
**MONTHLY AUDIT REPORT ON THE
SOUTHEAST ENERGY EXCHANGE MARKET**

November 2022

Prepared by:

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Independent Market Auditor

December 22, 2022

I. OVERVIEW

This is the Auditor report for the month of November 2022 on the Southeast Energy Exchange Market (SEEM). SEEM is a regional energy market that uses a centralized intra-hour energy exchange to create bilateral trades among its various participants. The automated market accepts bids and offers from the SEEM members and clears individual bilateral trades every 15 minutes using available transmission capability. The cleared trades are matched to maximize the trading benefit among all participants. The 15-minute trading extends the prevailing hour-ahead bilateral trading in the region and allows for fuller utilization of the available transmission capability.

SEEM was created and is governed by the SEEM Membership Board. The automated architecture of SEEM was developed and is operated by Hartigen and who also serves as the SEEM Administrator. Our auditing role is directed by the Membership Board in accordance with elements specified in the Market Rules as developed by the Membership Board and approved by the Federal Energy Regulatory Commission (FERC). The results of our auditing are reported to the Membership Board through submission of this Monthly Report. We also have a duty under the Market Rules to respond to inquiries made by regulators and other oversight authorities, including FERC. We received no such inquires during the period of this report.

The SEEM auditing framework is based on the provisions of the SEEM Market Rules Section VI. D. (Auditing Process). These duties are in four main categories. The first duty is to analyze SEEM input, constraints, and matching results to determine it operates in accordance with the SEEM Rules (SEEM Rules Sections VI.D.1, VI.D.1.4). This is the main day-to-day auditing work and represents most of the activities reported herein.

A second auditing responsibility is ensuring participants have access to SEEM data in accordance with the SEEM Rules (Sections VI.D.2). Access to SEEM data involves allowing each SEEM participant to review its own bids and offers and to view matches made by the system. We are in receipt of the bid and offer data and have verified that this data is available daily.

A third area of responsibility is to report to the Membership Board regarding (1) the reliability and accuracy of the SEEM System, and (2) any complaints received from a Participant to the Membership Board and to investigate further at the Board's direction (SEEM Rules Sections VI.D.3, VI.D.1.5). Section II of this report fulfils our duty to report on the reliability and accuracy of the SEEM system to the Board. Regarding reporting on complaints from participant, we did not receive any during the period of this report.

Finally, we have the duty to respond to written questions from Participants, FERC, NERC, applicable state commissions in the region, Tennessee Valley Authority's Inspector General, and any other applicable regulators that oversee the electric operations of any Member regarding the

integrity of the matching process (SEEM Rules Sections VI.D.6). We did not receive any such requests during the period of this report.

In the remainder of the report (Section II), we provide the result of our analysis of the first main area of responsibility: to analyze of input, constraints, and matching results to determine whether SEEM operates in accordance with the SEEM Rules. This is in two main parts. First, we review various daily screens that ensure specific inputs, constraints, and energy exchanges have met certain validation metrics. Second, we review the economic activity in SEEM to provide an overview of its functioning and performance.

II. AUDITING RESULTS

In this section, we discuss the results of our monthly auditing. In subsection A, we show the results of our daily screening. In subsection B, we present an overview of the economic activity.

A. Market Operation Screens

We calculate screens, metrics, and other analysis on a daily basis using market data and other data to meet the auditing obligations in the Market Rules. The screens and metrics are developed in accordance with specific Market Rules requirements and are divided into three main categories:

- Verification of bid/offer parameters;
- Evaluation of SEEM matching; and
- Verification of SEEM System Constraints.

The following three subsections describe the screens used for our auditing. Unless otherwise indicated, these screens are calculated daily for all fifteen-minute intervals.

1. Bid/Offer Parameters

The following screens audit the information provided in participant bids and offers.

- Offers (bids) from a participant must have Participant-Specific Constraints identifying at least three other non-affiliated Participants that can be matched as counterparties;
- All offers and bids properly include a source or sink;
- Each offer and bid should have a delivery interval;
- Bids and offers are in 4 MW increments;
- “All or Nothing Selection” indicated; and
- The Network Map is accurate (monthly).

