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INTEGRATING RELIABILITY- MUST-RUN PRACTICES INTO WHOLESALE ELECTRICITY MARKETS

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EXECUTIVE SUMMARY

CIn grid-integrated wholesale power markets operated by independent system operators and regional transmission organizations (simply referred to here as ISOs), the reliability of the bulk power system is a necessary foundation for the market's efficient operation. However, at times, reliability practices can inadvertently work to undermine market efficiency. One such practice is the use of reliability-must-run (RMR) agreements to keep a retiring generator in service to meet reliability standards. The effect of such rules is often to bias investment toward the cost-of-service regulated transmission grid and away from the market-driven generator and competitive retail sectors. The result is a less innovative and less dynamic power system than would otherwise emerge over time.

As ISO market designs have matured, ISOs have substantially reduced the use of RMR agreements. In the period between 2005 and 2011, ISO use of RMR agreements fell from about

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130 to 35. However, since 2011, use of RMR agreements have periodically risen and thus are a frequent source of controversy because of their cost and market effects. With the currently high pace of generation retirements, particularly among older thermal generators, the prospect of a resurgence in use of RMR agreements suggests that ISOs should pursue reforms to ensure RMR agreement terms work to support rather than undermine markets.

Accordingly, this paper examines various ISOs and their experience with RMR agreements, and focuses on changes in ISO rules that enable reduced use of RMR agreements and limit adverse consequences on markets. The primary market design principle involved is that of “incentive compatibility”: market rules should work to coordinate the economic interests of diverse market participants with the reliable and efficient performance of the shared system. When the use of RMR agreements is supported by appropriate market rules—particularly pricing rules that reflect the implied scarcity of useful resources—then reliability standards can be met at lower cost and in ways that support market-driven investment and promote long-run system efficiency.

The present analysis identifies four guidelines for review of existing RMR practices: when reliability principles dictate out-of-market actions by ISOs, energy and reserve prices should reflect resource scarcity; rules governing RMR service should provide for transparency in operation and with respect to cost of service; ISOs should enter into RMR agreements only when the benefits of meeting reliability standards through the agreement exceed the costs; and finally, ISOs should consider cost-effective alternatives to RMR agreements when such alternatives will adequately address the potential reliability needs.

INTRODUCTION

Much of the electric power system in the United States and Canada is organized into regional power grids with fully integrated wholesale power markets. The organizations operating these regional grids— independent system operators and regional transmission organizations (generically referred to as ISOs herein)— support trade and manage use of the transmission grid by electric utilities, generators, big industrial consumers and retail energy suppliers, while maintaining system reliability. A key challenge and continuing tension in ISO operation comes in maintaining reliability in a cost-effective and competitive way.

One tool available to ISOs to support grid reliability are reliability-must-run (RMR) agreements.¹ RMR agreements are contracts between the ISO and a generation unit that is planning to retire. They are intended to keep the unit in operation in cases in which retirement may lead to local reliability issues. RMR service is conceived of as a temporary tool intended to give market adjustments and transmission planning processes time to respond. However, the terms of RMR service can inadvertently work to undermine market adjustments and bias regional grids toward transmission-based solutions. Such bias moves system costs away from the competitive, market-based sectors of the electric power system and toward the monopoly, cost-of-service-based regulated sector of the system. In addition, transitioning generation resources from a market environment to cost-based rate regulation has proven complex and often controversial. The result is a somewhat less innovative, less dynamic and less efficient electric power system than is otherwise available.

Improvements in transmission operations and improved market rules have allowed ISOs to reduce the use of RMR services to a substantial degree. Whereas FERC-jurisdictional ISOs reported nearly 100 such agreements in 2005— mostly in the California ISO and ISO-New England— by 2010, FERC-jurisdictional ISOs reported just 31 RMR agreements. The Electric Reliability Council of Texas (ERCOT) had 69 RMR agreements in the period from 2002 to 2010, but just four in 2011, and one RMR agreement in 2016. However, market forces and regulatory changes have combined to accelerate the pace of unit retirements, especially among older base-load units. The resulting changes in power flows may lead

ISOs to rely more heavily on RMR agreements once again.² Given this potential for their increased use, ISOs should pursue reforms to ensure the terms of RMR service support, rather than undermine competitive markets.

