technology and service innovation, and empower and protect consumers. This article offers a brief refresher on how we should expect energy prices to form in a modern system and the ways in which they should be expected to shape critical investment decisions. The author lays out a robust and sustainable approach to ensuring a reliable, low-carbon electric supply at the lowest reasonable cost.

1. Introduction[2]

Competitive wholesale electricity markets are often said to suffer from a “missing money” problem. This refers to the idea that for various reasons prices for energy in these markets may not fully reflect the value of investment in the resources needed to meet customers’ expectations for reliable electric service. While the analysis behind these claims is often muddled, there can be legitimate concerns about the quality of implementation of electricity markets and whether prices in these markets adequately reflect demand for reliability. The possibility that money is “missing” from the market can, in turn, impede needed investment.

That said, there is no single pathway to a reliable power system, and different pathways come with different price tags. Experts agree that a growing share of variable renewable resources increases the value of flexibility elsewhere in the system,[3] value that can only be seen clearly in prices reflecting real-time conditions in the wholesale electricity market. Yet many of the measures proposed to replace missing money operate outside of that market, on different time scales and using different parameters. They dilute and thus subvert the unique role energy prices can and should play in shaping investment to meet the other half of the reliability challenge—reliable service *at the lowest reasonable cost to consumers.* As a result, in trying to restore missing money they create a new problem: misallocated money, that is, overcompensating some resources and undercompensating others.

Misallocation can create structural incentives to invest in a mix of resources ill-suited to the underlying needs of the system, particularly a low-carbon power system. It can obscure the true value of energy storage and flexible demand as supply becomes less controllable. As a result, the business case for innovation can be seriously compromised and consumers can face significantly higher costs for reliability.

“Keeping the lights on” is about more than just investment in generation. It’s about delivering value for money, and it’s about empowering and respecting consumers. Getting energy price formation in wholesale electricity markets right remains a key to tying these pieces together. This article briefly recaps the principles behind electricity market pricing, considers some of the ways those prices can go wrong in practice, and proposes a robust and sustainable market approach to meeting expectations for reliability at the lowest reasonable cost to consumers.

2. Energy prices in electricity markets

Misguided approaches to the missing money problem often originate in a flawed understanding of how energy prices are

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[1] Regulatory Assistance Project.

[2] The topics discussed in this article are explored at more length in Hogan (2016). *Hitting the Mark on Missing Money: How to ensure reliability at least cost to consumers.* Brussels, Belgium: Regulatory Assistance Project. Retrieved from http://www.raponline.org/knowledge-center/hitting-mark-missing-money-ensure-reliability-least-cost-consumers/

[3] For a comprehensive reference see International Energy Agency (2014). *The Power of Transformation – Wind, Sun and the Economics of Flexible Power Systems.* Retrieved from https://www.iea.org/publications/freepublications/publication/The_power_of_Transformation.pdf

http://dx.doi.org/10.1016/j.tej.2016.12.006

meant to be formed in the electricity market and how they are expected to support needed investment.

The competitive wholesale electricity markets introduced in regions including North America and Europe over the past thirty years were conceived of as true commodity markets in which the wholesale price of electricity is the price at which the quantity of supply willing to sell matches the quantity of demand willing to buy (the "market clearing price"). The clearing price of electricity was meant to be the principal basis for decisions regarding investment, production, and distribution.[4] That is, wholesale electricity markets were, in principle, meant to be no different from any other commodity market. That a low-carbon power system may be more capital intensive than in the past does not change this—the electric industry has always been highly capital intensive, and many, if not most capital-intensive commodity industries recover their capital costs as well as operating costs in markets based on unit pricing. Examples include petroleum refining, real estate, and commercial airlines.

In practice, few commodity markets live up to the theoretical ideal, which is why various forms of regulatory and administrative intervention can be appropriate. The more important the commodity, the more important it is that the integrity of the market be reinforced by judicious interventions. Electricity is both an especially important commodity and one that has historically exhibited its own particular set of challenges.