2. Matching

The following screens are used to audit the SEEM matches:

- Match price does not exceed the bid price and is greater than the offer price;
- Buyer and seller are distinct participants;
- Check participant-specific constraints for any changes (monthly);
- Verify calculation of SEEM benefits;
- Any maximum offer price declared must bind the transaction; and
- Each match has a NERC Tag.

3. Constraints

The following screens audit the SEEM constraints.

- Transaction volume must not exceed offer or bid volume;
- The SEEM algorithm shall only make energy exchanges that yield positive benefits to both buyer and seller; and
- Transaction volume over each segment shall not exceed the segment ATC.

We have data transfer and storage architecture in place to receive data from the SEEM market to support the calculation of these screens. We have developed data processing procedures for each one of the daily screens listed above. We applied the screens to the November SEEM data and found that in all intervals, the screens have indicated that requirements have been met. However, we did identify minor validation failures that we believe is a flaw in the rules and that should be eliminated.¹

For the monthly audit of the system map, we will use the initial map developed by Hartigen and the SEEM working groups as a basis for comparing subsequent maps. This map is an electronic file of all sources, sinks, balancing areas, and SEEM transmission segments that comprise the SEEM system. A SEEM segment is an interface between two balance areas and in many cases is synonymous with the path used by the system. In some cases, the segments are strung together to allow SEEM matches across multiple systems, forming a multi-segment path. The SEEM model allows any number of SEEM segments to be linked in order to find a beneficial trade.

By using this initial map as a basis of comparison, we will take advantage of the lengthy technical process used by SEEM and the SEEM members to develop the map and assume it is accurate. It would not be practicable to replicate this initial map. Each month we will check the map against the map using the prevailing system map and evaluate any changes. This process will begin with the December report.

¹This flawed rule is in section IV.C.6.b.ii.(c). The rule prohibits energy exchanges that cause:

For matched Bids and Offers, the Energy Exchange Price to (i) be less than the Offer Price plus half of net Losses, as calculated per Section IV.C.5.a, and (ii) more than the Bid Price minus net Losses, as calculated per Section IV.C.5.a.

This rule conflicts with a second rule in section IV.C.6.b.iii. Both rules are intended to ensure that the algorithm only creates matches that benefit both parties to the transaction. The second rule achieves this objective and is fully consistent with the SEEM settlement rules, including how losses are allocated to buyers and sellers. Hartigen correctly applied this rule, and we validated that all matches were consistent with this rule. The flawed rule is not consistent with the SEEM settlement rules and not consistent with the allocation of losses to buyers and sellers and was therefore not implemented by Hartigen. If Hartigen had implemented this rule, some beneficial transactions would not have cleared, which would have been inconsistent with the intent of the SEEM rules. Because this rule was not implemented, some of the matches failed to validate against this rule. Hence, we recommend the SEEM Membership Board address this by deleting this flawed rule.

In a similar fashion, we will evaluate changes to participant-specific constraints. These are counterparties and balancing areas acceptable to each participant for trades in SEEM, as well as any max price constraint. We will compare the participant-specific constraint each month and evaluate any changes. This screen will begin in the December report.

B. Market Activity

In this section, we summarize and discuss the market operations and outcomes. This discussion is intended to illuminate how the system is operated and the outcomes it is producing. We summarize our results and discussion in two main areas. First, is an overall review of the market trading, including volumes, prices, and characteristics of participation. Second is an evaluation of network usage, focusing on the key transmission paths and constraints.

1. Market Outcomes

Figure 1 shows a breakout of daily SEEM bids and offers. Each bar represents a day of SEEM activity. The bids and offers are divided between cleared offers to buy (blue bar above the x axis) and cleared offers to sell (blue bars below the x axis). The transparent bar stacked above and below the bids and offers are the uncleared bids and offers. The figure also shows a volume of transactions depicted in red, which represent a very small volume of cleared matches that failed transmission scheduling.

Figure 1 shows that activity was episodic in the first weeks of the SEEM launch. Cleared transactions ranged as high as 2,600 MWh and on several days, it was less than 100 MWh (and as low as 3 MWh).² This variation is likely the result of weather fluctuations combined with limited experience of the SEEM participants at this early stage. The figure shows that the total bids and offers are significantly larger than the bids and offers actually matched. As we discuss further in Table 1 below, the data suggests that the uncleared bids and offers generally do not clear because the bids and offers fail to coincide, rather than due to unavailable transmission capability on the SEEM segments. Nonetheless, these results raise no concerns at this early stage.