DEVISING RELIABILITY POLICIES CONSISTENT WITH COMPETITIVE MARKETS

The issue of RMR services is, in many respects, just one of many examples that reveal the potential tensions between grid reliability and market efficiency. While such tensions are not inherent in grid-integrated wholesale markets, the complexity of ISO design makes it difficult to devise rules that consistently support both reliability and efficiency. The most notorious example of failure arose in the California ISO, the early rules of which permitted and sometimes encouraged destructive trading practices that contributed to the market meltdown in 2000-2001.³ Less dramatically, before the development of effective shortage pricing rules, emergency actions taken by ISOs— such as deployment of operating reserves or demand response resources— could produce a counterproductive price suppression effect.⁴ Even failing to co-optimize reserve procurement can encourage generation resource owners to bid strategically in an effort to become dispatched for whichever service is expected to be more profitable, in some cases diminishing system efficiency.

Reliable grid performance results from the combination of the long-term investments by transmission owners, the short-term actions of individual market participants and the coordinating functions of ISOs. Both reliability rules and market incentives play important roles. For the most part, reliability rules are collaboratively produced by market participants but enforced centrally by ISOs and government regulatory agencies. Market-based incentives are especially important

2. See, e.g., Ira Shavel, Yingxia Yang, et al., "Reliability Risks Due to Coal Retirement at ERCOT," The Brattle Group for Texas Clean Energy Coalition, Dec. 7, 2016. http://www.texascleanenergy.org/Reliability_Risks_Due_to_Coal_Retirement_at_ERCOT_FINAL_REPORT_6_Dec_2016.pdf; Devin Hartman, "Embracing Baseload Power Retirements," *R Street Policy Study* No. 97, May 30, 2017. <http://www.rstreet.org/policy-study/embracing-baseload-power-retirements>; See also, North American Electric Reliability Corporation (NERC), "Potential Reliability Impacts of EPA's Proposed Clean Power Plan: Phase I," Atlanta, GA, April 2015. http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Potential_Reliability_Impacts_of_EPA_Proposed_CPP_Final.pdf; Susan Tierney, Paul Hibbard, et al., "Electric System Reliability and EPA's Clean Power Plan: The Case of PJM," Analysis Group, March 16, 2015. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/electric_system_reliability_and_epas_clean_power_plan_case_of_pjm.pdf; and Midcontinent ISO, "MISO's Analysis of EPA's Final Clean Power Plan Study Report," MISO Policy & Economic Studies Department, July 2016. https://www.misoenergy.org/_layouts/MISO/ECM/Redirect.aspx?ID=229189.

3. Darren Bush and Carrie Mayne. "In (Reluctant) Defense of Enron: Why Bad Regulation Is to Blame for California's Power Woes (or Why Antitrust Law Fails to Protect Against Market Power When the Market Rules Encourage Its Use)." *Oregon Law Review*, 83 (2004), 207. http://heinonline.org/HOL/Page?handle=hein.journals/orqlr83&g_sent=1&collection=journals&id=217.

4. See Federal Energy Regulatory Commission, *Staff Analysis of Shortage Pricing in RTO and ISO Markets*, Staff Report, Docket No. AD14-14-000 (October, 2014). <https://www.ferc.gov/legal/staff-reports/2014/AD14-14-pricing-rto-iso-markets.pdf>.

1. The comparable Midcontinent ISO practice is termed system support resource (SSR) service. For consistency within this document, all comparable practices will be described as RMR service and that term should be assumed to apply to MISO SSR service unless indicated otherwise.

to coordinate the actions of diverse market participants in support of reliable operations.

The market design principle at play is that of incentive compatibility: market rules should work to align economic interests of participants with efficient performance of the shared system. When the harmful economic consequences of reliability practices are small, so too are the resulting problems. At times, however, the harmful consequences are larger than they seem. While the benefits of reliability are easy to see, costs often are spread thinly and may be hidden altogether.

