**UNITED STATES OF AMERICA**
**BEFORE THE**
**FEDERAL ENERGY REGULATORY COMMISSION**

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| Modernizing Electricity Market Design | )<br>)<br>) | Docket No. AD21-10-000 |

# SOUTHWEST POWER POOL MARKET MONITORING UNIT PRE-TECHNICAL CONFERENCE COMMENTS

Keith Collins, Executive Director, and Jodi Woods, Manager, of the independent Market Monitoring Unit (MMU) of Southwest Power Pool, Inc. (SPP) are pleased to offer these written comments as part of this docket.[1] We hope these comments facilitate the Commission's consideration of a new framework for modernizing electricity market design in Commission jurisdictional organized wholesale electricity markets.

## I. Background

The Southwest Power Pool is at the forefront of integrating renewable generation into its markets. In 2014, wind nameplate capacity (8.5 GW) represented 19 percent of SPP's peak load. Today, wind nameplate capacity (29.8 GW) represents 58 percent of SPP's peak load. In 2020, wind generation surpassed coal generation as the largest source of generation in the SPP footprint, representing 31.3 percent of total generation for the year.[2] In May 2021, wind generation reached a peak penetration of 84 percent. This would have been up to 95 percent penetration had wind resources not been curtailed.

[1] Keith Collins will be participating in Panel 4. Jodi Woods will be participating in Panel 1.
[2] 2020 Annual State of the Market report, Southwest Power Pool Market Monitoring Unit, August 12, 2021, p. 37: https://spp.org/documents/65161/2020%20annual%20state%20of%20the%20market%20report.pdf.

Wind has been the primary source of new capacity added in the market over the past several years, and given the generation in the interconnection queue, we expect renewable generation – both wind and solar – to dominate new generation additions in the coming years. For instance, over the last three years, SPP added almost 9,000 MW of new generation, 98.5 percent of which was wind.[3] In the generation interconnection queue, renewable and storage resources represent 95 percent of the total, whereas thermal resources represent just five percent.[4] Wind represents 95 percent of the resources that have executed generation interconnection agreements, and solar represents four percent of resources with executed generation interconnection agreements.[5] We observe that these generation additions and potential additions are not because of pricing signals from the energy and ancillary services markets alone, but include factors that are external to the SPP markets.

The integration of renewable generation is not without its challenges. Because wind is a forecasted resource, actual generation can deviate significantly from expected values. On average, absolute day-ahead wind forecast errors were about 4.5 percent in 2020.[6] While this is very good, 4.5 percent of SPP's highest wind generation level is 950 MW.[7] This represents SPP's second largest single resource contingency[8] and is larger than the maximum spinning reserve requirement for the last few years.[9] Moreover, 4.5 percent is an average forecast error, and there are times when the day-ahead forecast error can be over 30 percent.[10] When wind is forecast at 20,000 MW, a 30 percent error results in a difference of 6,000 MW. This is more

[3] 2020 Annual State of the Market report, pp. 214-5.
[4] 2020 Annual State of the Market report, p. 35.
[5] 2020 Annual State of the Market report, p. 36.
[6] Real-time wind forecasts that go into the 5-minute market are much more accurate with an absolute error of about 0.7 percent on average in 2020, and a maximum absolute error of 9.1 percent for the same period.
[7] The highest wind generation level in SPP was 21,133 MW on March 29, 2021.
[8] SPP's largest single resource is the Wolf Creek nuclear unit at 1,241 MW. The next largest resource is 936 MW.
[9] Since 2019, the maximum spinning reserve requirement has not exceeded 800 MW.
[10] In 2020, the maximum absolute day-ahead wind forecast error was 30.5 percent in October.

than two and a half times the amount of upward ancillary services procured by SPP at any given time.[11]

Given the challenges with managing these large forecast errors, SPP operators are constantly reviewing grid conditions and taking active steps to secure the system from wind forecast uncertainties. Specifically, SPP operations have dedicated staff[12] to evaluate grid conditions and make recommendations to operators to manually add capacity in advance to provide backup capabilities in the event that wind generation deviates from forecast. These staff not only evaluate conditions for the current day, but also look ahead several days to determine if any advance commitments are needed.

