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Evaluating Options for Enhancing Wholesale Competition and Implications for the Southeastern United States

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Summary

Given stated stakeholder clean energy and consumer goals, this paper offers a way to evaluate options for enhancing competition, compared to how utilities traditionally operate the electricity grid. The focus here is on wholesale transactions between generators and utilities serving end-use customers. These utilities then sell electricity at retail to their customers, and in many regions including the Southeast, they are state-regulated monopolies responsible for serving their customers at least cost. Their customers generally cannot choose a different utility or particular type of generation. For the purposes of this paper, this retail structure is assumed to remain unchanged.

Suppose that the goals are to scale up non-emitting generation for customers in the Southeast and provide them with efficient, reliable service. Applying the proposed evaluation framework suggests that:

- Enhancing competition for wholesale transactions through a regional organized market, depending on details, is likely to lower wholesale costs, provide nonincumbent generators with easier access to the system, and improve power system efficiency and flexibility.
- While wholesale competition and regionalization are important in the long run for a more flexible and low-emissions grid, market and infrastructure changes alone cannot guarantee outcomes or meet specific targets, especially in the near term. For that, policies are needed.
- Consumers would likely see savings but would not necessarily have more choice in generation if their utilities join organized regional wholesale markets but maintain retail monopoly status.
- Organized regional markets offer relatively more transparency, educational training, and market monitoring, which are important for customers and nonincumbent generators.
- From a preliminary evaluation, it appears that southeastern utilities joining a Regional Transmission Organization would likely produce the most benefits compared to other options, especially if it results in a large footprint with diverse resources and customer demand.
- More quantitative work needs to be done to model how the Southeast electricity sector would evolve under various options: How much variable renewables and flexible demand-side resources would come online? How much emitting resources would retire as a result of market forces? How would wholesale prices change?

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I. INTRODUCTION

Gradually and to different degrees, parts of the U.S. electricity sector have departed from the traditional monopoly utility model to embrace competition between energy resources. This trend has been uneven geographically, as much of the Southeast and Mountain West still retain a vertically integrated utility structure operating largely outside of regional organized wholesale markets. Potential cost savings, consumer preferences, and environmental benefits have led stakeholders and decision makers to reconsider their options in enhancing retail and wholesale competition.

Policymakers have recently voiced interest in investigating competition as a means of facilitating development of newer lower cost resources for the benefit of consumers.[1] This paper focuses on options for enhancing wholesale competition and offers a framework for their evaluation given stated policymaker and stakeholder goals. For the purposes of this paper, the utilities are assumed to retain their vertically integrated monopoly retail structure.[2] Retail reforms that could allow customer choice in electric generation may be layered on to any of the options discussed here. Those possibilities will be described in a separate paper.[3] The focus here is on the Southeast because of recent developments indicating interest in revisiting competition in the region; however, much of this paper is relevant to other regions considering the same.[4]

The Southeast has enjoyed low electricity rates, but its total energy bills are high compared to consumer income.[5] The canceled V.C. Summer nuclear reactor has fueled demand for reform in South Carolina by incurring around $9 billion in debt that captive customers may have to foot.[6]

The Southeast also has high potential for solar energy, and three of the top ten U.S. states with the most installed solar capacity are the Southeast. While some large electricity buyers are able to procure renewable energy through their utilities, many with corporate or municipal sustainability goals are seeking to procure more renewable energy than southeastern utilities have been offering.[7]

Competition between energy resources across larger regions has helped to ensure resource adequacy and reliability at lower wholesale energy costs, and more recently, has facilitated natural gas and renewables displacing more expensive coal.[8] Balancing supply and demand across multiple utilities has helped smooth the variability in wind and solar at lower integration costs compared to utilities individually operating. Regional transmission planning

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[1] North Carolina House Bill 958 (Apr. 2019) would authorize the North Carolina Utilities Commission to require North Carolina investor-owned utilities to join or form a Regional Transmission Entity and study the benefits of such actions. South Carolina House Bill 4940 (Feb. 2020) would establish an Electricity Market Reform Measures Study Committee to study the public benefits of electricity market reforms and whether the legislature should adopt them. The Colorado Public Utilities Commission is investigating the costs and benefits to electric utilities and power generators of participating in regional transmission services and energy markets. Colo. Regulators Open Query into Regional Transmission Coordination, J. Stanfield (Sept. 2019). See also How To Design Markets for Effective Energy Transition in Colorado, S. Dahlke, Feb. 16, 2020. The U.S. House Energy and Commerce Committee's draft CLEAN Future Act (Jan. 2020) includes a requirement for each public utility to place its transmission facilities under the control of a regional grid operator.

[2] Vertically integrated utilities generate, transmit, and distribute electricity to consumers, while utilities in restructured states have separated generation from transmission and distribution and allowed for different companies to compete to supply generation. The theory is that competition incentivizes generators to minimize their costs, and the consequences of company investment decisions would be borne by their shareholders, not their customers.

[3] For a description of some retail competition options within the cost-of-service framework, see Harnessing Competition in a Transitioning Electricity System: Opportunities for Traditional Cost-of-Service States, J. Monast et al., Mar. 2019.

[4] See footnote 1.

[5] While high bills are due in part to air conditioning and electric heating usage, the Southeast also has a significant potential for energy efficiency to reduce these bills.

[6] SCE&G Customers Will Ultimately Pay $3.8B for VC Summer Under Dominion Deal, D. Sweeney (Mar. 2018); Santee Cooper's share of the debt is around $4 billion. Report of the Dept. of Admin. Pursuant to Sec. 9 of the Joint Resolution (A95, R113, H4287) Regarding the South (Feb. 2020). See also S. Carolina v. S. Carolina Pub. Serv. Auth., Summons (Mar. 27, 2018).

[7] A number of utility programs allow customers, mostly large commercial and industrial, to access renewables. See, e.g., Map of U.S. Green Tariffs and Utility Renewable Energy Solutions for Large Buyers, World Resources Institute 2019.

[8] Cheap gas has played a significant role in bringing down wholesale market costs. To some extent, gas has also displaced coal in regulated regions, but even more coal would retire if subject to economic forces. Half of All U.S. Coal Plants Would Lose Money Without Regulation, J. Ryan (Mar. 26, 2018).

has helped bring these zero-fuel-cost resources to consumers. Markets have encouraged the development of demand-side and energy storage resources, and some of these technologies can provide unbundled grid services faster and more accurately than traditional power plants.

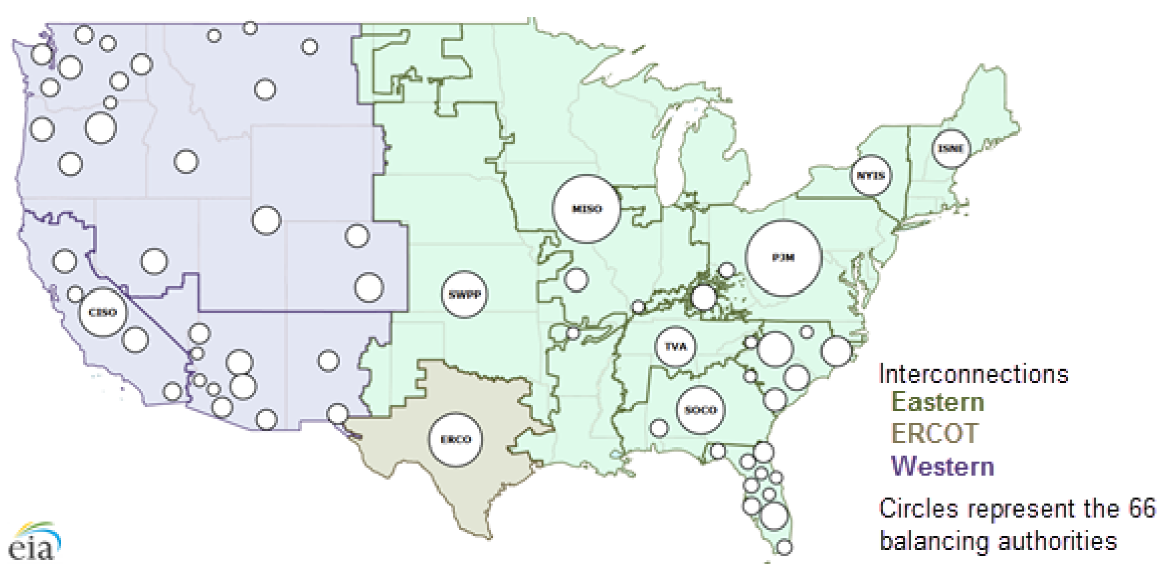
Competition alone, however, cannot predictably or directly achieve particular outcomes—policy and planning still play a critical role in shaping the future energy mix to meet goals related to the environment, jobs, economic development, and protecting low-income consumers. Nevertheless, competition and regional cooperation, with appropriately designed rules, are important tools in cost-effectively achieving goals.

How the grid is operated by different kinds of regional entities or individual utilities, therefore, can facilitate or inhibit policy goals. These entities serve a basic set of grid operator functions, described below, and how each entity performs each task is evaluated as to whether those tasks could help achieve desired outcomes as part of the framework.

A. Grid Operator Functions

Grid operators balance energy supply and demand in real time through unit commitment and dispatch, ensure that the power system is stabilized around a set voltage and frequency by providing "ancillary" services, and maintain adequate resources to ensure electricity needs are met in the future. Grid operators must also have a process for transmission planning and interconnecting new generation and energy storage. Generally, a grid operator could be a vertically integrated utility (or group of affiliates) that balances its own generation supply against its customers' demand or a Regional Transmission Organization that optimizes energy resources across several utilities' customers. Good governance can facilitate transparency in these processes, cooperation between states and other decision makers, and fair allocation of costs.

Figure 1. The Balkanized U.S. Power System



Source: EIA. A "balancing authority" is designated by North American Electric Reliability Corporation (NERC) and is responsible for ensuring electricity supply and demand are in balance, helping to stabilize the grid at a frequency within a required range in real time, and integrating resource plans ahead of time. This can include tracking unit commitment plans, generation operation, and transmission schedules across and in and out of its balancing area. Many balancing authorities also perform the grid operator functions discussed here.

Energy imbalance markets and power pools provide a subset of grid operator functions but rely on their member utilities to do the rest. These entities are briefly described further below.

II. FRAMEWORK FOR EVALUATING WHOLESALE COMPETITION OPTIONS

A framework for evaluating wholesale competition options will depend on the stated goals. Below are some proposed steps for option evaluation.

- ✓ **Define the goals**. These could include improved reliability, more efficient operation of the power system, more choices for customers, lower emissions, etc.
- ✓ **Develop metrics or factors to evaluate** whether the option can contribute to meeting the goal. These should be used to evaluate success in the short- and long-term and consider path dependency.
- ✓ **Describe the options**. These could be packaged options, such as joining existing regional entities like Regional Transmission Organizations (RTOs) or energy imbalance markets (EIMs). Breaking down the options into core grid operator functions can help inform which elements of these packages help or impede the goals and could suggest how to optimize the package or create a new one. These functions include balancing supply and demand in real time, procuring reserves or services that help mitigate outage events or restore reliability, ensuring the system has adequate resources, and transmission planning and interconnection.
- ✓ **Establish a base case** for how the grid is currently operated, against which to compare options. That would include how vertically integrated utilities handle each of the grid operator functions in the states considering the options.
- ✓ **Apply the metrics or factors** to each grid operator function for each option against the base case.

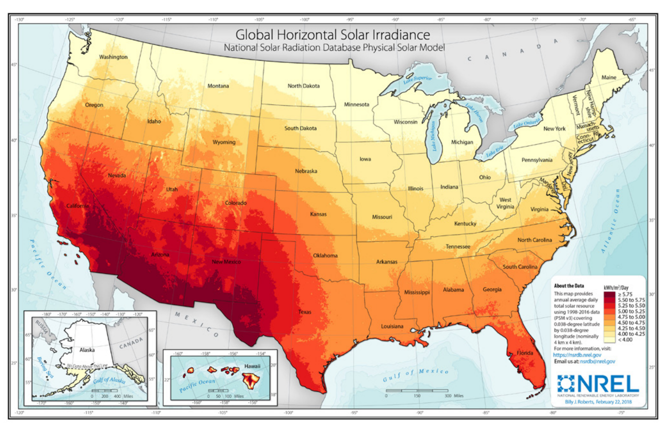
A. Illustrative Goals and Metrics/Factors for Evaluating the Options

Goals pertaining to the grid could also relate to climate resilience, cybersecurity, or jobs, but the ones at the forefront of the conversation about enhancing competition in the Southeast relate to customer benefits, particularly access to renewable resources, customer choice, and costs.[9] Thus, we attempt to capture some criteria (which are distinct from the solutions considered) important for achieving a suggested formulation of these goals. These criteria are not prefiltered for whether wholesale or retail changes would impact them—that comes out of the analysis.

1. Suppose the Goal Is to Encourage Investment in New Non-Emitting Technologies[10]

- ✓ Compared to the base case, does the option **facilitate access to renewable resources**? Access would include the ability for renewables to timely interconnect to sufficient transmission and distribution infrastructure as well as a footprint that encompasses high potential areas for renewables. Every region in the U.S. has renewable resources, but developing them in a timely manner has been a challenge due in part to the interconnection process. Even in regions where renewables are abundant and cheap, there are infrastructure and trading constraints to moving electricity to customers. The South has abundant solar, while higher potential

Figure 2. U.S. Solar Power Per Unit Area



Source: National Renewable Energy Laboratory (NREL), citing Sengupta, M., Y. Xie, A. Lopez, A. Habte, G. Maclaurin, and J. Shelby. 2018. "The National Solar Radiation Data Base (NSRDB)." Renewable and Sustainable Energy Reviews 89 (June): 51–60.

[9] See, e.g., Are Regional Transmission Organizations the Future of Renewables? S. Shparber (Aug. 2019).

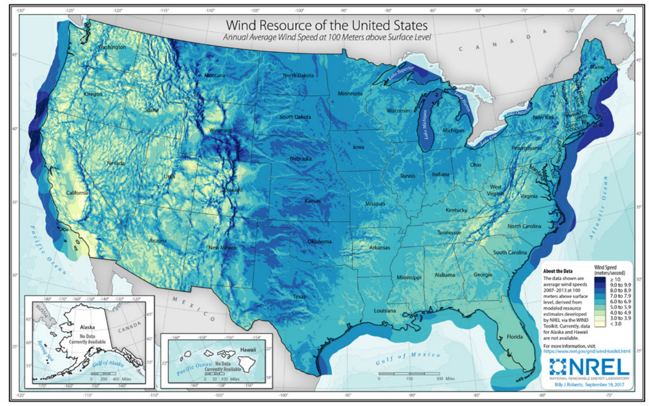
[10] Note that this example does not include nuclear resources if thermal pollution is considered. If carbon dioxide emissions reduction is the goal, nuclear power may be considered as well.

areas for onshore wind are located in the Midwest and Great Plains. Offshore wind potential is higher further north as wind speeds increase going north along the eastern coast.