Consider a generation resource dispatched out-of-market to meet reliability requirements. The benefits are obvious on days in which absence of the resource would have risked reliability problems, and market participants are sophisticated enough to appreciate the probabilistic nature of the protection. The resource owner is compensated for the services provided, and thus is willing to follow dispatch directions as long as the compensation is at least as good as otherwise available. The direct costs of out-of-market dispatch are spread broadly across consumers, so the immediate cost is small. Yet, if pricing rules fail to reflect the out-of-market dispatch, then market prices in that part of the region will be suppressed and will tend not to fully reward other generation resources and load for actions consistent with meeting the reliability standard in play. Suppression of prices in the area similarly reduces incentives for investment that would tend to support reliability on both the supply and demand side of the market.

Well-designed wholesale power markets meet reliability standards even as they promote efficiency among generators over both short-run and long-run time horizons. Economic dispatch principles with locational pricing—the fundamental market design approach used in ISOs—offers incentives for the lowest-cost generation available and promotes investment in generation in areas where it is most valuable. In the short run, reliability is secured by procurement of reserves and other grid-support services in ancillary services markets.⁵ Such markets enable the ISO and its consumers to secure both the energy and reserves necessary to provide protection against emergency failures of generation or transmission resources. Because providers of ancillary services are also the suppliers (and sometimes consumers) of energy, these markets are inherently connected to electric power markets.

5. FERC defines ancillary services as: “Those services necessary to support the transmission of electric power from seller to purchaser, given the obligations of control areas and transmitting utilities within those control areas, to maintain reliable operations of the interconnected transmission system. Ancillary services supplied with generation include load following, reactive power-voltage regulation, system protective services, loss compensation service, system control, load dispatch services, and energy imbalance services.” See “Glossary,” Federal Energy Regulatory Commission, March 15, 2016. <https://www.ferc.gov/market-oversight/guide/glossary.asp>. For a comprehensive overview of ancillary service markets, see Zhi Zhou, Todd Levin, et al., *Survey of U.S. Ancillary Services Markets*, Argonne National Laboratory, January 2016. <http://www.ipd.anl.gov/anlpubs/2016/01/124217.pdf>.

In many electricity markets in the United States, forward capacity markets provide supplemental payments intended to assure investment that is sufficient to meet resource adequacy needs.⁶ In ISO markets, capacity markets are one common approach to attain resource adequacy standards.⁷ However, capacity markets have also sometimes created conflict between reliability, on the one hand, and cost and market efficiency, on the other. Thus, they are similarly a source of controversy among market participants.⁸

The complexity of ISO operations and market designs almost ensure that the rules that govern ISOs will be incomplete and perhaps even internally inconsistent. Recourse to RMR agreements to attain reliability might signal one gap in ISO market designs. Retirement of a generation unit suggests that market revenue at the unit’s location was insufficient to maintain the resource in service. Yet, at the same time, the revelation of a potential reliability problem with retirement suggests the resource provided a high-value service to the market; namely, that of maintaining reliable operations under potential contingencies. The lack of sufficient market revenues for a unit that offers potentially high-valued service reveals a potential gap in the ISO markets for energy and ancillary services.

RETIREMENT, RELIABILITY AND RMR AGREEMENTS

The market process is dynamic, and constantly sees both investment in new generation and retirement of less-efficient generation. At times, retirement of a generating unit creates potential reliability problems. In such cases, the ISO may enter into an RMR contract with the resource owner to keep the unit in service and promote grid reliability. The contracts offer valuable short-term reliability services while transmission and other alternative approaches to reliability management are developed.⁹

While RMR service is an important tool to maintain grid reliability, the rules that govern RMR service should be consistent with market design principles that promote efficiency. To achieve such consistency can be challenging, and at times, RMRs undermine incentives for both short-run and long-run efficiency. For example, rules that govern the dispatch

6. See, e.g., Kathleen Spees, Samuel A. Newell, et al., “Capacity Markets—Lessons Learned from the First Decade,” *Economics of Energy & Environmental Policy* 2.2 (2013). <http://dx.doi.org/10.5547/2160-5890.2.2.1>.

7. ERCOT employs an “energy only” market design and regulatory mandates are also employed.

8. See, e.g., James Bushnell, Michaela Flagg, et al., “Capacity Markets at a Crossroads,” *EI @Haas Working Paper WP-278*, April 2017. http://ei.haas.berkeley.edu/research/abstracts/executive_summary_wp278.html.