Finally, Figure 1 shows that instances when transactions are matched and subsequently fail due to inadequate transmission capability are rare (shown in red). We attribute these instances to occasional delays in approving transmission service requests (TSRs), so the tag is denied for being late. It may also result from insufficient ATC when the TSR is processed. SEEM downloads ATC values from OASIS twice an hour, so it is possible that real-time changes occur that result in insufficient ATC by the time the TSR is submitted.

² We report our volumes in MWh. Each match is for 15-minutes, so a match of 4 MW is one MWh.

Figure 1: Daily Bids and Offers
November 2022

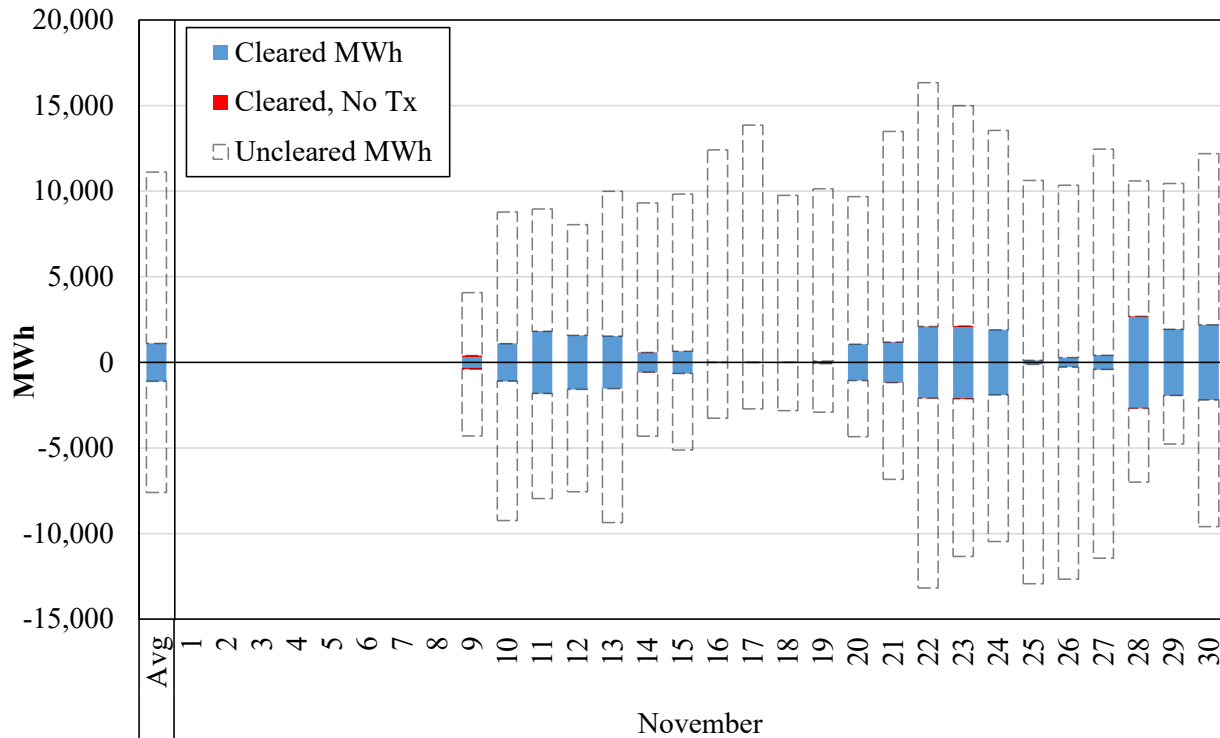


Figure 2 shows more detail on the matched bid and offers by showing the matches by market participant. Like the prior figure, the bars above the x axis are cleared bids and the bars below are cleared offers. The bars in this figure are divided by participant, each color a different participant (whether the participant is a buyer or seller). We do not reveal the identity of the participants for confidentiality reasons.

Figure 2 shows that on the buyer side, about 30 percent of the matched bids were by a single participant and the two largest buyers accounted for matched 60 percent of the bids. On the seller side, the largest seller accounted for 77 percent of the matched offer and the top two sellers account for 89 percent. These statistics provide a view into the character of SEEM participation and activity but are not a basis for drawing conclusions regarding the performance of the SEEM at this of development.