- ✓ Compared to the base case, does the option **increase access to financing and revenue streams**? These could include access to contractual arrangements from credit-worthy buyers, revenues for separate electricity services, and an investment environment that doesn't artificially maintain older, inefficient generation. Power purchase agreements (PPAs) have been a significant driver of renewables development.[11] Utilities can arrange renewables PPA for their customers. Beyond that, the ability for customers to access renewable energy through PPAs directly depends on the extent of utility monopoly protections. Newer, non-emitting technologies can also provide different electricity services for compensation if these services are procured separately. For example, batteries and demand-side resources can help provide and receive compensation for fast frequency regulation, capacity, or energy. Eliminating incentives to oversupply the power system and crowd out investments in newer, cleaner technologies is also important.[12] For example, retiring uneconomic, inefficient fossil power plants could make room for newer investment. However, incentives to retain generation with relatively high book value compared with newer, more efficient resources that are cheaper to bring online may impede those investments.[13]

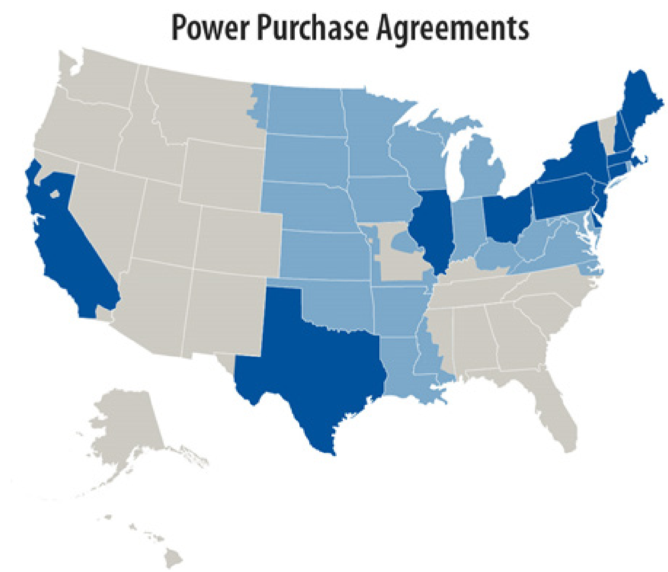
- ✓ Compared to the base case, does the option **facilitate sufficient power system flexibility cost-effectively or smooth renewable variability**? Larger systems typically offer a wider variety of resources that contribute to greater flexibility as well as reduce the need for flexibility services. Wide east-west footprints help smooth out the daily peak loads and even out variation in wind and solar resources. Large north-south footprints could also

Figure 3. U.S. Wind Speeds



Source: NREL, citing Draxl, C., B.M. Hodge, A. Clifton, and J. McCaa. 2015. "The Wind Integration National Dataset (WIND) Toolkit." Applied Energy 151: 355366.

Figure 4. Direct Customer Access to Power Purchase Agreements



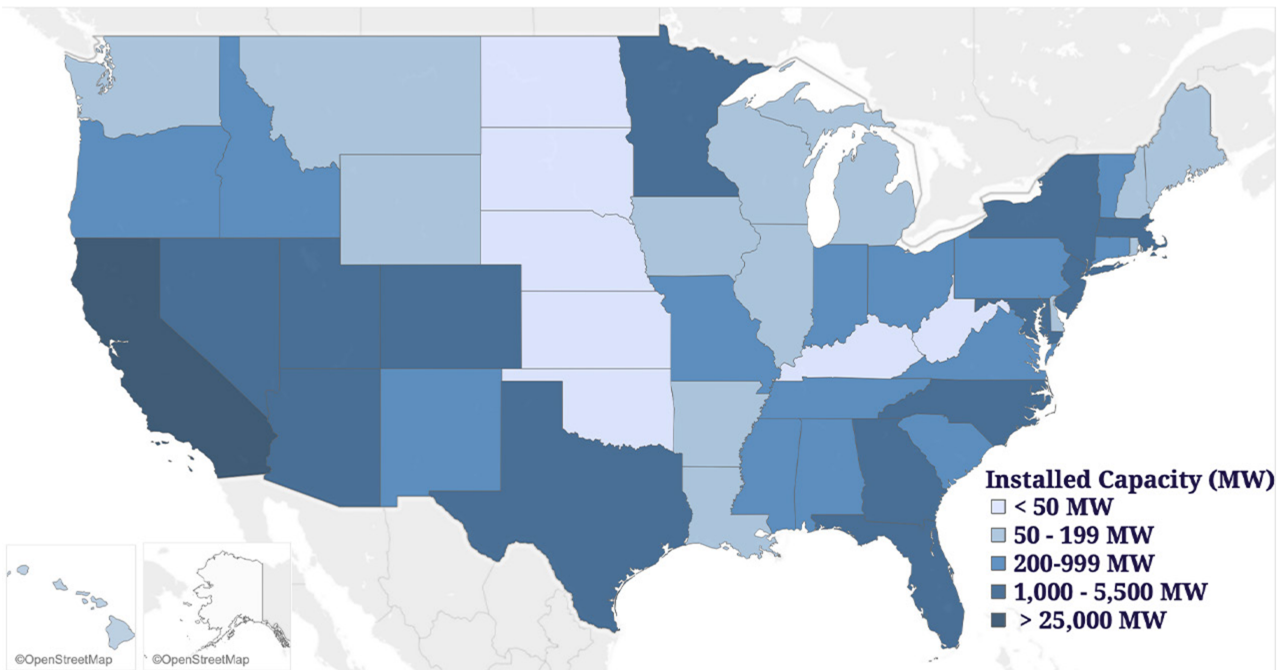
Source: EPA. Customers can directly access their choice of generation through a physical PPA in dark blue, mostly retail choice states. (This graphic is simplified—the part of Texas in Southwest Power Pool does not have retail choice.) This involves the physical delivery of electricity from specified generation, in contrast to a financial PPA (which may be for a financial hedge against price fluctuations or green attributes, but not electricity). Generators can technically locate in any region, but they would need access to customers, and this is easier in the blue regions with organized wholesale markets.

[11] E.g., As Corporate Renewable Buying Surges, Innovative PPAs Pressure Utilities To Improve Green Tariffs, H. Trabish, Feb. 6, 2019.
[12] E.g., Hitting the Mark on Missing Money, M. Hogan (Sept. 2016); Power Markets in Transition: Consequences of Oversupply and Options for Market Operators, S. Aggarwal (Mar. 2019); Is Capacity Oversupply Too Much of a Good Thing?, J. Chen, Wiley Periodicals 34 (2017): 15–21. doi:10.1002/gas.22016.
[13] The Growing Risks of Regulated Coal Ownership: Strategies to Assess Your Coal Position and Maximize Its Value, Charles River Associates (Apr. 2016).

diversify supply and demand, if offshore wind scales up as planned. Increasing access to flexible, non-emitting dispatchable resources can also help integrate renewables reliably. These include energy storage and certain forms of demand response and distributed energy resources.

✓ Compared to the base case, does the option **facilitate clean energy policies that help achieve emissions reduction goals**? While economics can influence the uptake in clean energy, policies have also been a significant driver. For example, the highest penetrations of solar PV are not necessarily in the sunniest regions of the U.S. Some methods for procuring supply are better aligned with policy choices or can help efficiently procure policy-preferred resources. Enabling demand-side resources like energy efficiency and demand response can also help reduce emissions. These resources can grow through State policies. Demand-side resources connected to the distribution system could also provide services to the transmission system and receive wholesale revenues if they can be aggregated.[14]

Figure 5. Installed Solar Capacity



Source: SEIA.

✓ Compared to the base case, does the option **provide accurate and timely information important to developing non-emitting resources**? Such information can include transparent energy prices (by time and location), and costs of generation that's built and dispatched. This information can help parties seeking to contract, e.g., through PPAs. Transparent interconnection process and costs and timely approvals can also aid project development. And finally, accurate short-term wind, solar, and demand forecasting help maximize the use of these resources while reducing needed reserves.

✓ Compared to the base case, is the option **governed in a way that enables or facilitates necessary changes**? This could include meaningful oversight and accountability, as well as the ability for nonincumbent interests, such those of newer, non-emitting technologies, to influence decisions.

[14] These smaller resources may not meet minimum size requirements or may see too high of a transaction cost to participate individually at wholesale. E.g., Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 157 FERC ¶ 61,121 (Nov. 17, 2016) at PP. 125, 126.

2. Suppose the Goal Is to Ensure Customers Fairly Benefit from Cost-Effective Electricity Services

Compared to the base case, does the option:

- ✓ **Facilitate efficient operation** of the generation fleet (for example, by dispatching lower marginal cost energy resources first, minimizing uneconomic self-commitment, and more efficiently procuring ancillary services, such as for voltage support)?
- ✓ **Ensure prudent investments** in lower cost power production while protecting against potential future stranded costs borne by customers?
- ✓ **Allocate risks and costs fairly?** Are system cost savings passed along to customers and/or are market revenues shared with customers commensurate to the risks that they bear, compared to shareholders? Do those who see the upsides also bear the risks of failed projects under the option?
- ✓ **Facilitate transparency and information sharing** so that customers can manage the costs that are allocated to them and ultimately their bills? For example, this could include posting prices that accurately reflect the value of the service, and/or educating customers about how usage can impact their bills.
- ✓ **Facilitate demand-side programs** that produce consumer savings and/or enable consumers to cost-effectively generate or store energy according to their preferences (such as demand response, energy efficiency, and distributed energy resources)?
- ✓ **Facilitate consumer choice** in generation sources and rate plans (for all consumers and not only large commercial and industrial consumers)?
- ✓ **Give consumers a meaningful voice in its governance?**

We will apply these checklists to a few existing options for wholesale competition compared to a general vertically integrated utility operating outside of organized regional markets further below.

III. EXISTING WHOLESALE COMPETITION OPTIONS

This section describes existing wholesale competition options that do not necessarily change vertically integrated utility structures. In particular, it explains Regional Transmission Organizations, energy imbalance markets, and power pools in terms of basic grid operator functions, and the following does the same for vertically integrated utilities.

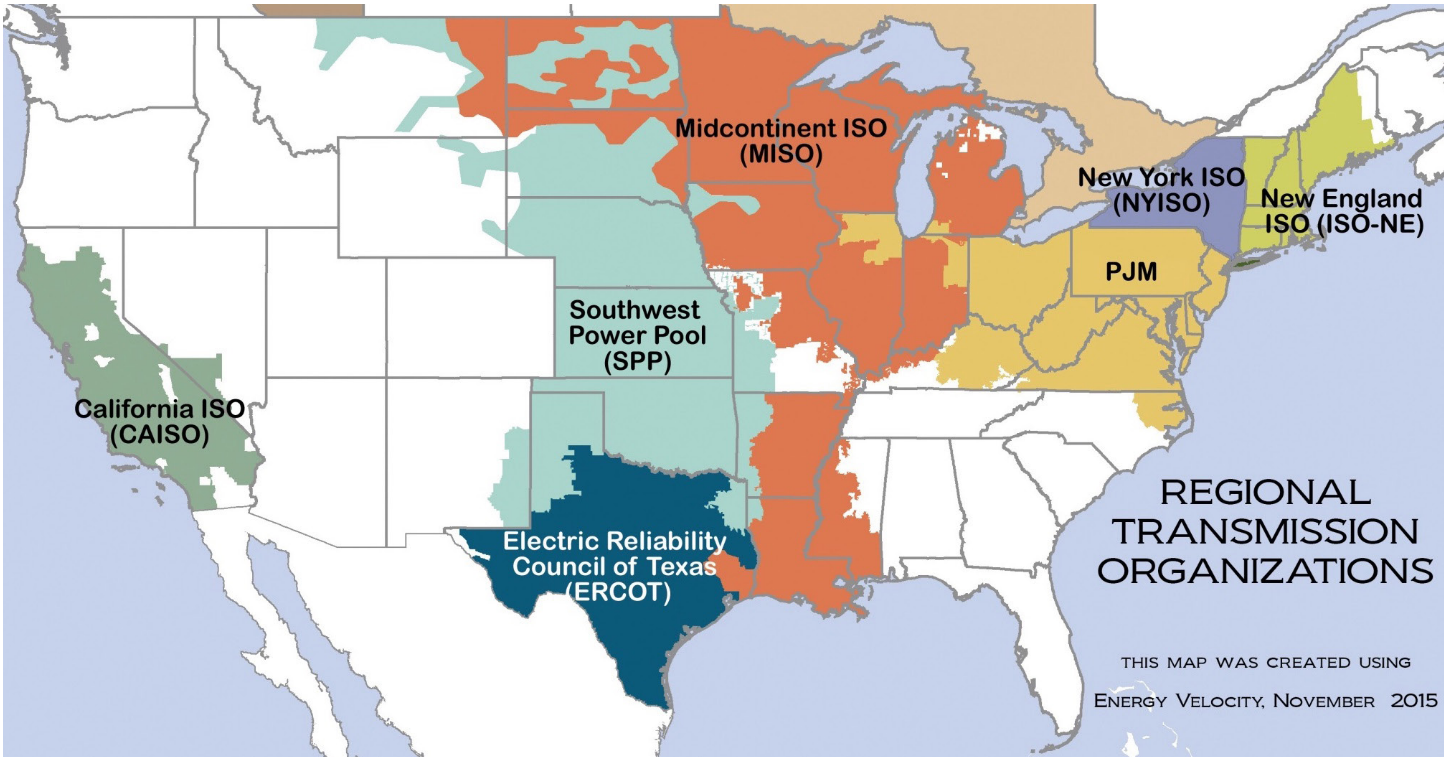
A. Regional Transmission Organizations

About two-thirds of U.S. customer demand is served by Regional Transmission Organizations (RTOs), which are regulated by the Federal Energy Regulatory Commission (FERC). RTOs independently operate the transmission facilities owned by its utility members, which can be located in restructured or vertically integrated states.[15]

RTOs strive to provide cost-effective reliable service by allowing competitors comparable access to the transmission system they operate and to their wholesale electricity markets.