9. In MISO, RMR agreements are termed system support resource (SSR) agreements. See MISO Tariff – Module C Section 38.2.7. <https://www.misoenergy.org/Library/Tariff/Pages/Tariff.aspx>. SSR services are referred to as RMR services within this report for the sake of consistency.

of energy from RMR units may depress locational prices in the area of the resource. This effectively reduces market payments to other resources that are capable of contributing to address the local reliability concern. Rules may lead the ISO to dispatch a less efficient mix of resources than available, which raises overall costs. In the long run, depressed local energy prices discourage generation investment in areas of the grid where such resources would be especially valuable. Capacity market prices may also be suppressed by retention of uneconomic generation for reliability reasons. As a result, when market signals for investment are reduced by RMR policies, the underlying reliability issue becomes more likely to be resolved by investment in cost-of-service regulated transmission grid upgrades or expansion.

An examination of RMR policies and practices helps to illustrate both the challenges of implementing RMR policies well, and the various approaches adopted by ISOs to minimize the undesirable side effects that can accompany RMR agreements.

EXPERIENCES WITH RMR POLICIES

CAISO

Among ISOs, the California ISO (CAISO) relied most heavily on RMR agreements in 2005.¹⁰ As of 2006, CAISO had more than 10,000 MW of power contracted under 80 RMR procurement agreements. The California Public Utilities Commission (CPUC) adopted a policy preference for the reduction of RMR contracts and toward reliance on electric utility procurement of resources to meet local resource adequacy standards. As a result, the use of RMR agreements was rapidly reduced.¹¹ In 2007, after implementation of the CAISO resource adequacy program began, the amount of capacity with RMR agreements fell to just over 3,300 MW. By 2012, CAISO had just one unit of 165 MW of contracted RMR capacity. The total costs of must-run contracts in CAISO dropped from \$254 million in 2005 to just \$39 million in 2008. In 2014, it was down to \$25 million.¹²

The CPUC attributes the reduction of the use of RMR agreements primarily to the locational requirements of the state's resource adequacy program. Other policy and market design changes may have contributed to the reduced use of RMR agreements to a smaller degree. On April 1, 2006, CAISO

10. Federal Energy Regulatory Commission, *2010 ISO/RTO Metrics Report*, Appendix D. California ISO, Docket No. AD10-5-000 (Oct. 21, 2010). <https://www.ferc.gov/industries/electric/indus-act/rto/rto-iso-performance.asp>.

11. See California Public Utilities Commission, *The 2016 Resource Adequacy Report*, January 2017. <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442453942>. In addition, see earlier annual reports and related information available from the CPUC at <http://www.cpuc.ca.gov/RA/>.

12. California ISO, *2015 Annual Report on Market Issues and Performance*, May 2016, pp. 13, 222. <http://www.caiso.com/Documents/2015AnnualReportonMarketIssuesandPerformance.pdf>.

implemented a nodal-based market design that replaced the previous zonal energy pricing design. CAISO Manager of Market Information Alan Isemonger explained that zonal prices did not differentiate between locations within the zone where constraints existed and those without constraints, so market incentives did not motivate retention or investment in generation or demand response resources in constrained locations.¹³ In the absence of sufficiently granular price signals, RMR agreements had been necessary to satisfy reliability standards. Growth in distributed energy resources, which tend to add generation resources near load and reduce demands on the transmission grid, may have also reduced the need for RMR agreements.

The current economic and regulatory environment in CAISO is pressuring many thermal generators into retirement, which may result in a temporary increase in RMR agreements. In 2015, RMR agreements were employed to address reliability issues that surrounded outages and the retirement of the San Onofre Nuclear Generating Station plants. These agreements have been extended at least through 2017. In addition, CAISO has determined that two of four small Calpine Corp. power plants that sought retirement were needed to maintain reliability, and RMR agreements are likely if alternatives are not available.

ERCOT

ERCOT frequently employed RMR contracts in its first several years of operation as an ISO. Of 74 total RMR agreements entered into since 2002, 69 of them were for local transmission stability before 2010. However, due to investment in transmission facilities and the switch from a zonal to nodal market design, ERCOT has been able to reduce reliance on RMR agreements. In December 2010, the implementation of nodal market design enabled much more effective coordination of generation and transmission resources, and provided more effective energy price signals. In addition, ERCOT's comparatively high offer cap has helped provide strong incentives for investment in new generation resources where needed.