The SPP Market Monitoring Unit has observed that SPP operators make manual commitments of generation on a regular basis as part of this process. At certain times, we have observed over 80 resources and thousands of megawatts committed to ensure reliability in the event of forecast errors. As the market monitor, we review these commitments and have found that given the variability and uncertainty of wind forecasts, the actions of operators to secure system reliability can be justified.

However, these operator actions do have significant consequences on market outcomes. Specifically, these actions lower prices in the energy and ancillary services markets. As SPP operators add more resources, the additional supply shifts the supply curve outward,[13] causing otherwise economic resources to run lower on their offer curve, thus earning less revenue. These manual commitments also reduce the incidence of scarcity events. While these actions can

[11] Since 2014, the maximum operating reserve requirement, which includes regulation up, spinning reserves and supplemental reserves, has been about 2,200 MW.
[12] This team is known as the Uncertainty Response Team.
[13] This outward shift is the result of minimum generation levels, as these manually committed resources typically operate at their minimum output level.

improve system reliability, they do so by lowering prices not only in intervals without scarcity, but also during periods where scarcity would have occurred. Without products to compensate for flexibility, resources are not appropriately compensated for their services and prices are inaccurate. Moreover, this has also led to an increase in make-whole payments, as both economic and additional resources cannot always recover their costs.

Another consequence of the increasing renewable penetration in the SPP market is the increase in the frequency of negative prices. This is because renewable resources offer generation into the market and can be profitable at negative offer levels because of production tax credits. In 2020, over 10 percent of all real-time market prices were negative, and almost 5 percent of day-ahead prices were negative. In spring 2021, almost 20 percent of all real-time market prices were negative, and nearly 13 percent of day-ahead prices were negative. As renewable capacity and generation continues to increase in the SPP market, we would anticipate that the incidence of negative prices will increase. This will continue to create challenges as these negative prices reduce net revenues, which could send retirement signals to resources that are standing by to provide flexibility and dependability.

## II. Understanding the current market problem

The market will get what it pays for. Before the integration of new generation resources, such as wind and solar, a produced megawatt often came packaged with different capabilities,[14] though the amounts of each varied. Because these capabilities were often a bundled deal, these capabilities were not defined, quantified, or paid for separately from the produced energy. Markets drive efficiency, so renewables evolved to provide inexpensive energy without the

[14] These capabilities include flexibility, dependability, availability, resiliency, and quality.

packaged extras. The reason renewables do not provide these extras is because the market has not asked for them.

Likewise, the market will not get what it does not pay for. The increase in renewable-produced energy is causing average marginal energy prices to decrease. For resources with fixed costs and non-decreasing fuel costs, these lower prices cause insufficient cost recovery, and therefore, a likely exit from the market. However, operators often commit these very resources outside of the market clearing engine, leveraging their additional capabilities to avoid reliability issues. Often, when these issues are successfully avoided, these reliable resources are merely made whole to their costs, while other resources receive infra-marginal profits. When resources are started to enhance reliability, they often produce their minimum output at a financial loss until needed. Absent any other payment, this means that they are losing money so that they can help ensure reliability. In other words, if they responded rationally to the energy price, they would not be available and system reliability would decline. The incentivized behavior is opposite of the desired behavior.

This does not mean that renewables are fundamentally unfit for energy markets or that competition should not drive down minimum output limits and minimum run times or cause market exit. The current incentives are not fundamentally flawed—just incomplete. Renewables did not cause this problem, but have only highlighted the shortcoming of the market by responding rationally. Now that technology has allowed us to separate produced energy from these necessary extras, we must define, quantify, and value them. If we want to continue to ensure reliability in addition to produced megawatts, we must incentivize it. We outline a framework below for how this can be accomplished.

## III. A new framework for modernizing markets

Given the challenges with integrating renewable resources, and thinking about how markets will need to change and evolve to meet these the challenges of integrating more renewables in the electricity markets, we have contemplated a new framework. This framework consists of the following elements: flexibility, dependability, availability, resiliency, and quality. Going forward, the markets will need to evolve to address each of these elements.