[15] FERC encouraged RTO formation and established their minimum requirements in Order 2000. Regional Transmission Organizations, Order 2000, 89 FERC ¶ 61,285 (1999). “Independent System Operators” (ISOs) have essentially become to mean the same thing as RTOs with small differences. “RTOs” herein also includes “ISOs.”

Figure 6. U.S. Regional Transmission Organizations



Source: FERC. All RTOs pictured in the map are regulated by FERC, except for ERCOT.

RTOs strive to provide cost-effective reliable service by allowing competitors comparable access to the transmission system RTOs operate and to their wholesale electricity markets. In theory, all types of resources should be able to compete, but in practice, removing barriers to newer resources is a work in progress.[16]

A key benefit of competitive markets across larger regions is the cost savings from greater efficiencies and improved reliability. RTOs have estimated these and other benefits in their value propositions.

- PJM (which stands for Pennsylvania Jersey Maryland) estimates that its services produce annual savings of \$3.2–\$4 billion.[17]
- The Midcontinent Independent System Operator (MISO) estimates that its services produced savings in 2019 of \$3.2–\$4 billion compared to standard industry practice without an RTO.
- SPP estimates that for 2018, its services provided \$2.2 billion in annual net benefits with a benefit-to-cost ratio of 14:1.[18]

1. Unit Commitment and Dispatch

At the core of every RTO today is the energy market. RTOs balance electricity supply and demand in their day-ahead and real-time energy markets by committing the least-cost resources a day in advance in hourly increments

[16] For example, FERC Order 841 requires all of its regulated RTOs to review their market rules and remove unnecessary barriers to energy storage resources. Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 162 FERC ¶ 61,127 (2018). As part of the original energy storage proposal, FERC had also proposed to enable distributed energy resources to participate in wholesale markets through aggregation. That part of the rule was severed from the storage proposal and is not yet finalized. See id. at ii–iii. See also the Technical Conference held on this topic. See also Customer Focused and Clean Power Markets For the Future, M. Goggin et al. (2018).
[17] Not all of the details are provided, but this incremental benefit appears to be compared to how grid operation was managed prior to PJM, with each utility acting separately. PJM Value Proposition (2019).
[18] SPP 14 to 1: The Value of Trust at 3.

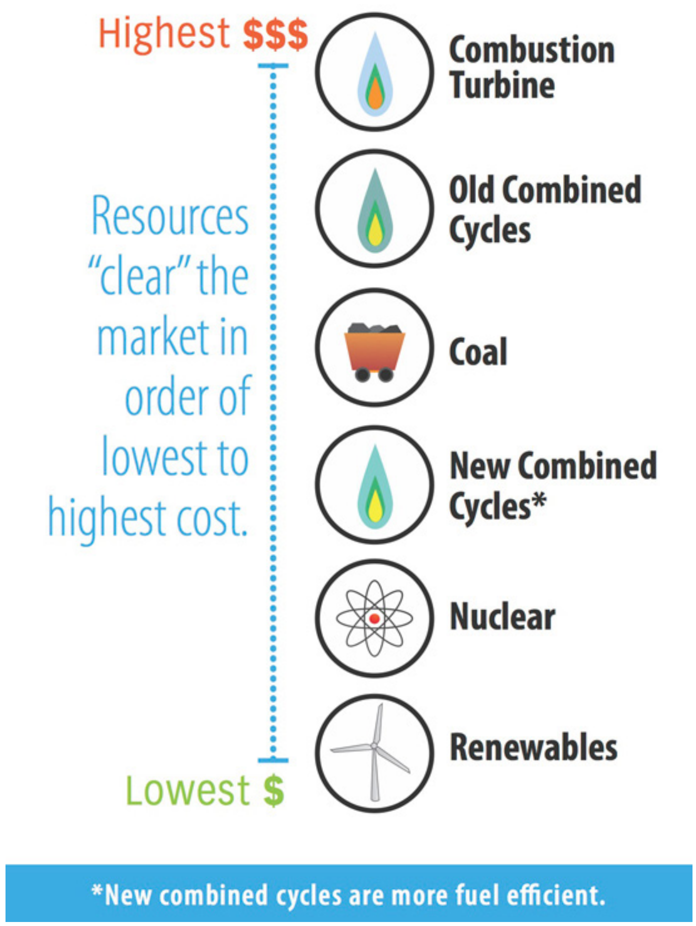
and then adjusting in real time by dispatching the least-cost resources every five minutes. This means lower marginal cost resources, such as wind and solar, are dispatched first.[19]

The savings from dispatch over larger regions have been significant. For 2019, MISO estimated $283–$313 million in dispatch savings.[20] Using peak demand as a rough proxy of the system size, this translates to a savings of about $2,400 per megawatt from dispatch (MISO's peak is about 125,000 megawatts). PJM estimates $600 million in dispatch savings per year,[21] and with an annual peak demand of about 150,000 megawatts, estimated savings are then $4,000 per megawatt.

SPP estimates that its Integrated Marketplace, which transacts energy, operating reserves, and congestion rights, has yielded on average about $776 million in savings per year.[22] (For reference, SPP's peak is about 51,000 megawatts).

A number of consultant studies have found that the production cost savings from RTO membership is in the 3% to 9% range, depending on the region analyzed.[23] Academics have also studied the efficiency gains from RTO participation. A University of Chicago study estimated that the production cost savings from U.S. wholesale markets were about 5% or roughly $3 billion per year based on 1999–2012 data.[24] A Dartmouth study found that 19 Midwest utilities joining PJM in 2004 produced efficiency gains of over $160 million annually, exceeding the one-time $40 million implementation cost.[25]

Figure 7. Illustrative Supply Stack in Order of Cost of Dispatch



Source: PJM. Security Constrained Economic Dispatch (SCED) deploys the least-cost energy resources subject to constraints and losses. Renewables and self-scheduled nuclear and coal are dispatched first in the energy market, then newer gas power plants, and then more expensive fossil plants. Demand response is currently expensive to dispatch in the energy market, but that may change as customers adopt enabling technologies.

a. Impact on Emissions

Wind and solar resources do not require fuel, and thus have zero or little marginal costs. The price of natural gas has fallen, rendering coal less competitive. Because these lower emissions resources—wind and solar, and more recently natural gas—now generally have lower marginal costs than coal, dispatching cheaper resources first has reduced emissions over time.

For example, PJM estimates that since 2005, emissions have fallen by about 30%—an annual average reduction

[19] Generation owners can also self-schedule their plants to run continuously, typically for inflexible power plants that are expensive to startup and shut down or have "take or pay" fuel contracts. Thus, these may be dispatched even if they are more expensive to run than other resources in the supply stack. See, e.g., Reviewed Work: "The Billion-Dollar Coal Bailout Nobody Is Talking About: Self-Committing in Power Markets," T. Kavulla (Jun. 12, 2019).

[20] MISO Value Proposition (2019).

[21] PJM simulated the economic dispatch and energy exchange before and after the PJM market expansion to find that operating the larger market creates production cost savings of $600 million a year. PJM Value Proposition at 3.

[22] SPP 101: An Introduction to Southwest Power Pool at slides 59–60.

[23] These are summarized in Potential Benefits of a Regional Wholesale Power Market to North Carolina's Electricity Customers J. Chang et al. (Apr. 2019) at pp. 3–6.

[24] Imperfect markets versus Imperfect Regulation in US Electricity Generation, S. Cicala, pp. 29, 30.

[25] Market Organization and Efficiency in Electricity Markets, E. Mansur and M. White (Jan. 13, 2012) at p. 4.

of more than 10 million fewer tons of direct CO_2 emissions—as a result of an increase in renewables and the shale gas boom. PJM attributes this to market competition resulting in greater efficiency, and efficient plants burn less fuel and produce fewer emissions.[26] SO_2 and NOx emissions rates have decreased as well in PJM.

Similarly, SPP estimates that wind in its Integrated Marketplace has displaced over 180 million metric tons of CO_2 since 2014, resulting in an emissions reduction of 27%.[27]

b. Price Transparency

Security Constrained Economic Dispatch selects the least-cost resources for specific time intervals and locations on the power system throughout the RTO footprint, subject to constraints and losses. Most studies have shown that optimizing resources from a larger pool produces lower wholesale energy costs, compared to utilities individually managing their own resources.[28] This optimization produces "locational marginal prices," which reflect the value of energy at specific times and locations. Locational marginal prices, along with other markets and operations information are posted on RTO websites. For example, PJM's website and app contains information about prices, generation mix, and imports/exports in real time. This information provides transparent price signals for market participants to determine where and what types of resources to invest in or whether they should update or build transmission to alleviate bottlenecks.[29]

In optimizing the system, RTOs can manage transmission congestion and increase available transmission capacity compared to individual utilities working separately.

In optimizing the system, RTOs can manage transmission congestion and increase available transmission capacity compared to individual utilities working separately. MISO estimated that it produced \$278–\$303 million in annual transmission system availability benefits.[30]

Customers can also benefit from transparent energy price signals—they can save money by curtailing or shifting their energy usage from times when electricity is the most expensive through demand response programs. Alternatively, customers can invest in back-up generation for when prices are high or when there is an outage. Accurate price signals can also help incentivize investment in flexible resources.

Essentially then, organized wholesale energy markets encourage system flexibility because accurate wholesale energy prices can attract resources capable of responding within five minutes.[31]

Self-scheduling, a practice in which utilities continuously dispatch energy from their inflexible baseload power plants, erodes the benefits of economic dispatch. This is a common practice for vertically integrated utilities (as well as some merchant generators) regardless of whether they are in an RTO.[32]

2. Ancillary Services

RTOs also operate markets for ancillary services, which can be provided by generation, storage, or demand-side resources to stabilize the power system around a certain voltage and frequency.[33] These include contingency

[26] PJM Value Proposition at p. 4.

[27] SPP 101: An Introduction to Southwest Power Pool at slide 111.

[28] E.g., Imperfect Markets versus Imperfect Regulation in U.S. Electricity Generation, Market Organization and Efficiency in Electricity Markets. Lower wholesale prices do not necessarily translate to lower retail prices. Prices consumers see ultimately depend on how savings from the wholesale markets are shared, and if the state deregulated, how stranded costs from assets unable to compete with new market entrants are allocated to consumers or taxpayers.

[29] Note, however, that markets have not been perfectly functional in efficiently incenting investments (e.g., pockets of high price persist), and thus they still need improvement.

[30] MISO Value Proposition (2019).

[31] See, e.g., Operating Reserves and Variable Generation, NREL (2011) at 18, 22.

[32] E.g., nearly half of the energy dispatched in SPP is self-committed. Self-Committing in SPP Markets: Overview, Impacts, and Recommendations, SPP Market Monitoring Unit (Dec. 2019) at 16.

[33] E.g., Survey of U.S. Ancillary Services Markets, Z. Zhou et al. (Jan. 2016).

reserves, which can start up in 10 or 30 minutes in the event of power plant or transmission equipment failure. Contingency reserves are typically provided by gas, coal, or other generation units that are not needed for energy. Regulation and frequency response reserves provide services to periodically correct the frequency of the system or respond within minutes to slow the impact of an outage, respectively. Newer technologies like batteries, controllable customer demand, and wind and solar with appropriate electronics systems can respond quickly and accurately. Other ancillary services include voltage support, which must be locally provided.

Ancillary service markets are much smaller than energy markets, but their importance will grow as variable renewables increase in share. CAISO, ERCOT, and SPP—regional grid operators with relatively more renewables than others in the U.S.—procure separate regulation services in the upward and downward directions. This distinction helps when wind generation is high at night, while demand is at its lowest, and inflexible power plants operating at their minimum levels cannot further reduce output.[34] Regulation down is more valuable at these times.

A region-wide market mechanism for providing ancillary services and sharing reserves is more cost-effective than each utility procuring its own ancillary services.

A region-wide market mechanism for providing ancillary services and sharing reserves is more cost-effective than each utility procuring its own ancillary services. For 2019, MISO estimated it saved $49–$54 million in regulation reserves and $23–$25 million in spinning reserves.[35]

3. Resource Adequacy

There are different models for resource adequacy decision making across the RTOs with varying levels of state involvement.[36] Generally, grid operators determine the amount of resources needed to maintain reliability in all but the rarest events, i.e., events that would happen once every ten years.[37] For PJM, for example, this amounts to procuring a target of 15.8% over its projected electricity demand. ERCOT in Texas is the exception—the amount of resources it keeps is largely driven by energy market prices.

RTOs with mostly vertically integrated utilities rely on their member utilities to ensure adequate resources through their planning processes.[38] However, the resources they each need to keep as a part of an RTO are less than what they would need individually. For example, MISO estimated savings of $2.2–$2.7 billion due to load diversity allowing for a lower planning reserve margin. It also estimated $154–$261 million in savings from deferring new resources due to demand response.[39] MISO also studied how wind turbines could be more optimally sited to meet state renewable targets and estimated that annual benefit to be $415–$477 million.[40]

RTOs with states that have restructured (which means they allow competing generators to supply customers) operate capacity markets, which transact commitments to provide energy (or reduce consumption) for a certain period of time in the future. These markets are smaller than the energy markets. They are intended to supply the

[34] A Survey of Operating Reserve Markets in US ISO/RTO-managed Electric Energy Regions, Sandia Nat'l Labs (2012) at 14, 15.
[35] MISO Value Proposition (Feb. 2019).
[36] State Participation in Resource Adequacy Decisions in Multistate Regional Transmission Organizations, J. Chen and G. Murnan. NI PB 19-03. Nicholas Institute for Environmental Policy Solutions, Duke University.
[37] This is a decades-old utility criterion, commonly used in both RTO and non-RTO regions. It is not based on a cost-benefit analysis or on what informed customers would choose as economical. ERCOT, in contrast, essentially allows price signals from its energy market to determine its reserve margin. See, e.g., Is Capacity Oversupply Too Much of a Good Thing?, J. Chen, Wiley Periodicals 34 (2017): 15–21. doi:10.1002/gas.22016.
[38] MISO Resource Adequacy Information (2019).
[39] MISO 2019 Value Proposition (Feb. 2019).
[40] Wind turbines required to meet renewable energy mandates may be reduced by approximately 11% through siting more regionally. Id. at 21.