For example, during the summer of 2011, four RMR agreements were entered into to address short-term local resource adequacy concerns. Since that time, ERCOT has had just one RMR agreement for Greens Bayou Unit 5, which was entered into in June 2016 and terminated in May 2017—a year earlier than had been projected. This was due to the beginning

13. Isemonger, Alan G. "Market redesign and technology upgrade: a nodal implementation." *The Electricity Journal* 22.8 (2009): 72-81. <https://doi.org/10.1016/j.tej.2009.08.005>.

of commercial operations of Exelon Corp.'s Colorado Bend Energy Center II.¹⁴

However, a combination of current market forces and changing policy environment may result in an increased pace of retirements over the next five years.¹⁵ System reliability is a complex mix of consumer demand, generation resources, transmission capability and operating practices. As such, each retirement potentially raises local reliability issues that may give rise to RMR contracts. In October 2016, ERCOT adopted changes to RMR study procedures to align customer demand forecasts with forecasts used in transmission planning studies, a change expected to further reduce use of RMR agreements. However, employment of local reserve requirements may better integrate reliability practices and market efficiency.¹⁶

NYISO

The New York ISO (NYISO) has not relied upon RMR services directly, but three units that sought to retire in the period from 2012 to 2014 were retained in service through reliability-support-service agreements between the transmission owner and the generation resource, and as approved by the New York State Public Service Commission. Independent power producers filed a complaint with FERC stating that terms of the agreement led uneconomic generators to bid into NYISO capacity markets at prices below their going-forward costs, which resulted in the suppression of capacity prices by out-of-market payments approved by state regulators. While FERC denied the complaint, it directed NYISO to consider whether capacity market rules should be modified to address the concerns. FERC subsequently directed NYISO to add RMR provisions to its tariff to provide for retention and compensation of generation resources needed for reliability purposes.

Much controversy centered on the proposed rules that govern so-called capital expenditure “clawbacks” and the controversy reveals some of the challenges of mixing out-of-market reliability practices into an otherwise competitive market. Under a clawback rule, should an RMR unit compensated for capital expenditure later return to commercial operation, the ISO recovers the cost of the capital improvement by taking any market revenue from the unit that is in excess of unit marginal cost. By their nature, RMR contracts involve sub-economic generation assets. Generation own-

ers notify the market of a desire to retire units because the units are not expected to secure adequate compensation in the market to justify the continuation of service.¹⁷ At times, in cases in which such units are retained for reliability purposes, the retained units require substantial capital investments to provide that service.¹⁸ RMR agreements provide cost-of-service based payments that are projected to be the minimum payments necessary to allow the unit to meet the reliability need.

After capital upgrades have been made, however, and market conditions change, resource owners may desire to return the unit into market service. In effect, such possibilities allow private investors to tap ratepayers for the capital needed to rehabilitate assets. This obviously creates unfair competition in the market and undermines sound investment incentives. Therefore, FERC directed NYISO to discourage units from “togglng” from market service to non-market reliability status and back to market service. On the other hand, if the upgraded generation resource had indeed become economical under expected market conditions, it would be inefficient to force the unit to retire. NYISO has proposed “clawback” repayments as a mechanism to recover capital expenditures undertaken while under a cost-based RMR agreement.

MISO

In 2010, the Midcontinent ISO (MISO) had no units under RMR agreements, but an increase in proposed retirements and potential reliability issues led to the ISO securing 1,024 MW of capacity from 16 units in 2014. As a result, RMR costs and cost allocation issues have become contentious within the ISO.

Beginning in 2012, proposed retirements in Michigan's Upper Peninsula led to RMR agreements in the area for several small generators and the 344 MW Presque Isle coal-fired plant. Disputes over cost recovery continued for several years. Industrial customers in the area protested that Presque Isle was recovering RMR related costs both through retail utility rates and through MISO surcharges. The Michigan Agency for Energy and other consumer interests claimed RMR charges included more than \$10 million for

14. Bellerio, Lauren, “ERCOT to end reliability agreement for NRG plant early,” *S&P Global Market Intelligence*, April 3, 2017. <https://www.snl.com/interactivex/article.aspx?KPLT=7&id=40131482>.