Figure 3 is comparable to Figure 2, but shows the revenues of matched transactions rather than the volumes. These are highly correlated with the transaction volumes shown in Figure 2. This suggests prices are not widely different among different matched transactions.

Figure 2: Volumes of Matched Bids and Offers
November 2022

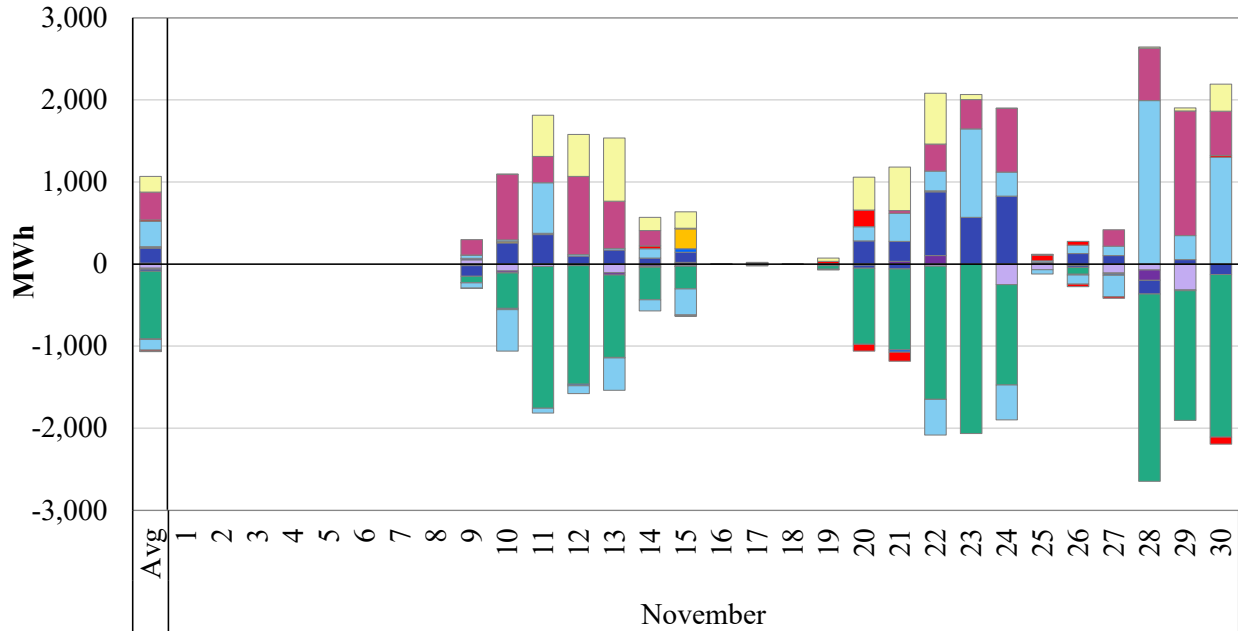
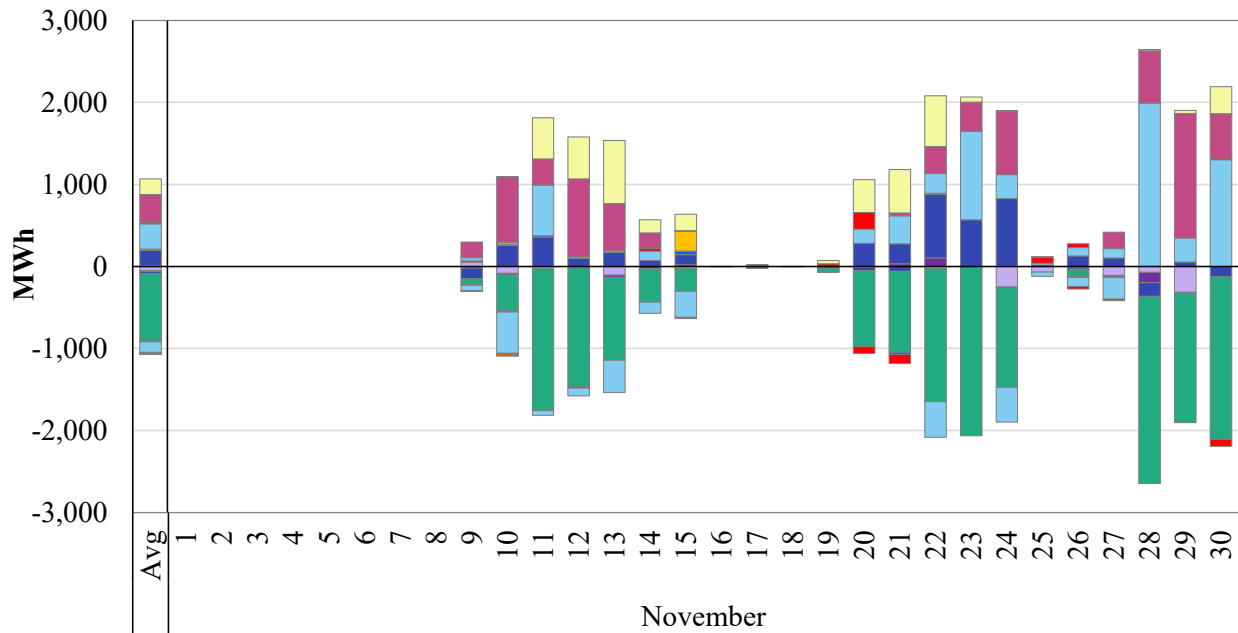