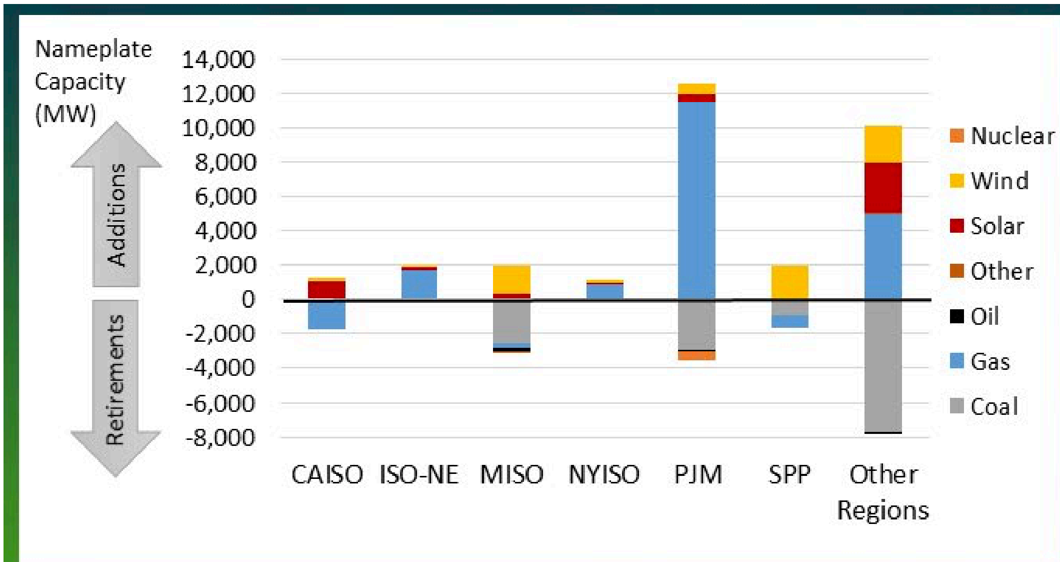
"missing money" to resources unable to earn enough from the energy markets and are designed so that capacity revenues decrease as energy revenues increase.[41]

While MISO has a voluntary capacity market, the RTOs in the East (PJM, New England, and New York) require customer-serving utilities to purchase a certain minimum amount of capacity from their markets to ensure that their systems will have adequate resources. In PJM, there is a mechanism for a utility to entirely carve itself out of the capacity market,[42] and a state can require that its utilities do so. This, however, would limit the utility's ability to benefit from the savings resulting from participating in a resource adequacy construct with greater economies of scale.

Even though vertically integrated utilities plan for resource adequacy separately, they are also required to participate in PJM's capacity market unless they have the carve-out mentioned above. For example, Dominion offers all of its capacity and bids in all of its load into PJM.[43]

These capacity markets are controversial because their requirements essentially favor certain types of resources, such as gas plants that have relatively low capital costs[44] and have contributed to excess capacity while largely excluding resources favored by state public policies and consumers.[45] On the other hand, capacity markets have provided revenue streams to resources that can help reduce emissions, like energy efficiency and some types of demand response.

Figure 8. Capacity Additions and Retirements by Generation Type



Source: U.S. Energy Information Administration (EIA) Form 860M. Data do not cover additions or retirements in Alaska or Hawaii.

Source: FERC.

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[41] Briefly, the "missing money" problem arises when regulators require the system to keep more capacity than the markets support. See footnote 37 and the text accompanying it.

[42] Fixed Resource Requirement Alternative in PJM. P. Bruno (Jan. 2020).

[43] See Dominion Energy comments concerning FERC June 29 Order Docket Nos EL16- 49-000, et al. at 2.

[44] Asymmetric Risk and Fuel Neutrality in Capacity Markets, J. Mays et al., USAEE Working Paper No. 19-385, (Feb. 2019) at 1.

[45] E.g., Hitting the Mark on Missing Money, M. Hogan (Sept. 2016); Power Markets in Transition: Consequences of Oversupply and Options for Market Operators, S. Aggarwal (Mar. 2019); Is Capacity Oversupply Too Much of a Good Thing? at 19–20 ; FERC Order Could Exclude Some Clean Energy from PJM Market (Dec. 2019)..

PJM estimated $1.2–$1.8 billion in annual generation investment savings from a lower target reserve margin and competition from alternative sources. According to PJM, another $1.1–$1.3 billion in savings resulted from replacement of less efficient resources through an efficient interconnection process and competitive capacity market.[46] Resource adequacy related savings appear to total $2.3–$3.1 billion per year.

Most independent studies focus on production cost savings, so more work on savings resulting from broader resource adequacy constructs, cost impacts of capacity oversupply, and who bear those costs in practice would be helpful.

4. Transmission and Interconnection

Joining an RTO requires that a utility convey operational control of its transmission system (though not ownership) to the RTO.[47] RTOs conduct regional transmission planning and manage generator requests to interconnect to the high-voltage system. These processes are conducted under FERC rules and have transparency requirements.[48]

To promote competition and encourage cost-effective service, FERC Order 888 required public utilities to provide open access transmission service without discriminating against generators unaffiliated with the transmission owning company. This applies to utilities that own or operate facilities used for transmitting electricity in interstate commerce regardless of whether they are in an RTO.

Transmission and modern transmission technologies can help bring inexpensive renewable generation to customers and reduce the need for flexibility services to balance variable output by relieving congestion and smoothing variations in renewable output over a larger geographic footprint.

Transmission and modern transmission technologies can help bring inexpensive renewable generation to customers and reduce the need for flexibility services to balance variable output by relieving congestion and smoothing variations in renewable output over a larger geographic footprint. FERC Order 1000 sought to expand the geographic scope of transmission planning so that projects that could bring cleaner, less expensive generation outside of a particular utility's footprint would be considered as part of a regional plan. The entire U.S. is divided into Order 1000 transmission planning regions, and each region must comply with the order's requirements regardless of whether they are a part of an RTO.

Each region has interpreted Order 1000 requirements differently. For example, PJM conducts transmission planning to improve market efficiency as well as reliability. PJM estimates $300 million in annual congestion savings from transmission upgrades identified in its planning.[49] MISO performs transmission planning that accounts for a combination of reliability, economic, and public policy benefits.[50]

RTOs also administer interconnection processes for studying impacts of new generators hooking up to the transmission system and determining required upgrades. These are governed by FERC orders on large and small generator interconnection agreements and procedures. The process has been criticized as slow and costly and reforming that process is a work in progress. Interconnection requests and their statuses are provided online along

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46 PJM Value Proposition (2019).

47 Note that a utility can join PJM without conveying control over its transmission system by joining the appropriate member sector. For example, Central Cooperative, in South Carolina, joined PJM in September 2019 as a Voting Member in the Other Supplier group but its system was not integrated. South Carolina Central Electric Power Cooperative Joins PJM, C. Smith (Oct. 2, 2019).

48 FERC has sought to improve transparency in its RTOs' interconnection and transmission planning processes through various rulemakings. Small Generator Interconnection Agreements and Procedures Order 792 (2013); Reform of Generator Interconnection Procedures and Agreements Order 845 (2018); Preventing Undue Discrimination and Preference in Transmission Service Order 890 (2007); and Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities Order 1000 (2011).

49 PJM Value Proposition at p. 2.

50 MISO Multi-Value projects (2011).

with other information. For example, interconnection requests at PJM are listed here. Based on posted data, the average time between the dates the projects entered the queue and the actual in-service dates is approximately three years.[51] MISO's queue is also available online, and includes an interactive map.

5. Governance, Market Monitoring, Education

Market monitors provide market analysis and police market participant behavior. They also promote transparency and timely dissemination of information and education to market participants and regulators.

RTOs are governed by an independent board, conduct stakeholder meetings, and have decision-making processes that account for minority stakeholder views.[52] This can help guard against decision making dominated by incumbent interests, which can stall reforms. However, RTO governance is a work in progress, as the issues covered are many and complex, and less well-funded stakeholder groups are still at a comparative disadvantage.

RTOs also provide a forum for general education and more detailed trainings—much of it posted online. Every RTO has an independent market monitor. CAISO, which is technically an ISO, has its own market monitor. Market monitors provide market analysis and police market participant behavior. They also promote transparency and timely dissemination of information and education to market participants and regulators.

FERC has jurisdiction over wholesale sales of power and transmission services by public utilities in interstate commerce and must approve any tariffs for these services offered by an RTO or an energy imbalance market. FERC also approves entities wishing to join or leave RTOs.[53] FERC tends to defer to RTOs over the states' perspectives when it believes reliability or the competitiveness of its markets are at stake, but it has in the past attempted to accommodate differences.[54]

Joining an RTO (or energy imbalance market or power pool) is generally voluntary, and there is typically an annual membership fee depending on the type of entity seeking membership.[55] Exit is similarly voluntary, but leaving an RTO may be costly, depending on obligations incurred. For example, Duquesne Light Co. had announced its intention to leave PJM for MISO in 2007 to avoid increased capacity costs stemming from PJM's capacity market. FERC's approval held Duquesne liable for capacity payments for three years into the future and prohibited Duquesne from reselling capacity acquired through the capacity market to third parties. Duquesne subsequently changed course and stayed in PJM.

States also are likely to have authority over the membership of their regulated utilities in RTOs. For example, Dominion's participation in PJM involved action by the state legislature and the State Corporation Commission.[56] Entergy, which operated in Louisiana, Arkansas, southeast Texas, and western Mississippi, had trouble obtaining state support for a number of its proposals to address regulator concerns about how it operated its transmission system. Eventually it joined MISO with conditional approvals from these regulators.

Every multistate RTO also has a regional state committee, which provides a forum for states to forge consensus and represents their perspectives to the RTO board, stakeholder body, and FERC. Any regional compact requires that individual members accept rules made by or with others so the region may benefit as a whole. RTOs are no

[51] This estimate is based on a simple average across completed projects and does not take into account the different size and complexity of the projects. The calculation is on file with the author.
[52] FERC requires that RTOs be responsive to customers and other stakeholders through inclusiveness, fairness in balancing diverse interests, and representation of minority positions. FERC Order 719 (2008) at P. 7.
[53] For example, FERC approved Dominion's entry into PJM. Order Establishing PJM South, Subject to Conditions; Order on Rehearing (Mar. 4, 2005).
[54] See, e.g., FERC's "Capacity Performance" Order at P. 205, and FERC's order on PJM's capacity market "minimum offer price rule" that many believe would frustrate state public policies. C.f., Order 719 allowing states and relevant electric retail regulatory authorities to opt-out of allowing demand response aggregators to operate in their territories (at 311–12).
[55] For example, voting members in PJM pay $5,000 per year.
[56] Virginia SCC Gives Approval for Dominion Virginia Power to Join PJM (2004).

different, and SPP and MISO have managed differences with and between states with relatively little controversy. PJM and its states have a history of disagreements over its capacity market, but as noted for PJM, there is a mechanism for states to isolate themselves from that controversial market.

A state can also negotiate for additional authority upon its utility's entry. For example, a settlement addressing Arkansas Public Service Commission's concerns about Entergy Arkansas transferring functional control of its transmission facilities to MISO led to increased authority for the states over transmission cost allocation decisions in MISO. FERC noted in its approval of the settlement that the outcome could "facilitate state consensus on certain regional issues, as well as a partnership between this Commission and state commissions."[57]

B. Energy Imbalance Market or Service

An energy imbalance market or service (EIM/EIS) allows utilities outside of an RTO to voluntarily trade their excess energy in real time with neighboring utilities through the RTO's real-time energy market. This mechanism does not require that the participating utility join an RTO, and there are generally no exit fees.[58] Participating utilities are typically vertically integrated and retain operational control over their resources and transmission.

The primary example of an EIM in the U.S. today is the Western EIM operated by CAISO. Historically, SPP operated an EIS before moving to a full market,[59] and it is currently launching an EIS for utilities in the Western Interconnection.

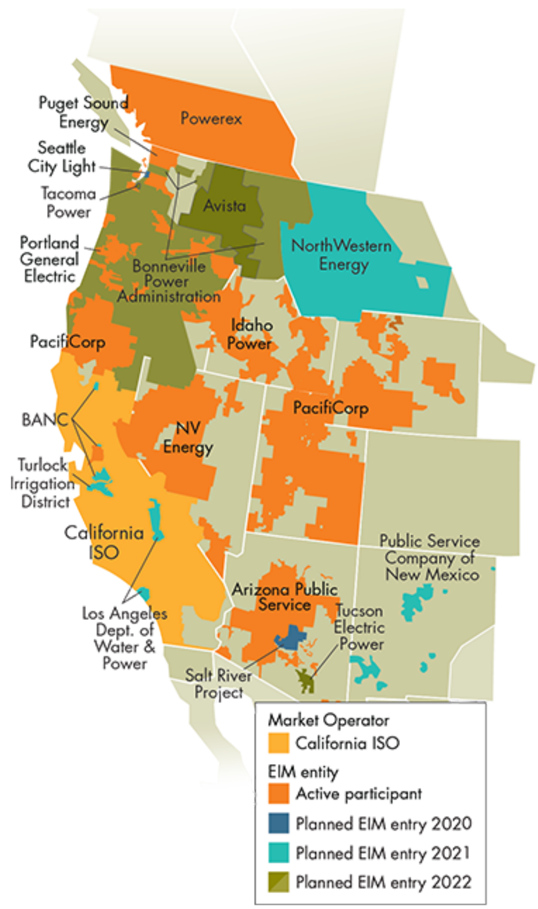
Utilities need not have contiguous borders (by contrast, FERC has suggested RTOs should[60]). Nevertheless, they must be connected via transmission. Each participating utility contributes rights to use some of their transmission to the EIM when they join.

1. Dispatch

The grid operator running the EIM or EIS (CAISO or SPP) handles dispatch, transmission congestion management, pricing, settlement, and market monitoring associated with running a real-time energy imbalance market. CAISO's EIM has a 15-minute market and a real-time market with energy dispatched in five-minute intervals. SPP's Western EIS is a market with real-time energy dispatch in five-minute intervals. All other grid operator functions are retained by the participating utilities.

For RTOs, about 5% of all energy transactions are scheduled in the real-time market, the rest having already been scheduled in the day-ahead market.[61] The energy transacted over the EIM is only the imbalance in real-time energy, which will likely be less than that 5%. However,

Figure 9. Map of Current and Planned Participants in Western Energy Imbalance Market



Source: Western EIM.

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[57] State Participation in Resource Adequacy Decisions in Multistate Regional Transmission Organizations at 9–10.
[58] SPP's Western EIS will have an exit fee for early withdrawal.
[59] The Power of Relationships-SPP, N. Sawyer and L. Dillahunty (2016).
[60] Regional Transmission Organizations, Order 2000, 89 FERC ¶ 61,285 (1999) at 259–60.
[61] FERC Energy Primer at 59 (2015).

sharing diverse resources across time zones avoids curtailment of zero-marginal cost resources, which has saved on production costs and reduced emissions.