15. Shavel, et al.

16. For additional detail, see the discussion of RMR agreements in Potomac Economics (Independent Market Monitor for ERCOT), *2016 State of the Market Report for the ERCOT Electricity Markets*, May 2017, pp. 96-97. <https://www.potomaceconomics.com/wp-content/uploads/2017/06/2016-ERCOT-State-of-the-Market-Report.pdf>.

17. Note that if RMR terms and conditions are not carefully devised, it may be possible for the generation resource to game the process to gain above-market compensation. This specific concern arose in PJM in 2014, when negotiations over RMR costs to retire GenOn Power Midwest LP units ended with a so-called “black box settlement.” A black box amount is a compromise payment agreed to by participants that does not specify exactly how the amount reflects the formulas or other payment terms set out in the ISO's Open Access Transmission Tariff (OATT). See GenOn Power Midwest, LP, Docket No. ER12-1901-001, and in particular the comments of the PJM Independent Market Monitor filed in this docket May 28, 2013. http://www.monitoringanalytics.com/reports/Reports/2013/IMM_Comments_ER12-1901-001_20130528.pdf.

18. Often the prospects of significant capital investment to continue a unit in service motivates the owner to seriously consider unit retirement as an option. Such investments are sometimes necessary to upgrade environmental controls and are, at other times, driven by maintenance reviews.

improvements not actually made. While the State of Michigan helped negotiate an end to the Presque Isle RMR agreement in 2015, the charges remained disputed well into the following year.¹⁹

Two smaller units under RMR agreements in the Upper Peninsula of Michigan were also a cause for controversy. The White Pine units 1 and 2 were retained under RMR agreements for about \$6 million annually from mid-2014 through November 2016. When the American Transmission Co. (ATC) proposed a transmission plan that was intended to address the reliability concerns underlying the White Pine RMR agreements, the Michigan Public Service Commission objected on multiple, seemingly inconsistent grounds. While the commission declared the agreements overly expensive—especially given poverty levels in the affected areas—it also stated that the ATC transmission plan would fail to provide adequate reliability protection for the area, and that the RMR agreement would be needed at least into 2018. Other parties objected that termination of the agreement would have adverse consequences for employment in the area. This resulted in counter-objections to efforts to use the MISO OATT to pursue public policy goals beyond regulated electric power services at just and reasonable rates.

The owners of the White Pine units themselves protested the ATC plan, implying that they preferred to remain on the RMR agreement to either retiring the units (as they had once indicated an intention to do) or returning them to commercial operation. Such a stance suggests that the terms of the RMR agreement may be more rewarding than necessary. Cost-based rates should fully compensate the owner for use of its resources, but should not provide a sufficiently attractive reward to induce the owner to prefer to remain an RMR resource when the ISO has determined it is no longer necessary.

BEST PRACTICES FOR RIGHT-PRICING

Grid reliability is not solely the responsibility of transmission grid operators. It is the shared product of the interaction of transmission operators, transmission owners, generators and consumers. Since most parts of the system are owned privately and operated separately, extensive coordination among these entities is necessary. Some coordination is obtained through rule-following and constant communication, but ultimately the system relies upon price signals to provide the strong incentives needed to ensure that private actions support grid reliability.

The most effective system to coordinate generation and load in the short run is a real-time market with locational marginal pricing and co-optimized procurement of energy and reserves. Alternatives to locational marginal pricing—such as the zonal markets once employed by CAISO and ERCOT—provide less effect coordination among market participants and often require more extensive ISO management of grid congestion. The co-optimization of energy and ancillary markets is also important to give the ISO system the information needed to identify the lowest-cost available energy and reserve resources.

Importantly, as indicated in the CAISO discussion above, locational prices must be sufficiently granular to reflect the value of energy production, capacity and other reliability-related resources at different locations within the grid. Along with the overall quantity and responsiveness of the reserve resource, when grid characteristics make the location of reserves important, reserve market prices should reflect the higher value of better-located resources. Similarly, in ISOs with capacity markets, such prices should also reflect projected transmission capability and any resultant locational capacity value.