Figure 3: Revenues of Matched Transactions
November 2022



2. Network Usage

In this subsection, we show the average transaction prices and evaluate the usage of different segments of the SEEM network. Figure 4 and Figure 5 show the average daily peak and off-peak prices for the month shown in bars. The figure also shows the range of daily weighted average prices by path from the highest to the lowest-priced path.

Figure 4: Average SEEM Clearing Prices: System-Wide and by Path
Peak Hours – November 2022

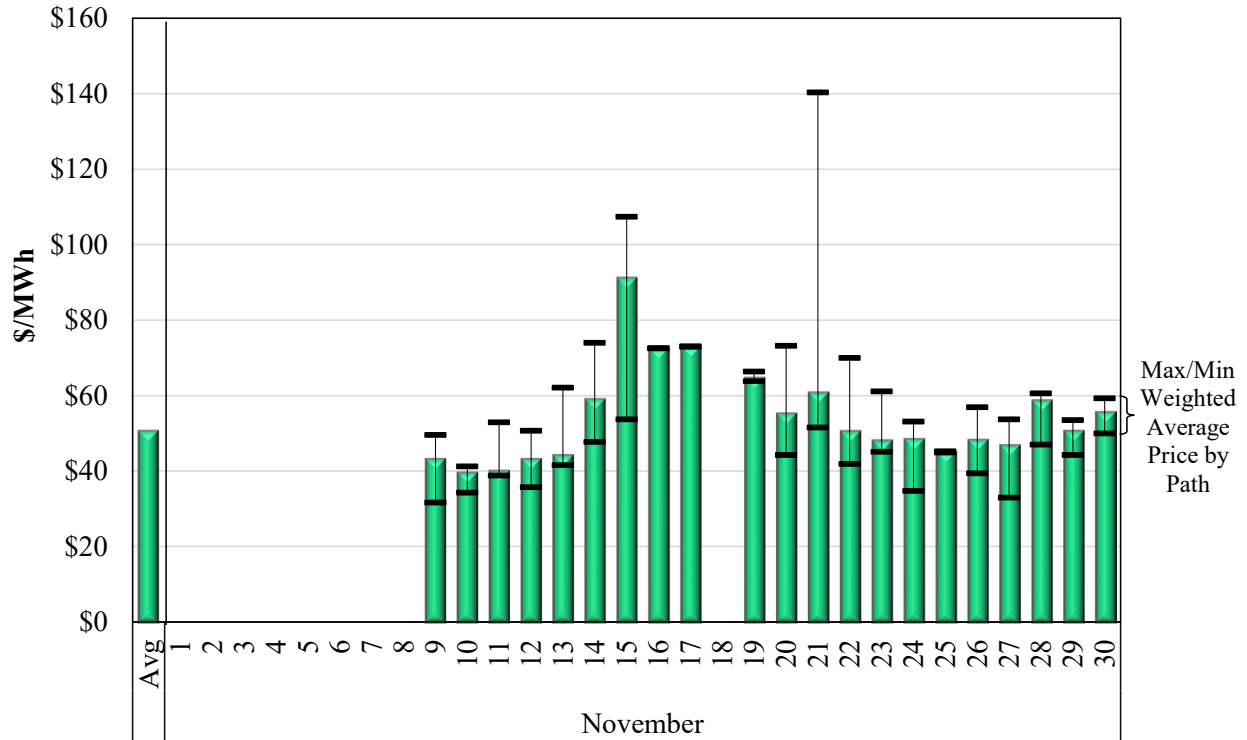
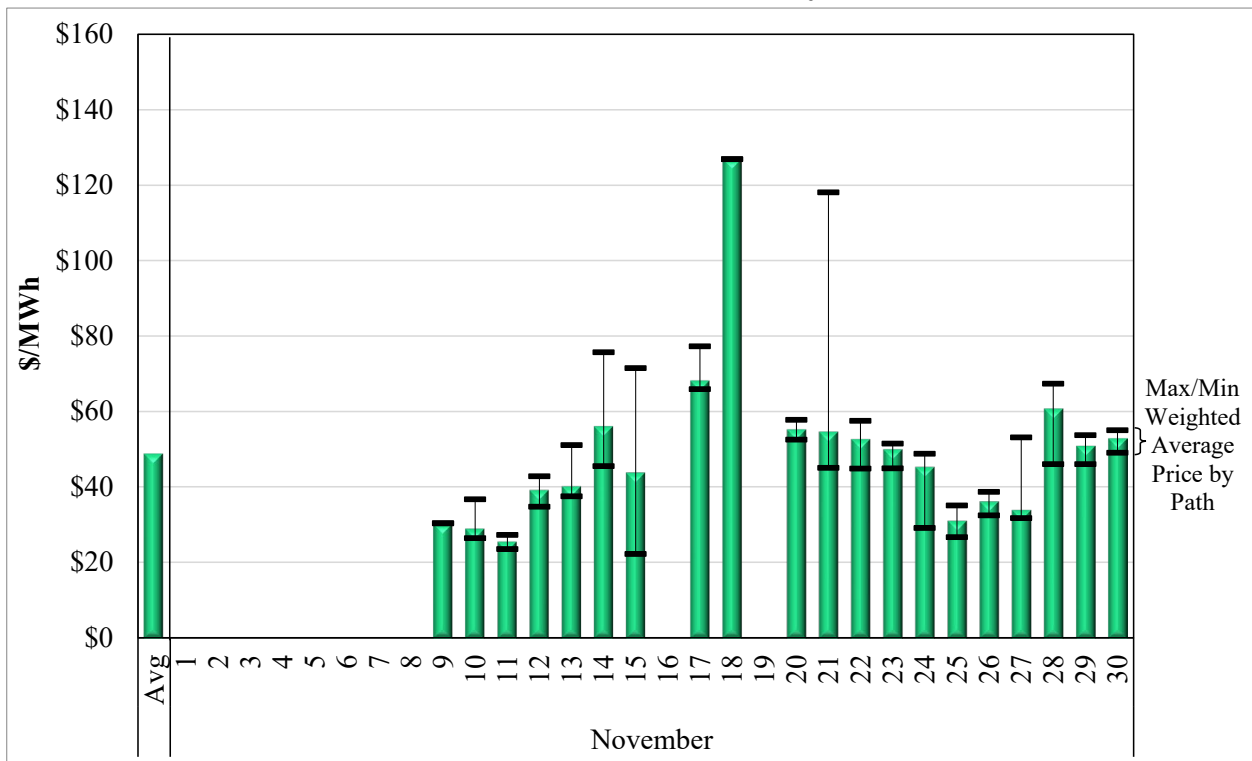


Figure 5: Average SEEM Clearing Prices: System-Wide and by Path
Off-Peak Hours – November 2022



The figures show that prices were slightly higher in on-peak hours but that the highest-priced transactions by path occurred on an off-peak period, although this average was set by a single transaction. The two figures show that the value of transactions can vary significantly by path. This likely is the result of certain paths linking areas where the most beneficial trade occur – paths linking low-cost to high-cost areas. Transmission constraints can contribute to higher prices between such areas. If a constraint prevents higher total flows between two (beneficial trading) areas, the average transaction price will be higher than if sufficient transmission capability was available to allow all beneficial trades to clear between the areas.