The CAISO EIM estimates that gross benefits since its start in 2014 through 2019 are over $861 million. For the U.S. utilities participating in the EIM, total 2019 benefits were over $280 million (for a combined noncoincident peak load of just under 83,500 megawatts).[62] This amounts to a savings of about $3,350 per megawatt, which is roughly comparable to the savings PJM and MISO estimate from their dispatch.

While this estimate doesn't include the costs for a utility to join the EIM, the benefits are estimated to outweigh total costs after a year or two. For example, Bonneville Power Authority estimated its startup costs (e.g., infrastructure, operations, and settlements) to be $29.7–$35.1 million, and its ongoing costs to be $6.9 million per year. It expected its annual gross dispatch revenues to be about $39.2 million.[63] Similarly, Arizona Public Service estimated its startup costs for metering, software, and rule updates to be $13–$19 million, while its ongoing costs were estimated at $4 million annually. Actual cost savings for 2018 were about $45 million for APS.

An energy imbalance market or service (EIM/EIS) allows utilities outside of an RTO to voluntarily trade their excess energy in real time with neighboring utilities through the RTO's real-time energy market.

The CAISO EIM may add a day-ahead market.[64] Day-ahead unit commitment and scheduling across a larger footprint can increase diversity and renewables integration benefits as well as improve efficiency. Production cost savings for the day-ahead market have been estimated to be $119–$227 million per year, depending on the level of participation and other factors.[65]

SPP's legacy EIS provided participants with approximately $170 million per year in net benefits from 2007 to 2013.[66] Like CAISO's EIM, this market dispatched resources to meet imbalances in real time, every five minutes. Participants estimated their energy usage and submitted operation schedules for each generator. Prices reflected the value of energy at specific time intervals and locations.[67] SPP operated this market until 2014, when it was incorporated into SPP's Integrated Marketplace.

SPP will launch an EIS that will provide a real-time balancing market in the Western Interconnection, starting in early 2021. Utilities do not have to become members of SPP to benefit from its central dispatch. Each utility will be responsible for committing generation to meet its real-time obligation to balance their customer demand and resources in their footprints.[68] Basin Electric Power Cooperative, Tri-State Generation and Transmission Association, Wyoming Municipal Power Agency, Municipal Energy Agency of Nebraska, and Western Area Power Administration (including WAPA Colorado River Storage Project, WAPA Rocky Mountain Region, WAPA Upper Great Plains Region) have announced they are joining SPP's new contract service.[69]

a. Impact on Emissions

A larger footprint and greater diversity of supply and load can avoid renewables curtailment. The total avoided renewables curtailment from 2015 to 2019 for the Western EIM was estimated at almost a million megawatt-

[62] Calculated from westerneim.com; EIA Operational_Data_2018.xls, Form EIA-861; California ISO Peak Load History 1998 through 2019.
[63] Bonneville Power Administration EIM Participation (Jun. 20, 2019) at Attachment A, 48–52.
[64] Extending the Day-Ahead Market to EIM Entities Issue Paper (Oct. 10, 2019) Presentation (Oct. 17 2019).
[65] Extended Day-Ahead-Market Feasibility Assessment (Oct. 3 2019) at 18.
[66] SPP Western Energy Imbalance Market Overview Nov. 2019 at slide 7. See also Western Energy Imbalance Service Market; The Power of Relationships – 75 Years of SPP at 125.
[67] The Power of Relationships – 75 Years of SPP at 123.
[68] A Proposal for the Southwest Power Pool Western Energy Imbalance Service Market at pp 5–8.
[69] Three Regional Utilities Announce Decision to Join Southwest Power Pool Market (Sept. 2019). SPP's Western Market Gains Two New Participants (Dec. 2019).

hours, equivalent to 433,120 metric tons of CO_2 or roughly the same as avoiding emissions from 91,062 passenger cars driven for one year.[70]

b. Price Transparency and Transmission Congestion

Prices are locational marginal prices and are displayed on CAISO's website. Additional benefits to an EIM/EIS running a dispatch process is that it can identify and mitigate transmission congestion by deploying different resources to stay within transmission operating limits. This optimization can more efficiently use transmission assets and increase available transmission capacity contributed by participants. Similarly, the tools needed to operate the EIM improve operators' awareness of grid conditions, and help identify, prepare for, and mitigate problems. This awareness can help improve reliability.[71]

2. Ancillary Services

In addition to production cost savings, a larger footprint and greater diversity of supply and load can reduce the amount needed for reserves. The CAISO EIM calculated that its participants were able to reduce flexible reserves by about 46%.[72]

A larger footprint and greater diversity of supply and load can avoid renewables curtailment. The total avoided renewables curtailment from 2015 to 2019 for the Western EIM was estimated at almost a million megawatt-hours, equivalent to 433,120 metric tons of CO_2 or roughly the same as avoiding emissions from 91,062 passenger cars driven for one year.

3. Governance

The EIM rules governing energy resale by public utilities in interstate commerce are regulated by FERC. The EIM also has a governance regime with various governing and stakeholder bodies, set up to educate and take part in decision making. CAISO's market monitor serves as the market monitor for the EIM as well.

C. Power Pools

Power pools grew out of voluntary cooperation between utilities, recognizing that it is more cost-effective and reliable for neighboring utilities to share resources compared with acting individually. These include a wide range of multiutility cooperative arrangements.[73] Power pools can span single or multiple states. Some pools simply interconnected two or more systems for joint planning and assistance, while others used a centralized dispatch to operate as a single system.

In 1970, the Federal Power Commission counted 21 power pools with formal agreements and 13 informal coordinating organizations in the U.S.[74] Some pools dissolved, and others later became RTOs, including PJM and the pools for New York and New England, which both formed in the aftermath of the 1965 Northeast blackout. Southwest Power Pool also later became an RTO.[75]

The Southeast has had a number of pool-like entities.[76] Carolina Power & Light Co., Duke Power Co., the South Carolina Electric & Gas Company, and the Virginia Electric & Power Company created a power pool in 1961. Each utility retained responsibility for its own service area. The pool established procedures for allocating shares in new generation and established rates the pool members were to pay each other in power transactions. The pool

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[70] Western EIM Benefits Report Fourth Quarter 2019 at p. 20.

[71] Qualitative Assessment of Potential Reliability Benefits from a Western Energy Imbalance Market, 2013.

[72] Western EIM Benefits Report Fourth Quarter 2019 at p. 3.

[73] The Federal Power Act does not recognize "pools" but section 202 directs the Commission "to divide the country into regional districts for the voluntary interconnection and coordination of facilities for the generation, transmission, and sale of electric energy" and "to promote and encourage such interconnection and coordination within each such district and between such districts." FPA section 202(a) 16 U.S. Code § 824a.

[74] Federal Power Commission, 1970 National Power Survey, pt. I, ch. 17, at 2–14.

[75] FERC Energy Primer at 39.

[76] Transmission, Power Pools, and Competition in the Electric Utility Industry, J. Fairman and J. Scott, 28 Hastings L.J. 1159 (1977) at 1169–71.

dissolved during negotiations betwe n the Justice Department and the Atomic Energy Commission with two of the members.[77] Later, Duke Energy Carolinas and Carolina Power & Light agreed to joint dispatch as a condition to the merger of Duke Energy and Progress Energy,[78] also a type of power pooling arrangement.[79] Under the agreement, Duke Energy Carolinas dispatches the companies' generation resources to meet load requirements and contractual commitments subject to reliability and contractual requirements.[80]

Southern Company currently operates a power pool with Georgia Power, Alabama Power, and Mississippi Power.[81] The main function is to centrally dispatch resources obtained through bilateral transactions. Thus, energy prices and volumes are determined in bilateral contracts, in advance. The centralized dispatch schedules resources according to variable costs (not generator bids) subject to constraints and obligations across the region. Transactions are settled hourly.[82]

Northwest Power Pool is another example of a pool that is operating today. It is a clearinghouse for operational data and provides a forum for its member utilities to discuss operational problems, establish operating guidelines, and prepare operating plans. The pool coordinates transmission planning with transmission providers. Pool members also coordinate their available electricity reserves in order to help each other meet power demand during emergencies. These efforts include a Frequency Response Sharing Group that uses reserves to stabilize the grid at around 60 cycles per second. They also have a contingency reserve sharing group, which shares backup reserves to replace power plants that fail.

1. Governance

Some negotiated multiparty agreements have been filed for approval under Federal Power Act section 202(a) as voluntary interconnections.[83] Pooling or joint dispatch agreements that establish rates and charges for services exchanged by members can require a rate schedule filing under section 205 of the Federal Power Act.[84] Some informal power pooling agreements were effectuated with a handshake.[85]

All of this variety among power pools highlights that there is a spectrum of wholesale competition options available with varying degrees of efficiency, cooperation, and durability.

IV. VERTICALLY INTEGRATED UTILITIES

Vertically integrated utilities serve about 40% of U.S. electricity customers,[86] where states have given electric utilities a monopoly to serve the consumers in a defined territory.[87] Public power and rural cooperatives also have

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77 Id. at 1200–01.

78 Duke Energy Corp. and Progress Energy, Inc., 139 FERC ¶ 61,193 (2012), order denying reh'g, 151 FERC ¶ 61,242 (2015), order on remand, Orangeburg, S. Carolina v. FERC, 862 F.3d 1071 (D.C. Cir. 2017), order on remand, 166 FERC ¶ 61,112 (2019).

79 Duke Energy, 166 FERC ¶ 61,112 at P. 11.

80 Duke Energy, 151 FERC ¶ 61,242 at P. 12. Public Service Company of Colorado, Black Hills/Colorado Electric Utility Company, LP, and Platte River Power Authority also have a Joint Dispatch Transmission Service and a Joint Dispatch Agreement to facilitate centralized intra-hour dispatch of resources. Order Accepting Joint Dispatch Agreement and Tariff Revisions, 154 FERC ¶ 61,107. These utilities plan to join the Western EIM, along with Colorado Springs Utilities. Xcel, 3 Other Colorado Utilities Choose California's Imbalance Market Over Southwest Power Pool.

81 The Southern Company pool does not include all of the entities in the Southern Company balancing authority. Southern Company System Intercompany Interchange Contract (2007).

82 Id. at 23.

83 Transmission, Power Pools, and Competition in the Electric Utility Industry at 1178.

84 Id. at 1190–91, footnotes 79, 80..

85 Nodal Governance of the US Electricity Grid, A. Gocke (2019) at 228.

86 Competition in Bilateral Wholesale Electric Markets, Energy Policy Group, LLC. (Feb. 2016) at 5.

87 Some states like Alabama have a clear grant of exclusive franchise in legislation to investor-owned utilities. Ala. Code 1975 §§ 37-14-30, -32. Whereas the North Carolina statute is less explicit, and monopoly status arises in part through the state commission's interpretation. For example N.C.G.S. §§ 62-30, 62-110 62-3(23)(a) (2015) empowers the public utility commission (NCUC) to issue certificates of public convenience, without which an entity that sells electricity to the public cannot begin construction or operate. Once a certificate has been issued to such an entity in a particular area, there is no explicit prohibition against NCUC issuing a certificate to a competitor. In fact, § 62-110.2(d)(1) states "Any electric supplier may furnish electric service to any consumer who desires service from such electric supplier at any premises being served by another

a monopoly over their service territories, regardless of whether the state has restructured. Electricity customers in the monopoly's territory can generally only purchase electricity from the local utility.[88] Some vertically integrated utilities belong to RTOs, and in fact, all of SPP and most of MISO consist of such entities. Some vertically integrated utilities in the West participate in the EIM, while utilities in the Southeast build and maintain their own facilities to supply their own consumers and rely little on wholesale transactions between neighbors.

A. Wholesale Energy Transactions in the Southeast

Some vertically integrated utilities belong to RTOs, and in fact, all of SPP and most of MISO consist of such entities. Some vertically integrated utilities in the West participate in the EIM

Southeastern utilities trade relatively little wholesale energy, and virtually all physical sales are done bilaterally. FERC reports that wholesale spot power markets in the Southeast are thin (accounting for less than 1% of overall supply) and lack transparency.[89] Price data is therefore scarce, and the Intercontinental Exchange does not provide a financial product in the Southeast. Wholesale energy sales reported in FERC's Electric Quarterly Report (EQR) database show no sales to unaffiliated companies for some Southeastern utilities, while Duke Energy Progress, Duke Energy Carolinas, Santee Cooper, and South Carolina Electric & Gas sell less than 1% of their total sales to unaffiliated entities. Some of Southern Company's utilities sell up to about 2% to unaffiliated companies.[90]

Southern Company holds auctions for day-ahead and hour-ahead power within the Southern Balancing Authority Area. According to its website, "the purpose of the energy auction is to resolve perceptions that Southern Company could exercise horizontal market power through the physical or economic withholding of generation." The auction is not a trading platform. Rather, it matches parties to facilitate bilateral transactions by sorting offers in ascending order and bids in descending order.[91] The website posts average hour-ahead purchases and sales a day after the transactions. Auction activity has been sparse since its inception in 2009.[92] For most days of the year, the auction does not report any transactions. Nearly all of the data is redacted in the public version of the market monitoring report.[93]

electric supplier, … , upon agreement of the affected electric suppliers …." Historically, however, NCUC has granted exclusive franchise under the theory that competition leads to duplication and waste. This practice has been upheld by the courts. See, State ex rel. Utils. Comm'n v. N.C. WARN, 2017 N.C. App. LEXIS 759 (2017); and Carolina Tel. & Tel. Co., 267 N.C. 257, 148 S.E.2d 100 (1966) ("The requirement of such a certificate is not an absolute prohibition of competition between public utilities rendering the same service…. There is, however, inherent in this requirement the concept that, once a certificate is granted which authorizes the holder to render the proposed service within the geographic area in question, a certificate will not be granted to a competitor in the absence of a showing that the utility already in the field is not rendering and cannot or will not render the specific service in question."). In contrast, however, N.C.G.S. §§ 117-10.1, 10.2 more explicitly grants municipalities a franchise that restricts other suppliers. Virginia's grant of utility franchise appears to operate similarly. See Guide to Electric Utility Regulation in Virginia, GreeneHurlocker LLC, (2018) at 7.

[88] Because the prohibition is on the sale of electricity to the monopoly's customers by nonutility developers, developers can still sell them non-electricity products like renewable attributes or financial hedge products. Nonutility developers in a monopoly region can also develop a resource in a monopoly's territory and sell that electricity into wholesale markets outside of the region (if the utility interconnects them) and pay wheeling charges to the utility to access those markets. Alternatively, the developers can sell to the local utility through the Public Utility Regulatory Policies Act (PURPA).