Despite the fact that it involves the placement of resources in the monopoly and cost-based regulation of a portion of the electric power industry, investment in transmission enhancement is, at times, the most efficient answer. But because transmission planning and cost allocation are out-of-market reliability actions, attention must be given to the potential for adverse consequences for overall market efficiency. For example, within ERCOT, some parties have called the existing transmission planning and approval process overly eager to invest in transmission over alternative reliability-enhancing approaches.²⁰

Nevertheless, grid operators find it necessary to supplement private, decentralized responses of generation and load by taking out-of-market actions to ensure reliable operations. When out-of-market actions are used to maintain reliability—including securing RMR agreements—the policies that govern such actions should promote market efficiency to the extent possible. At a minimum, out-of-market actions should be taken in ways that minimize the cost of compliance with reliability standards and limit direct effects on market outcomes. Accordingly, the following principles should guide RMR practices so that the service supports, rather than undermines market efficiency:

19. See Chris O'Malley, "FERC Faulted, Asked to Reconsider Presque Isle SSR Ruling," *RTO Insider*, March 30, 2015. <https://www.rtoinsider.com/ferc-miso-presque-isle-ssr-13958>; and Michigan Agency for Energy, "Judge recommends SSR payments for Presque Isle Power Plant be reduced by one third for U.P. electric customers," July 26, 2016. www.michigan.gov/energy.

20. For a discussion of transmission planning concerns in ERCOT see William Hogan and Susan Pope, "Priorities for the Evolution of an Energy-Only Market in ERCOT," FTI Consulting, May 9, 2017, 69-79. https://sites.hks.harvard.edu/fs/whogan/Hogan_Pope_ERCOT_050917.pdf. The report also delves into several other issues touched on in this paper in much greater detail.

Pricing rules should reflect resource shortages

By entering into an RMR agreement, the ISO at least implicitly acknowledges a shortage of sufficient market-supported resources to assure reliability. For this reason, ISO market prices should reflect the shortage of market-supported resources even as the RMR agreement temporarily supplies the reliability gap.²¹ RMR policies should avoid price suppression effects and other adverse consequences in the ISO energy, ancillary service and capacity markets.

Accurate market prices are necessary both to coordinate supply- and demand-side actions in support of system reliability in the short run, and to provide efficient signals for market entry and exit in the long run. The more granular the pricing signal with respect to location, the more productive the market response can be. Similarly, the right prices – either energy price, ancillary services price, capacity market price or some combination thereof – should reflect the shortage in order to induce the more efficient and effective response.

RMR service rules should provide for transparency

RMR service is intended as a temporary means to secure system reliability while supporting the resource owner's stated intention to retire as promptly as possible. As a transmission support service, RMR agreements are appropriately paid on a cost-of-service basis. The high cost of traditional cost-of-service ratemaking procedures generally leads to abbreviated proceedings, but shortcuts often result in the kinds of controversies discussed above. The difficulties of ratemaking procedures are compounded by the subject unit's prior service as a market-based resource, which lacks a book value established according to standard regulatory approaches.

When necessary costs include capital improvements, caution is necessary to avoid the creation of perverse incentives for owners of marginal resources. For example, an economically marginal unit that faces a significant capital expense to meet environmental standards, and that considers itself necessary for reliability reasons, may declare retirement in an effort to induce the ISO customers to fund the capital investment via an RMR agreement. Once the capital investment has been paid for, the owner may find it economical to return the unit to commercial operations. An owner allowed to execute such a maneuver has effectively socialized the costs of necessary capital improvements through the ISO OATT, to the disadvantage of its competitors.

Setting cost recovery and allocating the costs necessarily will involve trade-offs between the minimization of both the

21. For an extended discussion of shortage pricing see Federal Energy Regulatory Commission, *Staff Analysis of Shortage Pricing in RTO and ISO Markets*, Staff Report, Docket No. AD14-14-000 (October 2014). <https://www.ferc.gov/industries/electric/indus-act/rto/energy-price-formation.asp>.

cost of securing the necessary reliability services and interference with market outcomes. For example, it is possible that only a portion of a resource's potential output needs to be held online as reserve. To allow the remainder of the generator's capability to be offered as reserves or sold into energy markets would produce revenues that could offset the amount that requires cost-based recovery. However, as a result, competing resources that are capable of providing services may see their revenues reduced. It is likely that no simple rules will cover all cases, and the judgment of the ISO and regulators will be called upon.