First, electricity is more difficult and expensive to store than most commodities. As a result, electricity markets are more susceptible to being manipulated by the withholding of production. This puts a high premium on reducing market concentration, and it means the competitiveness of the market must be monitored and enforced as close to real time as possible. In many cases, the response to these challenges has been to impose various forms of direct and indirect price controls in an attempt to mitigate possible market power abuses. This both undermines legitimate price formation and simply postpones the necessary work of ensuring competitive markets, because no market, however constituted, can function without effective competition.

Second, even when wholesale prices have been allowed to reflect more closely the conditions in the real-time market, demand for electricity has tended to be "inelastic"—relatively unresponsive to higher costs during shortages or to greater opportunities during surpluses. While the value of uninterrupted service can be quite high for some energy services, the inelasticity of demand is more generally attributable to the common practice of non–time-varying retail pricing. This practice arose, in turn, from the combination of monopoly retail franchises and the historical impracticality of serving any but the largest individual customers selectively based on their willingness to pay. The result has been that virtually all loads in a given area are served for the same price in shortage hours and in surplus hours, until none of them are served.[5] Consequently, the demand impacts of fluctuating wholesale prices have played out only in longer time frames, if at all.

The fact that demand has historically been relatively inelastic does not mean consumers place an unlimited value on reliability. The value of continuous service (the "value of lost load" or VoLL) varies widely, from near zero (for example, when charging an electric vehicle at 2am) to tens of thousands of euro per megawatt-hour (MWh) (say, at a hospital). While cheap and convenient options for consumers to act on that range of values are expanding rapidly, for now we continue to rely principally on standards set by public officials that impute a single reliability value for all loads. That imputed value varies but is typically set toward the upper end of the range.

Table 1
Representative Rank Order of Marginal Costs (Excluding Price Responsive Demand).[11]

System Resource	Full Marginal Cost (€/MWh)
Generation capacity	20–250
Imports	20–1000
Secondary (operating) Reserves	250–5000
Emergency generation	500
Primary (regulation) reserves	500–9000
30-min responsive back-up	1400
30-min controllable demand response	2400
10-min controllable demand response	2600
10-min responsive back-up	3700
Emergency load-shedding	9000

System operators apply that value by acting, in effect, as the buyer and seller of last resort, procuring the various reserves and other services needed to be able to comply with the public standard in real time. System operators procure these services from the same pool of resources that are expected to meet the demand for energy. When production to meet the demand for energy begins to eat into what is needed in reserve by the system operator to comply with the reliability standard, the true marginal cost of producing a kilowatt-hour (kWh) of energy—the true basis for "marginal cost pricing"—includes the cost system operators should be willing to incur to reserve additional resources, or should charge to release resources to meet the rising demand for energy. If we believe what we say about the value consumers place on reliability, then this "opportunity cost" is as real as any other marginal cost reflected in market prices.

In this way, wholesale energy market pricing is meant to reflect not just the short-run marginal cost of energy sold in the forward energy market but the marginal cost of all actions required to meet the demand for reliable energy (see Table 1).[6] When supply margins are tight, the demand for energy and balancing services can drive marginal costs well above the variable cost of the last kWh sold in the forward market. This in turn reveals the true window of opportunity for consumers to play their role in balancing supply and demand.

Fig. 1 illustrates how this might be expected to affect market pricing during a typical period of tight supply margins on a hypothetical system (resulting either from high demand or from the unavailability of a significant amount of generation). In Scenario a, demand for reserves is not reflected in the demand curve, the marginal costs of "emergency" resources available to the system operator are socialized or ignored and thus not reflected in the supply curve, and the price of supply is capped well below the imputed VoLL. The result is market clearing price p_1. In Scenario b, the marginal costs of all actions available to balance the system are reflected in the supply curve, the price cap has been lifted to imputed VoLL, and the demand curve now reflects total demand