[89] FERC Energy Primer (2015) at 66–67.

[90] Based on FERC EQR data for 2018. Data on file with the author.

[91] Technical Conference Presentation Of Southern Companies (May 2016).

[92] FERC Energy Primer at 68. Also Order On Updated Market Power Analysis, Instituting Section 206 Proceeding (Apr. 27, 2015) (justifying the investigation on the "limited number of transactions cleared in the Auction, the limited number of participants in the Auction, and Southern Companies' high prices for sales relative to other sellers' prices in the Southern balancing authority area").

[93] E.g., Tenth Annual Informational Report of the Independent Auction Monitor (Jun. 28, 2019).

B. Grid Operation under Vertically Integrated Utilities

Each vertically integrated utility independently serves its electricity consumers in its territory, unless there are arrangements between utilities to share or optimize resources between them, or carve-outs for other parties to provide services. Their grid operator functions are described below.

1. Unit Commitment and Dispatch

Vertically integrated utilities outside of RTOs rely on bilateral contracts for energy, which determine energy prices and volumes traded.[94] These bilateral obligations feed into unit commitment and dispatch which deploys these resources based on their variable costs as well as constraints and obligations, such as a need for voltage support or take or pay contracts. Utilities employ traders, who seek wholesale purchase opportunities up to an hour ahead for hourly real-time transactions. The duration of unit commitment transactions can last for years. Traders may transact via telephone, trading platforms such as the Inter-Continental Exchange, and voice brokers.[95]

Unlike the economic dispatch in RTOs, which determines prices and volumes transacted based on seller offers and customer demand forecasts, utility dispatch deploys resources that have already been procured bilaterally, based on cost. The utility dispatch process therefore doesn't produce a price for energy based on supply and demand in real time. In an RTO market, when there is much more supply compared to demand, sellers may bid strategically to clear the market. This can produce a price that more acutely pressures the least efficient generators to retire compared to the utility cost-based procurement. When supply is short compared to demand, market sellers can bid more—up to $1,000/MWh for incremental energy offers, beyond which such offers must be verified by the RTO or market monitor to be based on costs. Further, locational marginal prices cannot be set by incremental energy offers greater than $2,000/MWh. This mechanism is intended to produce a price that incentivizes resources to come online during scarcity while mitigating the potential for market power to inflate prices.[96]

Joint dispatch can save money compared to every utility optimizing its own system. Savings generally grow as the balancing area expands, but a diversity of resources and demand help bring costs down too.

There is no standard protocol for dispatch and unit commitment across vertically integrated utilities that do their own balancing. As mentioned above, Southern Company operates a joint dispatch among its affiliated utilities as part of a power pool. Duke Energy Progress and Duke Energy Carolinas jointly dispatch energy subject to constraints. Payments are settled hourly (compared to every five minutes for RTOs and EIMs).[97] Unit commitment is determined by a fuel systems optimization department, which procures the fuels based on a 7-day unit commitment plan. This commits power plants further in advance than RTOs do. Another department (the Energy Control Center) separately checks for transmission constraints, so commitment is a two-step process rather than the single optimization that RTOs carry out.

Joint dispatch can save money compared to every utility optimizing its own system. Savings generally grow as the balancing area expands, but a diversity of resources and demand help bring costs down too.

Economics have driven gas to displace coal across the Southeast, while the trends for solar and wind are uneven and appear to depend on state policies. As a result of this evolution in the resource mix, CO_2 emissions have fallen by 28% between 2010 and 2017.[98]

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[94] These bilateral contracts can also arrange for capacity and ancillary services. Competition in Bilateral Wholesale Electric Markets, Energy Policy Group, LLC. (Feb. 2016).

[95] Id. at 13–14.

[96] Offer Caps in Markets Operated by Regional Transmission Organizations and Independent System Operators, 161 FERC ¶ 61,156 (Nov. 9, 2017) at PP. 2–3.

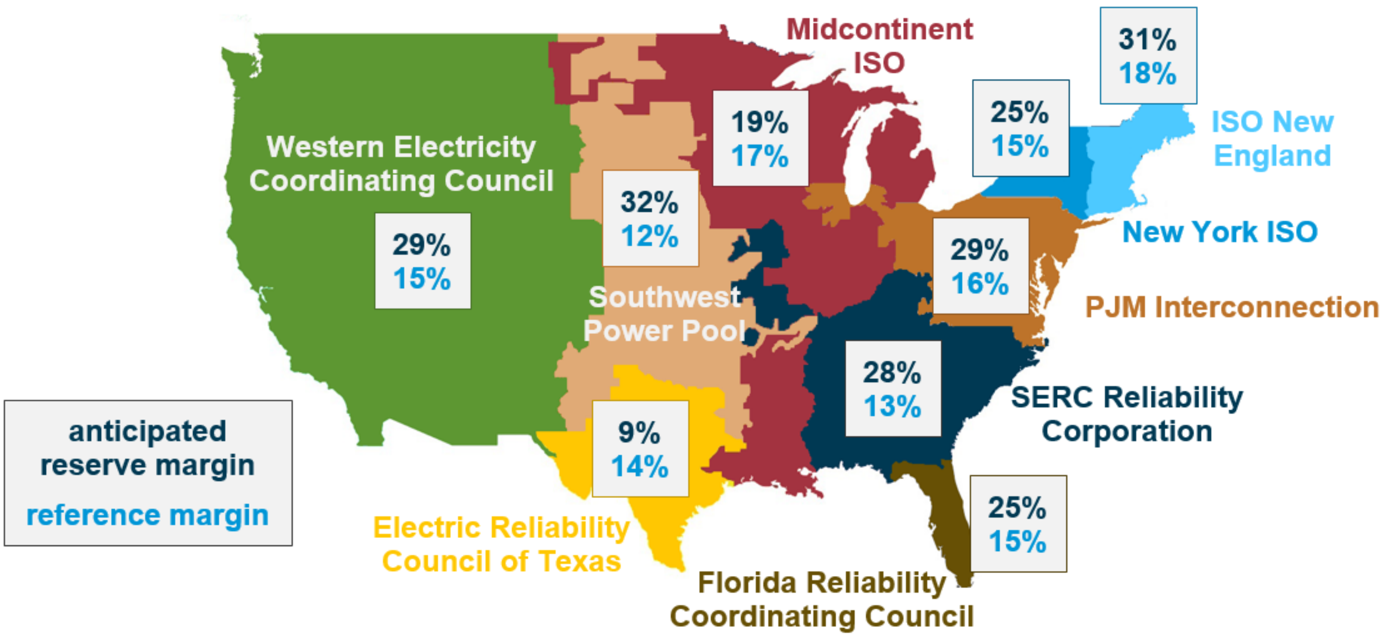
[97] Joint Dispatch Agreement Between Duke Energy Carolinas, LLC Carolina Power & Light Company (2011) at 7–10.

[98] Tracking Decarbonization in the Southeast 2019 Generation + CO2 Emissions Report, Southern Alliance for Clean Energy, at 27.

2. Resource Adequacy

Vertically integrated utilities typically ensure sufficient long-term supply for their own territories through an integrated resource planning process. For example, Duke Energy Progress recently submitted a plan to the North Carolina and South Carolina utility commissions. The utility projects an additional electricity demand around 2.2 GW between 2020 and 2034, the majority of which it plans to meet with new natural gas plants. Duke Energy Progress determined that the minimum amount of reserves beyond the generation it needs to satisfy demand is 17%. Typical target reserve margins for utilities are roughly in that range.[99] Compared to the target, utilities in aggregate have far more capacity (top dark blue number in the map below) than required to meet the target (bottom light blue number).

Figure 10. Summer 2019 Actual and Target Reserve Margins



Source EIA. Except for ERCOT and MISO, nearly every region, both regulated and market, is oversupplied. Oversupply can crowd out investments in newer technologies, mute energy price signals, and increase costs customers pay. Larger geographic footprints with load diversity can maintain a comparable degree of reliability with leaner margins, but most resource adequacy constructs have a tendency to overprocure.

The Southern Company as a system is moving to seasonal target reserve margins, and its member companies are proposing in their Integrated Resource Plans to maintain a System Target Reserve Margin of 16.25% for summer periods, and 26% for winter periods for long-term planning starting in 2022.[100] Similarly, the Tennessee Valley Authority is recommending to increase its planning reserve margin targets to 17% in summer and 25% in winter.[101] These utility winter planning reserve margin targets are much higher than those recommended in RTO regions.

State resource adequacy planning may have some advantages to capacity markets as they currently exist because the generation mix can, theoretically, be better tailored to match state public policy goals. With a couple of exceptions, state clean energy policies in the Southeast have not been a significant driver in resource planning, and thus southeastern states have yet to take full advantage of this feature.

[99] Long-term Reliability Assessment, NERC (2019).
[100] E.g., Alabama Power 2019 Integrated Resource Plan at 2.
[101] Tennessee Valley Authority 2019 Integrated Resource Plan Volume I – Final Resource Plan at D-7.

3. Ancillary Services

Vertically integrated utilities typically use contracts, requests for proposals, and internal acquisitions to procure ancillary services. Typically, power plants provide a suite of energy, capacity, and ancillary services (including reserves) bundled together.

Some vertically integrated utilities share reserves, and the North American Electric Reliability Corporation recognizes reserve sharing groups for contingency, frequency response, and regulation reserves. For example, the Southwest Reserve Sharing Group shares contingency reserves between utilities in Arizona, New Mexico, southern Nevada, parts of southern California including the Imperial Valley, and El Paso, Texas. In Virginia and the Carolinas, Duke Energy Progress, Duke Energy Carolinas, Santee Cooper, South Carolina Electric & Gas, and Dominion Virginia Power are part of a contingency reserve sharing group. Together, these utilities keep enough reserves online to replace the largest power plant on the system should it fail.[102]

Reserve sharing enables participating utilities to save money compared to each utility maintaining its own reserves. Some of these reserves may play a bigger role as renewable resources ramp up. However, other means of integrating variable renewable generation can be less costly than procuring reserves. Sub-hourly dispatch, expanding the balancing footprint, joint system and markets operation, improved forecasting, good energy market design, and certain forms of demand response can be less expensive than procuring coal and gas ramping reserves.[103]

4. Transmission Open Access, Planning, and Generator Interconnection

Regional transmission planning is required under FERC Order 1000 and each region has interpreted the order differently. The Southeast has historically focused on transmission planning for more local reliability and not market efficiency or public policy needs.[104] Utilities in the Southeast approach transmission planning from the bottom up, with each utility planning transmission to serve its customers. Some utilities may coordinate planning, but each utility ultimately decides what to build.[105] Individual utility plans are rolled up into a regional plan through the Southeastern Regional Transmission Planning process.

Grid operators manage the generator interconnection process in their territories, which enables a new project to connect to its system. Thus, unless a vertically integrated utility is in an RTO, the utility manages the queue of generation projects seeking to interconnect to its transmission system through a FERC-approved tariff as well as its distribution system.[106]

State commissions may also have a role. For example, interconnection in North Carolina requires an administrative and technical review by the state utility commission. The interconnection queue is first-come-first-served, and the commission currently analyzes each project separately. If a project requires additional study during a phase of the interconnection review, the project may lose its place in the queue and be required to start over.[107]

If a nonutility developer outside of an RTO wishes to transmit or wheel power into an adjacent RTO to sell to customers there, it would have to interconnect through the vertically integrated utility's process and request transmission service from that utility. While neutral third parties like RTOs should have no incentive to favor a utility's project over others, some vertically integrated utilities with control of its own transmission system may

[102] See PJM Manual 12 Balancing Operations Revision: 38 (Apr. 20, 2018) (discussing VACAR reserve sharing) at 44.
[103] Sources of Operational Flexibility, Greening the Grid (May 2015) at 2.
[104] E.g., Southeastern Regional Transmission Planning has in the past received proposals for possible transmission needs driven by Public Policy Requirements but declined to take further action on them.
[105] E.g. North Carolina Transmission Planning Collaborative Participant Agreement (Mar. 2018) at p. 5. The North Carolina Transmission Planning Collaborative describes its process as satisfying FERC's requirements for "local" transmission planning, while regional planning, as required in Order 1000, is provided by the Southeastern Regional Transmission Planning process.
[106] E.g., Joint Open Access Transmission Tariff of Duke Energy Carolinas, LLC, Duke Energy Florida, LLC, and Duke Energy Progress, LLC, Attachment J.
[107] North Carolina Clean Energy Plan at 59.

prioritize transmission for generation they own.[108] Independent generators are sometimes impeded from accessing the system because the utility's studies indicate that upgrades would be necessary to connect them and generators seeking to interconnect may have to pay for the upgrades. Meanwhile, the utility has the advantage of having its retail and transmission customers pay for transmission it needs to connect its own generation.[109]

Nonutility generation developers have frequently criticized the utility interconnection process as being slow and opaque.[110] They have also raised concerns about ballooning costs and the lack of adequate explanation for such increases. Cost allocation for transmission upgrades can also be unfair to generation developers who happen to be in the queue when a major upgrade is required.

5. Governance and Transparency

Vertically integrated utilities other than public power and rural cooperatives are generally regulated by their state legislatures and public utility commissions but which actions require approval depends on the state.[111] For example, the reserve sharing between the utilities in the Carolinas required affirmative approval from the South Carolina commission but not for North Carolina. Duke Energy is required to give 30 days' notice to the North Carolina commission before it takes any regulatory request to FERC.

State legislature and public utility commission governance of their regulated utilities has been criticized for too little oversight.[112] Some state legislatures are part-time and unlike FERC, state commissions must spread their resources across multiple industries, and do not focus on electricity regulation. And unlike for RTOs, vertically integrated utilities conducting their own grid operations generally do not have an equivalent to an independent market monitor or educational trainings for stakeholders.

V. COMPARING THE OPTIONS AGAINST THE METRICS

What are the benefits and challenges of each option in light of the metrics if a southeastern utility maintained monopoly control and formed or joined an RTO or EIM/EIS (supposing an existing RTO offered the service in the Eastern Interconnection)? A power pool is not well-defined enough to be evaluated as a packaged option, but it could be a selection of grid operator functions that are helpful in achieving a goal.