### A. Flexibility

As variable and forecasted resources have higher penetrations in the electricity markets, both expected and unexpected changes in supply increase needs for ramping and resource flexibility. We have observed that this includes both short-term ramping needs (i.e., 10 minutes) and longer-term flexibility needs.[15]

Ultimately, it is important to consider the type of ramping that the system needs. For instance, SPP averaged 3.7 scarcity intervals per day in 2020. Over 90 percent of scarcity events were regulation related scarcity events. Of these events, 85 to 90 percent were resolved in 10 minutes or less. The issue in this case is not with resources offering in flexibility; we find that very, very few scarcity events have occurred as a result of participants not offering in or maintaining enough rampable capacity. The problem is that the system is not managing ramping resources to meet short-term flexibility needs. By not accounting for the flexibility and ramping available to the market, the market uses the ramp to meet energy needs and does not save it to

[15] As indicated earlier, the difference in forecast errors between the day-ahead and real-time contribute to this distinction in short-term and long-term flexibility needs.

meet flexibility needs. Ramping products implemented in CAISO and MISO, and soon to be implemented in SPP in early 2022, are primarily concerned with addressing these very short, transitory ramping related needs. Ultimately, these needs are about short-term ramping management and can be addressed by planning for short-term needs.

Longer-range ramping products such as SPP's proposed uncertainty product are designed to consider ramp over a longer period of time, such as an hour, and will also be procured in the day-ahead market. This is designed to consider not just 10-minute ramp management, but to ensure that sufficient resources are available to provide ramping. Not only can it pre-position resources and account for offline resources to be ready should a ramping need arise, it also pays resources and sends price signals for providing this service. SPP operators are performing comparable actions today. However, this occurs without sending price signals or making direct payments for the ramping services they provide.

Ultimately, ramping and flexibility have value before scarcity occurs. In a system with a high penetration of variable energy resources, managing ramping and uncertainty is more challenging, and it requires flexibility to meet uncertain system needs. With a product, market participants will get pricing signals before energy scarcity or emergency conditions occur. This can help ensure resources, that may otherwise retire, are available to provide needed flexibility.

### B. Dependability

A key assumption as part of the commitment and dispatch in the electricity markets is that generation performs as expected. However, we increasingly see that resources are not capable of performing at expected levels. This can occur for different reasons. First, forecasted resources, such as wind and solar, have a range of potential outcomes based on a probability distribution. For instance, a forecasted resource may be expected to provide 100 MW.

However, the system may get 120 MW or it may get 80 MW, or some other value. Second, dispatchable demand response resources may be rated at a certain level, but may not perform consistently with the rated level given the time of day, day of week, or period of year.[16] Third, resources may be called to start-up within a certain timeframe, but may fail to do so. For instance, a fast start resource may be expected to start in 10 minutes, but instead comes on in 15 minutes. In each of these cases, the challenge that operators face is that the expected output is not dependable. The lack of dependability can drive uncertainty, which in turn can result in operator actions to address uncertainty including out of merit commitment of generation, which in turn distorts price signals.

Increasing dependability requires proper accounting of resource capabilities, and incentives and penalties based on performance. The key is to reward resources that perform dependably and to penalize those that do not perform as expected. This can provide incentives to add firming technologies to increase dependability, or alternatively rate resources more conservatively with respect to expected performance. The more dependable a resource is, the less uncertainty there is in the market, resulting in fewer operator actions to address uncertainty.

### C. Availability

While SPP does not have a capacity market, it does have a capacity construct. In fact, SPP's generation compared to load at peak exceeds 130 percent based on MMU estimates.[17] In February 2021, SPP experienced extreme winter weather that stressed SPP operations and markets. During the February 2021 winter storm, SPP's issue was not a lack of capacity. SPP had plenty of capacity relative to peak load needs. The reason for the loss of load during the

[16] For further discussion, see: http://www.caiso.com/Documents/ReportonDemandResponseIssuesandPerformance-Feb252021.pdf.
[17] 2020 State of the Market report, p. 217.

event was the result of lack of generator availability. Half of SPP's natural gas fleet (18.3 GW) was on outage because of lack of fuel. Capacity cannot do anything without fuel availability. Many of the generators in SPP's system do not have backup or dual fuel capabilities. This was a significant issue.