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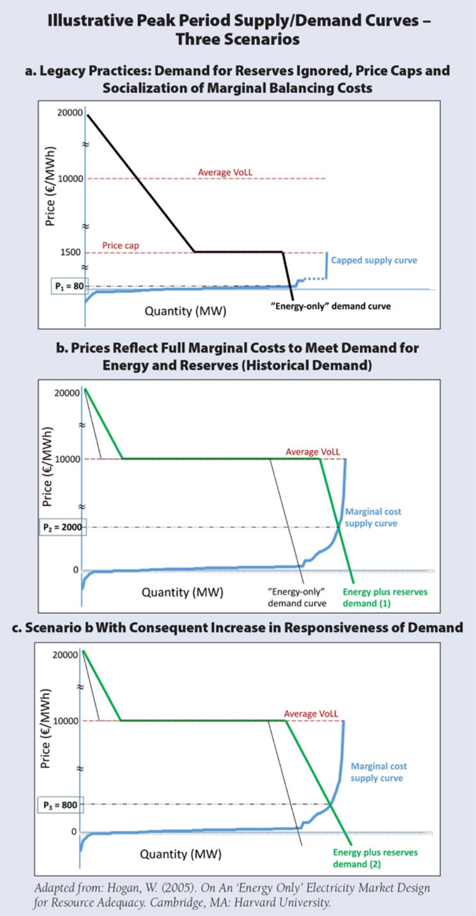
[4] See Joskow (2008). Lessons Learned from Electricity Market Liberalization. *The Energy Journal.* Special Issue. Retrieved from http://economics.mit.edu/files/209 "The overriding reform goal has been to . . . ensure that an appropriate share of [societal] benefits are conveyed to consumers through prices that reflect the efficient economic cost of supplying electricity and service quality attributes that reflect consumer valuation." (Page 11)

[5] It is this characteristic, referred to as "non-excludability," that has led to the treatment of electricity as a "public good." Technology is rapidly eroding the non-excludability of electricity.

[6] In essence, this describes the difference between a market based simply on "economic dispatch" (as commonly misconstrued) and the actual design basis of "security-constrained economic dispatch."

[11] Adapted from Pfeifenberger et al. (2013). *Resource Adequacy Requirements: Reliability and Economic Implications.* The Brattle Group; and Newell et al., 2014. *Estimating the Economically Optimal Reserve Margin in ERCOT.* The Brattle Group.



Adapted from: Hogan, W. (2005). On An 'Energy Only' Electricity Market Design for Resource Adequacy. Cambridge, MA: Harvard University.

Fig. 1. Illustrative Peak Period Supply/Demand Curves—Three Scenarios.

for *both* energy *and* reserves. The clearing price (p_2) now reflects the true marginal cost of meeting the historical level of demand. Scenario c illustrates how cost-effective innovations in products and services that enable demand to respond to market conditions can moderate the cost of meeting the demand for reliability (p_3) when prices are allowed to reflect the true cost of energy. There is now a visible and accessible business case for such innovations.

3. Capacity vs. capability

In practice, most wholesale electricity markets have yet to exhibit the intended pricing behavior portrayed in Scenario c above, largely for two reasons: the imposition of various forms of price controls—a well-recognized issue—and a failure to update balancing market practices so that the full marginal cost of balancing services is properly reflected in energy market clearing prices—a much less well-recognized issue.[7] As a result, the energy market's ability to remunerate needed investment can be impaired. But when measures meant to fix this problem bypass the energy market to focus only on paying for investment in a *quantity of resource capacity*, something else goes missing—the value of investment in *flexible resources*.

As the share of variable sources of energy grows, there will be growing value in the ability of other components of the power system—demand, transmission, distribution, more controllable generating resources—to respond in a timely manner to conditions of surplus and scarcity. The most reliable way to determine what kind of flexibility is needed and what it's worth is by revealing the value of energy when and where it's plentiful and cheap, and when and where it's scarce and costly. That differential is, by definition, the value of flexibility.