A. Some Evaluation Criteria for Achieving Greater Investment in Emissions Reduction Technologies

Facilitate access to renewable resources

- The Southeast has plentiful solar and offshore wind resources that vertically integrated utilities could develop. However, as NREL data indicates, the Southeast as a region has lagged in variable renewables development. For nonutility developers, Public Utility Regulatory Policies Act (PURPA) has been a driver for solar development in the Southeast, particularly in North Carolina,[113] but utility obligations under PURPA were scaled back in 2017.[114]

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108 For example, Entergy, which owned generation and transmission, was criticized for neglecting improvements to its lines and keeping lower priced electricity from competitors from reaching customers. Department of Justice launches probe of Entergy, A. McCullough (Oct. 2010).

109 See Competition in Bilateral Markets at p. 22.

110 Duke Energy Progress posts data on its interconnection queue, but there is not enough information to calculate how much time on average successful projects spend in the queue process. Interconnection Queue. Also Southern Companies' Transmission System Active Generator Interconnection Requests.

111 And as mentioned above, FERC oversees public utilities' transmission service rates and terms as well as wholesale energy sales.

112 Payne, Heather, Game Over: Regulatory Capture, Negotiation, and Utility Rate Cases in an Age of Disruption (Jul. 6, 2017). 52 Univ. of San Francisco Law Rev. 75 (2017).

113 North Carolina Clean Energy Plan at 54.

114 Under General Assembly of North Carolina House Bill 589 (2017), fixed-price PURPA contracts are limited to projects 1 MW and smaller (from 5 MW), and contract lengths are shortened from 15 to 10 years.

- Adopting an RTO in the Southeast would likely offer a more transparent transmission interconnection process compared with that of a vertically integrated utility. Interconnecting at the distribution level would still be governed by the utility's process. For larger nonutility developers, the newly formed or joined RTO would facilitate renewable project interconnection at the transmission level, and thus developers' abilities to contract with buyers outside of the vertically integrated utility's region or with other utilities seeking to procure renewables.

Figure 11. Installed Capacity and Shares of Annual Average Wind and Solar Generation

	Installed Cumulative Capacity of Variable Renewable Energy (VRE)[13] as a Percentage of Total Generation Capacity (2016)	Annual Average VRE Generation as a Percentage of Total Generation (2016)
CAISO	26.1% (16.8 GW)	21.0%
ERCOT	19.1% (19.2 GW)	13.8%
SPP	18.1% (15.2 GW)	16.1%
WECC	12.0% (17.5 GW)	7.7%
MISO	9.0% (15.5 GW)	6.9%
ISO-NE	5.8% (1.9 GW)	3.1%
PJM	4.7% (9.0 GW)	2.5%
NYISO	4.7% (1.9 GW)	2.9%
SERC	3.1% (5.3 GW)	1.6%
FRCC	0.6% (0.3 GW)	0.1%

Source: Renewable Energy Grid Integration Data Book, NREL (2016) at p. 5.

SERC and FRCC represent the Southeast and Florida, which had the least shares of wind and solar generation on average compared to the rest of the U.S.

- Coordinated planning through vertically integrated utilities may help develop renewable projects and the transmission needed to access it, if the utility is seeking to develop such resources. Generally, however, the bottom-up transmission planning done in the Southeast, compared to the more robust regional transmission planning in RTOs, may miss low cost renewable resources that are not in a utility's footprint. The RTO transmission planning process, may in comparison more seriously consider transmission projects to improve market efficiency, which could benefit lower cost resources, or facilitate public policy. The RTO advantage is relative, as the RTO interconnection and transmission planning processes have also been criticized as being slow and opaque, but less so.
- An EIM would not change interconnection or planning, but it has opened up some transmission capacity across participating utilities to provide renewables with access to market demand. Available transmission depends on what the utilities are willing to contribute to the system. An EIM footprint can extend more broadly: while FERC policy has led to near-contiguity of RTOs, and EIM utilities need to be connected with transmission, how an EIM is configured is comparatively relaxed.
- The size and shape of the RTO or EIM footprint can help access more diverse resources that could help balance Southeastern solar, such as midcontinent wind resources.
- Note, however, that fewer projects with access to RTO markets would likely qualify for obligated PURPA purchases if FERC's proposed PURPA reforms are adopted. These PURPA projects would also likely have more difficulty obtaining financing.

Open up access to financing and revenue streams

- The vertically integrated utility can develop renewable resources and finance it through customer rates (subject to regulatory approvals), which can allow it to borrow at more favorable rates than a merchant generator. Nonutility renewable project developers generally cannot sell electricity to captive customers without going through the utility. This remains true even if the utility joined an RTO, if there are no changes at the retail level. In an RTO, however, the developer may sell into the wholesale electricity markets from which a vertically integrated utility (as well as others) may purchase power.

- Price transparency has been key in enabling renewable developers to contract by making information equally available to them as well as potential counterparties. Locational marginal prices posted on RTO and EIM websites have helped in this regard.
- RTOs have markets for different wholesale services, which offer revenue streams to competitive resources. If these services reward faster or more accurate performance, newer technologies with these capabilities can benefit from those revenue streams.
- Capacity oversupply is an issue in all regions except parts of Texas and perhaps MISO. Oversupply mutes investment signals for new resources. Allowing uneconomic power plants to retire helps make room for newer investment. Regions operating under a market rather than cost-of-service construct would see more of an economic signal to retire inefficient units. However, vertically integrated utilities under cost-of-service would also feel more pressure to turn over inefficient assets if prices are transparent, like in RTO and EIM markets.

Facilitate sufficient power system flexibility cost-effectively or even out renewable variability

- The most common approach for grid operators to increase system flexibility has been to procure ramping or balancing reserves. For lower emissions options, a vertically integrated utility can implement demand response programs, procure energy storage, and incentivize distributed energy resources. These resources scale up with the availability of revenue and wholesale markets can offer another source of revenue for services these resources offer at wholesale. Demand response, largely for emergency but not flexibility services, and energy storage have been receiving revenues from RTO markets. A pending FERC proposal may also provide the ability for distributed energy resources to receive wholesale revenues by allowing them to participate in the markets through aggregation.
- A vertically integrated utility is more limited in terms of geographic size, while an RTO or EIM offers power system flexibility that scales with size, as well as diversity of resources and load.[115] While some bilateral markets may have geographic reach comparable to smaller RTOs, they do not offer clear price signals, the liquidity of organized markets, or regional planning. Size and diversity offer the win-win of access to renewable resources as well as ability to smooth the variability of renewable generation and thus reduce the need for flexibility services. Wide footprints in the east-west direction are particularly advantageous if they contain different time zones or allow for midcontinent wind resources that peak at night or in the winter to balance solar generation. North-south footprints can help provide diversity too, especially if the systems peak in different seasons or offshore wind potential is greater further north. PJM is summer-peaking and parts of the Southeast that primarily use electricity for heating are winter peaking.

While some bilateral markets may have geographic reach comparable to smaller RTOs, they do not offer clear price signals, the liquidity of organized markets, or regional planning.

- RTOs and EIMs also offer the benefit of five-minute dispatch and settlements, which optimize resources subject to constraints and provide price signals for flexible resources like energy storage to quickly kick in when needed.[116] RTO and EIM security constrained economic dispatch can also help increase available transmission capacity, which also contributes to flexibility. Utility dispatch based on bilateral contracts does not produce clear prices as a result of real-time supply and demand dynamics.

[115] NREL's renewables integration study showed if Duke Energy Carolinas and Duke Energy Progress operated as separate systems, solar curtailments would increase. R. Matsuda-Dunn et al. Carbon-Free Resource Integration Study (2020).

[116] FERC requires that real-time energy transactions are settled as well as dispatched every five minutes, which help ensure accurate prices. Settlement Intervals and Shortage Pricing in Markets Operated by RTOs and ISOs, Order 825 (Jun. 16, 2016). This granularity in settlement is not common with vertically integrated utilities operating outside of RTOs.

- RTOs share and optimize most ancillary services in region-wide markets that could provide flexibility more cost-effectively if needed.[117] These markets include a wider variety of ancillary services than those pooled in reserve sharing groups.

Facilitate clean energy policies

- Vertically integrated utilities can plan their generation mix and transmission consistent with initiative from their states. Georgia's success with solar could be attributable to a state utility commission chairman's initiative,[118] while PURPA, as implemented in North Carolina, played a large role there in scaling up solar. Dominion is starting to ramp up solar development as a result of state policies and large customer demand.[119]

- Regional market approaches can help cost-effectively achieve policy goals. For example, a regional procurement approach to satisfying state renewable portfolio standards, can site wind turbines more optimally, for example.[120] However, this may not result in all of the renewables being sited in-state, which may be important to state economic development policies.

- PJM's capacity market is intended to shift investment risks from the consumer to shareholders and has procured abundant gas resources, which PJM credits with helping to displace coal. But the capacity market has not helped further state renewables goals. Nevertheless, utilities can carve themselves entirely out of mandatory capacity market participation, and a state can require that its utilities do so.

Utilities can carve themselves entirely out of mandatory capacity market participation, and a state can require that its utilities do so.

- Importantly, while well-designed markets can facilitate meeting policy goals cost-effectively, RTO membership, even with the competitive costs of renewables, does not guarantee near term renewables build in vertically integrated utilities. For example, Dominion—a PJM member since 2005—had only 1 MW of solar capacity in Virginia in 2015. In 2018, Dominion's solar grew to 824 MW (operational or under development).[121] In response to a new state law in 2018, Dominion announced plans to develop 3,000 MW of solar and wind resources.[122]

- Properly designed state and utility programs can incentivize demand-side resources like energy efficiency and demand response to reduce emissions. Enabling smaller demand-side resources to participate in RTO markets and receive revenue for those services via third-party aggregation can also help grow these resources.

Provide accurate and timely information important to developing non-emitting resources

- RTOs post locational marginal prices, peak load forecast, current total load, and the generation mix on their websites updated in real time (e.g., PJM, SPP, and MISO). Market monitors provide regular, detailed state of the market reports.

- RTOs have relatively sophisticated wind, solar, and demand forecasting, which could help optimize the use of these resources.

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[117] Methods for Procuring Power System Flexibility, Greening the Grid, J. Cochran et al., NREL (2015).
[118] How Georgia Became a Top 10 Solar State, With Lawmakers Barely Lifting a Finger J. Bruggers (Jun. 2018).
[119] Dominion Energy's Solar Energy Report (Nov. 2018).
[120] MISO Value Proposition at 20-21.
[121] Dominion Energy's Solar Energy Report (Nov. 2018) at 6.
[122] Dominion Energy Launches Grid Transformation Program, Paving Way for Virginia's Energy Future With 3,000 Megawatts of New Solar and Wind Planned by 2022 (Jul. 24, 2018).

Is governed in a way that enables or facilitates necessary changes

- State governance of vertically integrated utilities may be relatively lighter than the federal counterpart given that some legislatures are part-time, and state commissions are typically not dedicated to energy regulation like FERC and must divert attention to other public utility issues. Vertically integrated utilities generally don't have the level of stakeholder engagement and trainings as RTOs. This makes it more difficult for nonutility voices to meaningfully engage. State forums may facilitate participation from grassroots and local interests compared to RTO stakeholder processes, but retail issues would still be governed through the states even if the state becomes part of an RTO.
- RTO governance is not without issues and experience disparate power dynamics between incumbents and newer technologies, as well as transparency issues. However, there are some protections built in: RTOs must have an independent board and take into account minority perspectives in stakeholder discussions. They also all have market monitors who are well-equipped to perform analysis independent from the RTOs. RTOs have regional state committees that provide a forum for states to hash out compromises and voice disagreement with the RTO. FERC's process in approving RTO proposals must take into account public comments.
- Any regional compact that optimizes efficiency across multiple states requires some reduction in autonomy for individual members. This has not been a significant issue in SPP or MISO. As mentioned above, state decision making over resource adequacy has been an issue in PJM, but concerns can be mitigated with negotiations when joining.

Table 1 below attempts to succinctly summarize the preceding discussion with the caveat that it cannot capture nuances. Benefits and challenges are indicated with a (+) and (-) respectively. If benefits are greater for one option compared with another, the relative magnitude is indicated with another (+).

Table 1. Clean Energy Scorecard (Summarizing the Discussion Above)

	Vertically Integrated Utility only	Vertically Integrated Utility in RTO	Vertically Integrated Utility in EIM
Access to renewable resources	(-) SE lagging in RE (see NREL data), (+) PURPA, (+) Some states lead on solar in SE	(+) Larger territory, (+) Interconnection and transmission	(++) Larger territory
Access to financing and revenue	(+) Rate-base	(+) Easier contracting, (++) Markets	(+) Markets
Grid flexibility	(+) Balancing services	(++) Balancing services, (+) Larger territory, (++) Unit commitment & SCED, (++) Congestion management, (+) Settlement intervals that match dispatch intervals	(++) Larger territory, (+) SCED, (+) Settlement intervals that match dispatch intervals
Facilitates clean energy, climate, and clean air policies	(+) State policies and utility resource adequacy planning	(+) State policies and utility resource adequacy planning, (-) Capacity markets	(+) State policies and utility resource adequacy planning

	Vertically Integrated Utility only	Vertically Integrated Utility in RTO	Vertically Integrated Utility in EIM
Accurate, transparent, and timely information	(-) Transparency, data access	(++) Pricing, markets and operations data	(+) Pricing, markets and operations data
Fair governance	(-) Relatively resource constrained state governance bodies	(+) Minority rights, (+) Market monitoring, (+) Governing body dedicated to energy, (-) States have limited role in RTO policy-making	(+) Market monitoring