RMR agreements should pass cost-benefit muster

At times, the reliability violations created by a proposed retirement are modest and the costs of retaining the resource under an RMR agreement would be large. In such cases, the ISO should be given wide latitude to develop alternatives to a costly RMR agreement, particularly when a durable alternative can emerge through market or transmission planning processes. As long as the violation of the reliability agreement is properly valued—including the appropriate reflection of the costs associated with potential involuntary loss of load—the ISO ought not be required to enter into an RMR agreement for which the costs of the agreement exceed the benefits of meeting the reliability standard.

ERCOT agrees in principle with this approach.²² In a response to questions from the Public Utility Commission of Texas, ERCOT said it had engaged in discussions with stakeholders regarding the development of a reliable, but simplified probabilistic analysis that could be used in a benefit-cost analysis. In March 2017, the Public Utility Commission of Texas proposed rule changes that, among other things, would allow ERCOT to assess the economic value of the reliability provided by RMR or RMR alternatives and the ability to decline to enter into an agreement based on the analysis.²³

Cost-effective alternatives should be considered

Policies that govern resource retirement and the enactment of RMR agreements when necessary should be crafted in such a way so as to develop the most efficient and effective long-term response. When units can retire with relatively short notice to the market, it increases the difficulty for alternatives to the RMR agreement to be developed. At the same time, owners of economically challenged generating resources assert that an excessively long notice requirement

22. "ERCOT Reply Comments to Commission Staff's Questions and Strawman Proposal," Project No. 46369 Rulemaking Relating to Reliability Must-Run Service, Public Utilities Commission of Texas, Nov. 28, 2016, 7. http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/46369_31_919987.PDF.

23. "Proposal for Publication of Amendment to \$25.502 as Approved at the March 30, 2017 Open Meeting," Project No. 46369 Rulemaking Relating to Reliability Must-Run Service, Public Utilities Commission of Texas, March 30, 2017. http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/46369_51_934723.PDF.

creates difficulties for plant operations, including retention of specialized personnel and the negotiation of fuel procurement and other services.

In addition, when considering alternatives to an RMR agreement, the reliability requirements should be specified carefully so as not to rule out potential alternatives inadvertently. For example, before entering into an RMR contract, ERCOT rules require consideration of possible operator actions to manage the potential violation, such as reconfiguration or temporary adjustments to transmission facilities, changes to emergency action plans of transmission owners and load response services.²⁴

CONCLUSION

One may see the overall decline in the frequency of RMR contracts as a natural consequence of the maturation of ISO markets. ISOs inherited a generation fleet and transmission grid developed by individual electric utilities, regulated by state commissions and largely constructed so each utility could serve its local load. As the regional systems were organized and expanded in the late 1990s and early 2000s, more efficient generation was built, older generation units retired and the transmission system was upgraded in response to changing conditions. At this same time, ISO market rules were undergoing rapid development as ISO leadership, market participants and federal regulators worked to build competitive markets that would complement reliable system operations. Rapid changes revealed localized area of transmission weakness and ISOs frequently determined that generation units seeking to retire were needed temporarily to address local reliability concerns.

The conclusion might be drawn that RMR policy is of declining importance. Yet, market conditions continue to change, generation resources continue to enter and exit the market and the transmission system will continue to need to adapt. Older, more polluting generation resources increasingly find that environmental policy restrictions limit operating times and raise costs. A combination of such policies has the potential to drive retirement of several generation resources within a relatively short period. In view of this, poorly designed RMR policies could adversely shape generation investment and dispatch for years into the future.

Experience with RMR services and other cases in which reliability standards and market efficiency has come into contact has yielded a few principles to help RMR service support, rather than undermine markets. First, when reliability principles dictate out-of-market actions by ISOs, energy and reserve prices should reflect resource scarcity. Second,

rules governing RMR service should provide for transparency in operation and with respect to cost of service. Third, ISOs should enter into RMR agreements only when the benefits of meeting reliability standards through the agreement exceed the costs. And finally, ISOs should consider cost-effective alternatives to RMR agreements when they would adequately address the potential reliability needs. Before another potential wave of retirements occurs, now is the time to consolidate and implement these best practices.

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24. ERCOT, "Current Protocols: Reliability Must Run," May 1, 2016, Sec. 3.14.1. <http://www.ercot.com/mktrules/nprotocols/current>.