Flexibility is different from capacity. The definition of a unit of firm or reliable capacity is well developed and will remain constant regardless of how the resource portfolio evolves. Flexibility defies simple definition. It may be an increase or a decrease in supply (or a decrease or increase in demand), over milliseconds or minutes or hours or days. The best sources for some kinds of flexibility are usually not the best sources for others. And the portfolio of flexibility valuable to the system will evolve continuously depending on which low-carbon pathway is chosen and how demand and the various technologies evolve.

The evolving nature and value of resource flexibility can be illustrated by looking at the expected evolution in the value of demand response as depicted in Fig. 2. The graph on the left is a generic representation of demand response's traditional role as a "peak shaving" resource, available to "keep the lights on" during periods of extreme system stress by paying a small number of large customers willing to reduce their consumption on request, typically on a very limited basis. Demand response in this case is simply an alternative form of capacity. The graph on the right depicts the kind of demand response that will be valuable in a low-carbon power system, in this case during a typical summer week. The value of flexible resources (in this case demand) now lies in the ability to flex in either direction, at any time of the year, as often as needed—even daily. Demand response as "capacity" is no longer a sufficient metric. (This picture of demand response is quite realistic, especially as transport and heat become more electrified.) But it's value, and the value of a range of other innovative sources of flexibility, will need to be more apparent as the relationship between supply and demand continues to evolve.

Fully formed energy prices are the clearest expression of what flexibility the system needs and what it's worth. Measures that bypass energy market prices to rely on out-of-market payment mechanisms degrade that functionality. It is difficult to envision an out-of-market payment mechanism capable of matching the effectiveness of fully formed energy prices in valuing investment in flexible capacity resources. Whether or not we pursue a low-cost pathway to a low-carbon power sector will depend on how well we cultivate or replicate that functionality.

4. A smart strategy for tackling missing money

The response to the missing money problem should be effective, efficient, and durable. That response must begin with the setting of an economically rational standard for reliability and an independent process for determining what investment is actually needed, incorporating opportunities for imports, energy efficiency, and flexible demand as cost-effective capacity resources. Low prices are not necessarily an indication of missing money. In fact, low commodity prices usually have a far simpler explanation—surplus production capacity. Most, if not all, of the financial distress currently plaguing many European and North American generation markets can easily be traced to overcapacity

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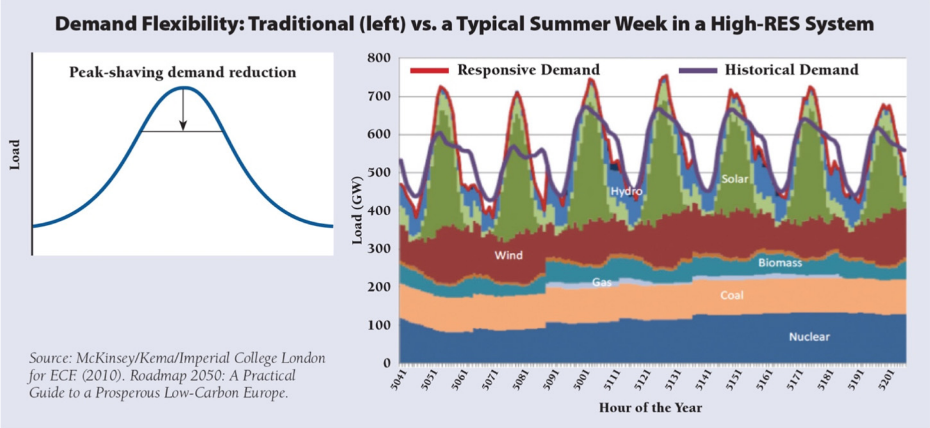
[7] Historical technical and economic barriers to responsive demand are often cited as a third reason but these barriers are falling rapidly. The key remaining barriers are in retail tariff design, including adoption of time-varying retail pricing, which is beyond the scope of this paper. For more information on this issue, see Lazar and Gonzalez (2015). *Smart Rate Design for a Smart Future.* Montpelier, VT: Regulatory Assistance Project. Retrieved from http://www.raponline.org/knowledge-center/smart-rate-design-for-a-smart-future