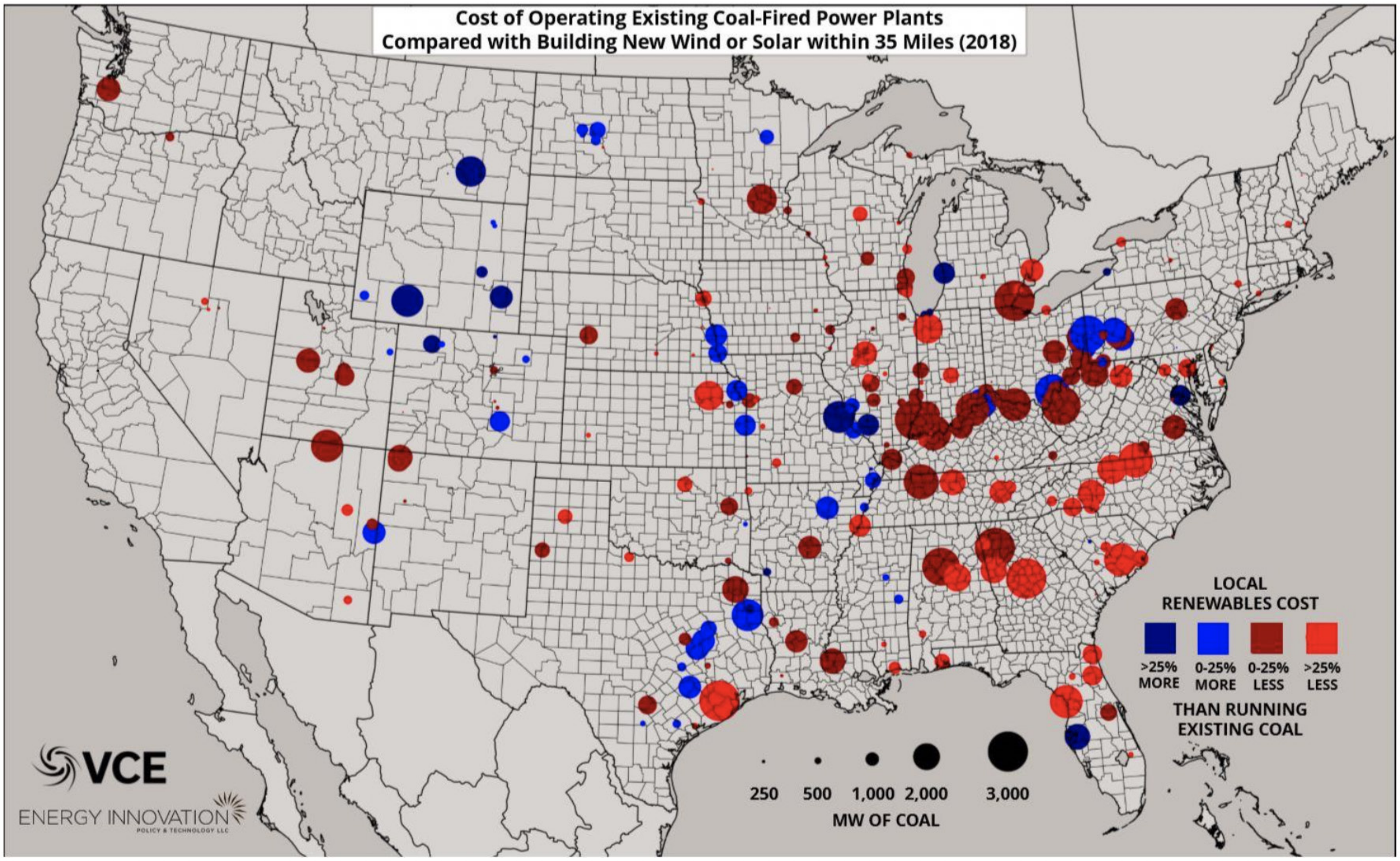
B. Some Evaluation Criteria for Ensuring Customers Fairly Benefit from Cost-Effective Electricity Services

Facilitate efficient operation of the generation fleet

- Compared to utilities operating largely on their own, an RTO in the Southeast would produce significant production cost savings. A 2019 report estimates the potential benefits of an RTO to North Carolina of up to almost $600 million a year.[123] Dominion, a vertically integrated utility in Virginia and a small part of North Carolina, estimated that it saved $75 million and $109 million in energy production costs in 2013 and 2014 respectively by joining PJM.[124]
- Cost savings scale with size. For example, merging Duke Energy Corporation and Duke Progress Energy was expected to save $364.2 million between 2012 and 2016 through joint dispatch of the two utilities' generation assets and an additional $330.7 million in savings through sharing and implementing best practices for fuel procurement and use over the same period.[125]
- Must-run designations on baseload plants can significantly erode savings from a regional market, however. A 2016 study estimating the production cost savings of forming a regional market between most of Colorado and Wyoming projected that maintaining must-run designations would reduce potential savings of 9.4% to 5.7%.[126] For must-run designations on coal plants, the difference in cost savings is likely even larger in the Southeast, where coal is even less cost-competitive.

[123] Potential Benefits of a Regional Wholesale Power Market to North Carolina's Electricity Customers, J. Chang et al. (Apr. 2019).
[124] Id. citing to Direct Testimony of Alan Meekins on Behalf of Virginia Electric and Power Company, Before the State Corporation Commission of Virginia, Case No. PUE-2015-00022, Feb. 27, 2015, and Direct Testimony of Alan Meekins on Behalf of Virginia Electric and Power Company, Before the State Corporation Commission of Virginia, Case No. PUE-2014-00033, May 2, 2014.
[125] NCUC Order Approving Merger at p. 17. The merger applicants committed to deliver $650 million in savings to customers over the next five years. Id.
[126] Production Cost Savings Offered by Regional Transmission, J. Chang et al. (Dec. 2016) at p. 36.

Figure 13. Cost of Operating Existing Coal Plants Compared with New, Local Wind or Solar



Source: Energy Innovation and Vibrant Clean Energy. Bloomberg New Energy Finance has a similar map showing the long-run operating margins for U.S. coal plants in the Southeast are the direst nationally.[127]

Facilitate transparency and information sharing

- From the perspective of most customers, it is the accuracy of pricing and transparency of the retail rate that enables them to rationally decide when to curtail or consume electricity and thereby optimize their use consistent with the scarcity of the resource. The utility delivering energy to end-use consumers has a role in educating them on how energy use can impact their overall bills.
- To achieve retail rates that reflect the value of energy, the wholesale prices must be accurate. RTO and EIM prices can reflect the value of wholesale energy through five-minute dispatch and settlements. All RTOs have a way to reflect the scarcity of energy and short-term reserves when the grid is stressed. However, these mechanisms limit prices from fully capturing the value of energy during scarcity.[128]
- Transparency in prices can also help inform regulators as to whether a utility is indeed procuring services at least cost, or whether alternatives available through the market could be a more cost-effective substitute.

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[127] Half of U.S. Coal Fleet on Shaky Economic Footing, W. Nelson and S. Liu, BNEF (Mar. 26, 2018) at 10.

[128] See the text accompanying footnote 96 on incremental energy offer caps. ERCOT in Texas is the exception, as it allows for energy prices to rise to $9,000 per MWh, much higher than the offer caps imposed in other RTOs. Market Design Executive Summary, ISO/RTO Council (Aug. 2017) at 5. Market power impacting prices is important to guard against; however, a recent study of Texas' transition from a decentralized bilateral trading market to a centralized auction market found that information aggregation has a positive effect on market efficiency that dominates any change in market power incentives. The Efficiency and Environmental Impacts of Market Organization: Evidence from the Texas Electricity Market, P. Brehm and Y. Zhang (2019) at 1, 33.

- RTOs provide trainings related to how wholesale market activities impact consumers.

Ensure prudent investments and fair allocation of risks and costs

- Anyone can make investment decisions that in hindsight were not a good idea. The consequences of these are, by design, borne by customers in vertically integrated utilities (if they are not excluded from rates by the state) and shareholders in restructured states. This risk is still borne by customers even if that vertically integrated utility is in an RTO as long as regulators approve those costs in rates, but greater transparency from markets could better inform regulators as to whether utility investments are cost-effective. In practice, customers in restructured states may still bear some stranded costs through taxes or other channels.

- If a vertically integrated utility joins an RTO, special care must be taken to ensure that the utility does not have incentives to finance unnecessary investments through customers in order to make a profit through the markets. Even if the customers share in the profits, doing so converts them into involuntary shareholders. For example, Dominion's ability to profit from sales to the energy market could encourage the utility to build more than what it needs to serve its customers.[129]

Allow for robust, cost-effective demand-side programs

- Vertically integrated utilities can implement demand response and energy efficiency programs; however, customers may only see savings rather than receive compensation for their response. For example, Southern Company offers energy efficiency and demand response programs, along with a few more tools for larger consumers to manage energy usage.[130]

- RTO markets can compensate energy efficiency and demand response providers like supply-side resources for services rendered at wholesale, at least in states that do not bar third-party aggregators. Allowing demand-side resources to earn wholesale market revenues can further develop them and bring additional savings to consumers. This can be layered on top of utility programs if these resources can provide distinct services at the retail and wholesale levels.

Allow consumer choice in generation sources, rate plans

- Vertically integrated utilities can implement different rate plans and may be able to offer green tariffs to larger customers.

- RTOs and EIMs don't necessarily provide choice in their markets, but customers in retail choice regions in RTOs can execute physical power purchase agreements to procure certain types of generation.

- A large corporate purchaser like Walmart may be able to buy energy at wholesale from RTOs directly and serve as its own retail provider, but this is not common.

- Virginia, which is a vertically integrated state in PJM, recently allowed large customers wishing to purchase 100% renewable energy to leave the incumbent utility, Dominion, because it didn't offer the same service. Regulators earlier had denied Walmart's request to leave Dominion because of concerns that it would raise rates for the remaining captive customers.

Give consumers a meaningful voice in its governance

- This metric is similar the one above on fair governance for nonincumbent technologies, and the evaluation discussion is nearly identical.

[129] § 56-249.6. Recovery of fuel and purchased power costs. D.1. Dominion is allowed to keep 25% of off-system energy sales.
[130] Southern Company Asset Strategy, Planning and Risks (2017).

Table 2. Consumer Scorecard (Summarizing the Discussion Above)

	Vertically Integrated Utility Only	Vertically Integrated Utility in RTO	Vertically Integrated Utility in EIM
Efficient operation of fleet	(-/+) Depends on utility and extent of self-scheduling	(++) SCED, (+) Larger territory	(+) SCED, (++) Larger territory
Prudent investments, fair allocation of risks and costs	(-) Rate-base	(-) Rate-base	(-) Rate-base
Transparency and information	(-) Transparency, data access	(+) Transparency, (++) Pricing data	(+) Transparency, (+) Pricing data
Demand-side programs	(+) State, utility programs	(++) Wholesale compensation, (+) State, utility programs	(+) Wholesale compensation, (+) State, utility programs
Consumer choice	(-) Captive customers	(-) Captive customers	(-) Captive customers
Fair governance	(-) Relatively resource constrained state governance bodies	(+) Minority rights, (+) Market monitoring, (+) Governing body dedicated to energy regulation	(+) Market monitoring

VI. CONCLUSIONS

Given the goals discussed herein and depending on the details, enhancing competition at the wholesale level is likely to benefit consumers, nonincumbent developers, and power system efficiency and flexibility. The governance framework associated with RTOs is also likely to yield more transparency in costs and pricing, as well as provide a more formal way for minority perspectives to be heard. While enhancing wholesale competition and regionalization are important in the long run for a more flexible and low-emissions grid, these changes alone cannot displace state policies designed to meet specific environmental targets, especially in the near term.

Consumers would likely see savings but not necessarily more choice if their utilities join RTOs or EIMs with monopoly protections intact. Studies have been consistent in showing that regional markets would benefit customers by bringing down wholesale electricity costs. However, savings must flow back to customers in their retail rates for them to realize the benefit. A vertically integrated utility joining an RTO will not enable customers to choose their preferred generation—for that, carve-outs to the utility's exclusive franchise or retail choice reform would be needed. Similarly, investment decisions by the utility that balloon in costs would still be borne by customers unless these costs are excluded from rate base or more general changes at the retail level are made.

RTOs offer more transparency, educational training, and market monitoring compared to utilities in non-RTO regions, which is important for customers as well as developers.

In terms of renewables development and integration, participation in RTOs and EIMs offer advantages. Interconnection and the ability to connect far-flung but cheap renewables with customers through transmission is an advantage of RTOs. For example, RTO regions have seen more wind generation development compared to comparably wind-rich regions outside of RTOs.[131] Markets with large geographic reach can improve the flexibility of the power system, which is important in the long run as more variable renewables come online. Regionalization

[131] The Role of RTO/ISO Markets in Facilitating Renewable Generation Development, J. Pfeifenberger et al. (Dec. 2016) at pp. 1, 6. See also Senate Bill 350 Study at pp. XI–5 (as of 2014, over 77% of wind generation capacity was installed in areas with regional electricity markets).

can also bring more diverse resources and load, with the appropriate configuration. The Western EIM is a good example of a market that has produced cost savings, renewables integration with reduced reserve requirements, and reductions in CO_2 emissions. Similarly, for the Southeast, midcontinent wind would be a good complement to Southeastern solar resources. Evening out the peak demand across time zones is another advantage to larger grids. A North Carolina and South Carolina RTO could realize some of the benefits of RTOs but wouldn't be able to achieve the scale of customer savings and renewables integration of a larger RTO.[132]

While economics and markets are beginning to drive more renewables build because of their declining costs, policies and utility planning are still important to incentivizing renewables development in the short term. Recent renewable growth in the Southeast has been driven by utility procurement of large-scale solar that now clears utility economic screens, as well as by PURPA. Other drivers include sales into PJM and North Carolina's renewable portfolio standard.[133] State renewable portfolio standard requirements have helped spur roughly half of all U.S. renewable electricity generation and capacity growth since 2000, but that role has diminished to under 30% in 2018.[134]

RTO regions have seen more wind generation development compared to comparably wind-rich regions outside of RTOs.

The current tensions between mandatory capacity markets and state public policies have created concern over the states' ability to efficiently and effectively implement their policies. Nevertheless, how resource adequacy is handled for new RTO members could be negotiated upfront. A state could require that its utilities carve themselves out of PJM's mandatory capacity market, for example, and exactly how that mechanism works could be tailored to suit a new member joining an RTO.

If scaling up non-emitting technologies and efficiently providing customers with reliable service are the goals, then joining an RTO would likely produce the most benefits compared to other options discussed here, especially if that RTO is large and is able to diversify resources and load. An EIM with sufficient diversity is also a good option. More work needs to be done to model how the current resource mix in the Southeast would evolve and how prices would change under various options. In particular, modeling would be helpful to better understand how much variable renewables and flexible demand-side resources would come online and emitting resources would retire as a result of market forces under various options.

[132] This possibility, called GridSouth, was considered in the wake of FERC Order 2000, where FERC required each public utility that owns, operates, or controls transmission facilities to file proposals to form or participate in an RTO. FERC Order 2000. FERC conditionally approved GridSouth, but ultimately state regulators and utility executives could not agree to the changes needed to satisfy the independence requirement of RTOs and the regional scope FERC sought. Competition Case Study the Southern Grids: 2000-2006, K. Konschnik (2019).
[133] U.S. Renewable Portfolio Standards, 2019 Annual Status Update, G. Barbose, Lawrence Berkeley National Laboratory, at p. 4 (Jul. 2019) at 16 and 18.
[134] Id. at 4.

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