This event was precipitated by cold weather that significantly affected natural gas systems. However, what if a future event is affected by a wind icing event or dense unexpected cloud cover? This could result in significant loss of generation that would require backup or standby generation to be available to offset this loss. In fact, a week prior to the February 2021 winter weather event, SPP experienced a significant wind icing event that resulted in the loss of thousands of megawatts of renewable generation. During that event, natural gas resources had fuel availability to back-up the loss of wind generation. Things could have turned out differently during that period had conditions been worse on the natural gas system.

In addition to fuel availability, maintenance outages can also affect availability and availability can affect maintenance outages. Maintenance outages are necessary to produce reliable energy. To serve annual load peaks due to heating and cooling needs, maintenance outages are typically avoided in summer and winter so that generation can be available. Due to increased system volatility, flexible generation must also be available in spring and fall. Although SPP can deny a maintenance outage, this process by no means optimizes resource availability and does not account for economics. Denied maintenance outages can turn into forced outages. Delaying outages also decreases dependability. An organized, shorter-term availability incentive, however, could optimize availability in the SPP market while optimizing outage timing for market participants.

Addressing availably by ensuring that effective incentives are in place is paramount to ensure that effective generation is available to meet system needs in the event of unexpected supply or demand conditions. After SPP's experience during the February 2021 winter weather event, we see availability incentives as appropriate and necessary to ensure system reliability. We see a mechanism that secures and incentivizes availability in advance of the energy and ancillary services markets as preferable to a crisis model that relies on random events to signal scarcity.

**D. Resiliency**

While resiliency has received some discussion over the past few years, we define resiliency here as the ability to serve load in extreme conditions and contingencies. As noted earlier, SPP experienced significant system stress during the February 2021 winter weather event. The SPP system would not have been able to meet system needs without significant support from imports from outside regions, including PJM and MISO. These imports were driven by scarcity pricing signals. Thankfully, during this event, there was sufficient generation available throughout the Eastern Interconnection to provide the resiliency SPP needed to meet demand. Relying on resiliency from scarcity prices and imports worked in this case. However, going forward this approach may not work for the next event should conditions be more widespread.

Ensuring resiliency requires effective planning and consideration of potential events, including extreme weather events, pipeline outages, wind turbine icing, drought, wildfires, floods, hurricanes, and others. While ensuring resiliency does have a significant planning element, there are examples today of resilient mechanisms that affect energy and ancillary service markets. For instance, the New York ISO has Minimum Oil Burn procedures to manage natural gas pipeline contingencies, as well as a Thunderstorm Alert procedure that adds pre- and post-contingency constraints to the market models. In both cases, these procedures are designed to increase system resiliency and have the potential to affect energy and ancillary service market outcomes. Each region may face unique threats that may need to be addressed through specialized rules to address resiliency needs.

### E. Quality

While we often think of a megawatt as a megawatt, some megawatts have valuable qualities beyond serving load that others do not. For example, inertia and voltage support do more than simply provide energy for load. As generators with physical inertia retire and inverter-based resources replace them, physical inertia may need to be replaced by synthetic inertia.[18] There is also a growing demand for green energy. If customers value green energy more than $CO_2$-emitting energy, then the market should reflect the value of this quality. Going forward, requirements must be defined and quantified. With defined and quantified requirements, the market can identify ways to secure and pay for the desired energy qualities.

## IV. Conclusion

We applaud the Commission for taking this time to consider how the energy and ancillary services markets will need to evolve to integrate new resources. We hope the Commission finds our experience and framework helpful as it considers potential changes moving forward.

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[18] For further discussion, see: https://australiainstitute.org.au/wp-content/uploads/2021/03/VEPC-system-security-report-FINAL.pdf.

Respectfully submitted,

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