Demand Flexibility: Traditional (left) vs. a Typical Summer Week in a High-RES System

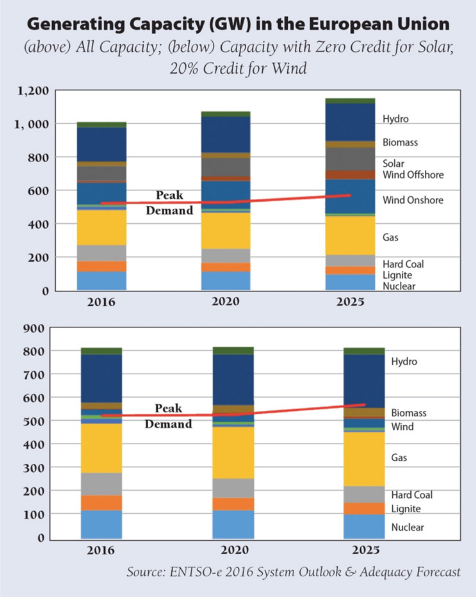
Source: McKinsey/Kema/Imperial College London for ECF. (2010). Roadmap 2050: A Practical Guide to a Prosperous Low-Carbon Europe.

Fig. 2. Demand Flexibility: Traditional (left) vs. a Typical Summer Week in a High-RES System.

(Fig. 3). Sometimes claims of “missing money” are just rent-seeking in disguise.

4.1. Settling for third best: capacity remuneration mechanisms

When considering measures to deal with missing money, the tendency in some jurisdictions has been to default immediately to what is actually the third-best option—out-of-market capacity mechanisms administered by a central agency, sometimes referred to as a “capacity remuneration mechanism” (CRM). CRMs extract some components of the energy value chain—investment and other fixed costs—and treat them as a discrete product called “capacity.” They can range from relatively mild interventions—such as a decentralized capacity obligation placed on retail suppliers to demonstrate access to adequate resources six months to a year in advance—to highly distorting measures such as public auctions of 5- to 15-year price- and volume-guaranteed purchase commitments exclusively to new investments.


Generating Capacity (GW) in the European Union
(above) All Capacity; (below) Capacity with Zero Credit for Solar, 20% Credit for Wind

Source: ENTSO-e 2016 System Outlook & Adequacy Forecast

Fig. 3. Generating Capacity (GW) in the European Union.
(above) All Capacity; (below) Capacity with Zero Credit for Solar, 20% Credit for Wind.

System operators continue to experiment with different approaches to ensuring that capacity paid by a CRM actually performs when most needed. In response to widespread failures during an early 2014 event in the eastern U.S. markets known as the Polar Vortex, system operators there have implemented reforms to their CRMs that dramatically increase the penalties that capacity providers will face for failing to perform when called. These reforms place most or all CRM payments at risk for failure to respond, with virtually no exceptions allowed. They tend to favor more flexible resources, those able to avoid low-priced hours preceding and following shortage events, over resources that must operate through those hours to be sure they can perform during the shortage hours. Because CRM payments are typically fixed for a relatively short period—six months to a year at a time—they are in any case likely to be significant only during periods when capacity resources are growing scarce. As a result, directionally these reforms move the investment proposition under a CRM back toward what it would be in a market relying on effective energy market price formation.

Despite early hopes for greater simplicity and transparency, most CRMs that have been in operation for extended periods of time have encountered frequent political controversy and creeping complexity. One reason for this is the difficulty in striking an equitable and cost-effective balance between the benefits CRMs are meant to offer investors—a greater level of certainty around at least a portion of their revenues—and the long-term investment risks that CRMs shift back to consumers. CRMs also do not bypass concerns about the effectiveness of competition in the market, indeed they may be more vulnerable to market power.

CRMs were expected to reduce political risks to investors and reduce costs to consumers by flattening energy market price volatility and spreading the cost of reliability over all hours. Over time it has become apparent that politicians and other stakeholders are equally likely to seek to interfere with CRM prices that “spike” to reflect the need for new investment, or that fail to “confirm” a need for favored new investment projects. To the extent CRMs are reformed to improve their effectiveness, these issues become only more apparent.

If a CRM is ultimately adopted, it should a) supplement rather than substitute for the first- and second-best alternatives described below; b) accommodate all capacity-equivalent resources equitably; c) recognize and reward resources based on desirable capabilities to the extent possible; and d) be designed with the objective of eventually phasing it out.

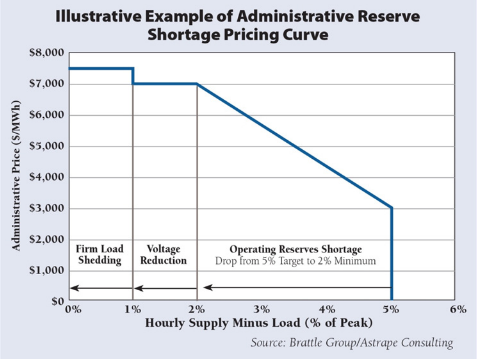
4.2. First- and second-best strategies: redress root causes alongside administrative reserve shortage pricing

The first priority should be to make progress on the first-best option—identifying and redressing root causes. These tend to range across several categories[8]:

1. Price controls to compensate for failure to establish institutional frameworks and processes needed to give confidence in the competitiveness of the market;
2. Failure to reflect the demand for balancing services in energy market clearing prices and socializing the real-time costs of providing those services;
3. Maintaining traditional market rules and procedures that effectively exclude non-traditional sources of the services needed to maintain reliability; and
4. Failure to anticipate and correct for unintended consequences of beneficial policies, such as overcapacity resulting from support for deployment of new zero-carbon supply.

In many cases these issues are known or can be readily identified. Redressing root causes—correcting the problem that gives rise to energy price distortion in the first place—can be technically and politically challenging, but viable strategies for redress can be drawn from experience in a number of markets. Options range from relatively straightforward measures like modernizing the rules and procedures for procuring and pricing balancing services, to more challenging measures like setting gate closures much closer to real time or implementing locational pricing that reflects actual congestion boundaries, to building a continuous market monitoring and enforcement framework consistent with established best practice, robust enough to provide the confidence needed to relax and eventually remove price controls. In markets where deployment of new zero-carbon resources and barriers to exit combine to create overcapacity and depressed pricing, an appropriate administrative response may be targeted assistance for the early retirement of resources legitimately stranded as a result. How one intervenes to deal with these issues will determine how closely the results come to a least-cost reliability solution.

While these are common themes in most markets, identifying and rooting out specific problems will take time. In the meantime, some form of administrative market mechanism may be necessary, at least on a provisional basis to ensure that the right amount of the right kind of resources can attract and retain investment. Therefore, the second priority, to be pursued in parallel with redressing flaws in the implementation of the energy market, should be developing administrative mechanisms designed to adjust prices in the energy and balancing services markets if and when they fail to reflect the true marginal cost of energy and balancing services, particularly during periods of shortage. There are multiple examples in operation, from markets where they operate in parallel with out-of-market CRMs, to the ERCOT market where this is the principal administrative mechanism deployed to ensure reliability.



Source: Brattle Group/Astrape Consulting

Fig. 4. Illustrative Example of Administrative Reserve Shortage Pricing Curve.

The most widely recognized version is sometimes referred to as “administrative reserve shortage pricing.”[9]; This approach leverages the central administrative role the system operator currently plays in virtually all energy markets as, in effect, the buyer and seller of last resort. As system operators look to position required balancing resources for the next day or the next few hours, this approach sets the price they are willing to pay for reserves. To do so they use a demand curve that tracks the extent to which reserves available in future balancing intervals are expected to fall short of what is needed[10] (see Fig. 4). If market prices do not already reflect the system operator’s demand for balancing resources, they are adjusted up (or down) to a level that is administratively determined to do so. Indeed, in every respect other than the relevant time horizons they operate in a similar fashion to most auction-based CRMs.

By ensuring a price signal that reflects the full cost of meeting the demand for energy and reliability close to real time, this mechanism mimics price formation in a fully functional energy market. It affords market participants the opportunity and the incentive to respond before shortages become acute. As the risk for higher and more volatile prices rises in proportion to the need for new investment, it spurs the growth of commercial risk management activities, such as bilateral long-term contracts and forward hedging by buyers and sellers, which in turn contribute to supporting the business case for needed investment. In giving greater visibility to temporal swings in the value of producing energy, it reveals more efficiently than alternative out-of-market measures the value of investing in resources (including “smart demand” technologies) better suited to responding to frequent swings in the availability of variable generation.

A version of this approach was introduced in the Great Britain market in 2014 as part of the Electricity Balancing Significant Code Review, with the hope that it will eventually make redundant the recently adopted capacity market. In May 2014, the ERCOT market in Texas implemented a reserve shortage pricing mechanism as its principal administrative mechanism, so far with good results (see Fig. 5). It was adopted in 2013 by the PJM market operator alongside their existing capacity auction as part of an overall effort to improve energy market price formation. An early version (the “Capacity Payment”) was introduced in the late 1980s in the England & Wales Pool. Implemented in conjunction with a robust

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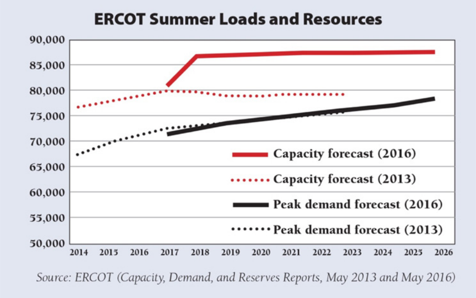
[8] For an in-depth review of how price formation in competitive wholesale power markets can and often is distorted, see: Pope, S. L. (2014, October). *Price Formation in ISOs and RTOs: Principles and Improvements*. Retrieved from https://www.epsa.org/forms/uploadFiles/2CC210000016F.filename.EPSA_Price_Formation_Oct_29_2014_FINAL.pdf

[9] In perhaps the most well-known example, the ERCOT market in Texas, this measure is referred to as an "Operating Reserve Demand Curve."

[10] For an extensive description of the concept see Hogan (2014). *Electricity Scarcity Pricing and Resource Adequacy*. Cambridge, MA: Harvard Energy Policy Group. Retrieved from https://www.hks.harvard.edu/fs/whogan/Hogan_HEPG_022714.pdf and Hogan (2013). Electricity Scarcity Pricing through Operating Reserves. *Economics of Energy & Environmental Policy*, *2*(2). Retrieved from http://econpapers.repec.org/article/aeneeepjl/2_5f2_5fa04.htm



Source: ERCOT (Capacity, Demand, and Reserves Reports, May 2013 and May 2016)

Fig. 5. ERCOT Summer Loads and Resources.

market monitoring regime, an administrative reserve shortage pricing mechanism also affords system operators a tool for mitigating market power abuse when shortages develop.

5. Conclusion

Energy price formation and missing money are complex topics about which volumes have been written, but the essential issues are surveyed here. They go to the heart of how electricity markets, where they have been adopted, are expected to accomplish their central function—to deliver reliable electricity at the lowest reasonable cost.

Claims that these wholesale electricity markets suffer from a missing money problem that can only be solved with a parallel forward capacity mechanism can be grouped into three themes:

- “Energy pricing *was never meant to* drive the investment needed to ensure security of supply, so we have to pay directly for capacity.” That turns out not to be true.
- “For x, y, or z reasons, energy prices in practice *can't* do the job alone and require a parallel form of payment for capacity.” The need for administrative measures to compensate for flaws in energy price formation may yet be with us for some time, but there are administrative options to improve energy prices themselves that can be effective and that offer advantages that would be difficult if not impossible to replicate in a parallel capacity mechanism. They should be used in preference to mechanisms that pay for capacity outside of the energy market.
- “In reality we *won't* do what is needed to enable proper price formation, and in any case we *won't* tolerate such prices, so we have to pay directly for capacity.” This ignores the roles that aggressive market monitoring and the growing empowerment of consumers and demand management can play in offsetting concerns about energy market pricing. It also ignores similar risks that have emerged with CRMs. It is, in effect, an argument for re-regulation/re-nationalization. If that is what we're really about, we should be honest about it and commit to doing a proper job of it.

This doesn't mean an effective energy market cannot tolerate measures, such as emissions restrictions or targeted support for investment in zero-carbon resources, that seek to accomplish other societal objectives. Virtually all important commodity markets have learned to adapt to similar kinds of interventions. It does mean that energy markets need to be able to seek the lowest cost responses to the effects of such measures if they are to serve their intended purpose. In an ideal world, they would do so by forming prices fully reflecting the ever-shifting balance between supply and demand. In reality, markets are never perfect and require constant, judicious administrative intervention.

Electricity markets are especially challenging in this regard, in part because society has a lower tolerance for interruptions in the supply of electricity than, for instance, in the supply of tomatoes, and in part because most consumers are only now beginning to acquire the practical capacity to decide in acceptable ways whether and how much to buy at a given price. This calls both for sustained efforts to improve energy price formation, but also for more active administrative measures to address the gap that remains when energy prices are set below a level that can drive the business case for needed investment—to replace missing money.

A range of options have been developed to accomplish both objectives—to improve the quality of energy prices and to replace money that nonetheless goes missing from what is required to meet expectations for reliability at the lowest reasonable cost. Options for the latter fall broadly into two categories—those that inject money back into energy and balancing services prices close to real time (for example, administrative reserve shortage pricing) and those that divert revenues into a separate, parallel mechanism to set fixed payments for capacity months or years into the future (so-called CRMs).

CRMs are a third-best option for ensuring reliability at the lowest reasonable cost. CRMs offer very limited scope for valuing capacity resources on the basis of their flexibility, and they tend to institutionalize the diversion of money from the energy and balancing services prices that are better suited to the job. At a time when most studies point to the value of moving from a conventional generating portfolio dominated by baseload to a smaller but equally reliable one dominated by flexible mid-merit plants, the fact that CRMs tend to place the same value on all firm capacity—and incent existing capacity to remain on the system regardless of its capabilities —is especially problematic.

If it becomes necessary to resort to a CRM, it should be designed to the extent practicable to recognize the relative values of more flexible versus less flexible resources, it should be accompanied by a thorough reform of the process for assessing the amount of capacity really needed to ‘keep the lights on’ in accordance with the established standard (accounting equitably for all cost-effective sources), and it should be a supplement to rather than a substitute for measures to improve the quality of energy price formation, with the ultimate objective that at some point in the future it will no longer be needed.

Rather than defaulting to the third-best option, top priority should be given first to the pursuit of better energy price formation. Because this is expected to be a challenging and time-consuming project, it should be reinforced by administrative measures that address energy and balancing services prices directly. Some combination of these first two options—improved price formation and administrative shortage pricing mechanisms—should be given an opportunity to succeed before resorting to more desperate measures, especially where a proper resource adequacy assessment would indicate that the need for more capacity is years in the future, as is the case in most of North America and Europe. This approach can both address the problem of missing money and ensure that the risks and rewards for investment are not misallocated. Especially in the midst of the current transformation, it offers the best chance of ensuring that consumers enjoy the clean, reliable service they demand at the lowest reasonable cost.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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