Accordingly, we evaluate the trading in the SEEM by path segments. We gathered ATC and trading statistics for the 180 SEEM segments available to the model. The data includes the median, maximum, and minimum ATC values during each interval, as well as the total MWh that cleared using that segment. We calculate a “load factor” based on the scheduled transactions and ATC on the segment during each 15-minute interval.

Table 1 shows an excerpt of our statistics. The table displays the top 13 segments that had more than 1,000 MWh of transactions scheduled during the month. The full data for all segments with more than 10 MWh scheduled during the month is provided in Appendix A. In addition to the ATC and schedule values, the Table also shows how each segment was utilized by interval during the Month. For each segment, the interval was either:

- (1) Partially used (MWs cleared were less than ATC);
- (2) Fully Used, ATC was used up for the interval;³
- (3) Unavailable ATC (ATC was less than 4 MW at the start of the interval); and
- (4) Uncleared (no schedules on the segment).

The table shows the most common case for these segments is segment was case (4), when ATC was available, but the segment was not used because there were no beneficial transactions that could be cleared by the SEEM model over the intervals (over 350,000 segment intervals). The second most common case was case (3), where ATC was not sufficient to clear any SEEM transactions (over 16,000). The third most common case was case (1), intervals where the segment was partially used about (4,400). Finally, in a small number of intervals, case (2) prevailed where the segment was completely scheduled in the interval (196).

³ ATC less the MW schedule was less than 4 MW (i.e., no additional SEEM transaction could be cleared).

Table 1: Most Used SEEM Segment Statistics

Segment	ATC			Loading MWhs	Factor	Partially Used		Fully Used		Unavailable		Uncleared	
	Min	Median	Max			Intervals	%	Intervals	%	Intervals	%	Intervals	%
P/LGEE/LGEE-TVA//	0	1,382	1,623	18,393	3.27%	773	37%	1	0%	406	20%	891	43%
S/TVA/LGEE-SOCO//	0	2,828	2,828	9,215	0.67%	447	22%	0	0%	104	5%	1520	73%
SS/SOCO/TVA-SOCO//	307	836	1,289	6,179	1.45%	245	12%	0	0%	0	0%	1826	88%
S/TVA/LGEE-DUK//	0	355	355	5,136	2.94%	325	16%	0	0%	104	5%	1642	79%
S/SC/SOCO-SC//	0	1,244	2,111	4,205	0.73%	329	16%	5	0%	114	6%	1623	78%
S/TVA/LGEE-TVA//	237	2,828	2,828	3,889	0.27%	333	16%	0	0%	0	0%	1738	84%
S/SC/DUK-SC//	0	1,707	2,772	2,747	0.32%	196	9%	2	0%	24	1%	1849	89%
S/DUK/TVA-DUK//	128	543	692	2,725	0.95%	210	10%	0	0%	0	0%	1861	90%
S/DUK/TVA-SC//	63	543	692	2,683	0.94%	181	9%	2	0%	0	0%	1888	91%
SS/SOCO/SOCO-SC//	52	416	665	1,390	0.70%	89	4%	0	0%	0	0%	1982	96%
SS/SOCO/TVA-SC/MULTIPATH//	52	416	665	1,274	0.64%	131	6%	0	0%	0	0%	1940	94%
S/AECI/AECI-TVA//	0	401	449	1,151	0.78%	241	12%	3	0%	472	23%	1355	65%

Overall, these statistics indicate that many segments remain available for SEEM trades. At this juncture, it remains unclear if these are less valuable to the participants or arising from the early stage of the current SEEM market. Despite the general availability of segment capacity, there are significant instances of insufficient ATC. Most prominently, Exhibit A shows the AEC-Southern Company segment and the AEC-Duke segment, both had insufficient ATC 39 percent of the time. These same two segments were the ones most often fully scheduled by SEEM, although this only occurred in 81 intervals.

A constrained segment is one where either ATC is insufficient (less than 4 MW) prior to SEEM matching, or the segment is completely used by SEEM in at least one interval during the hour. These two circumstances occur in over 16,000 segment intervals and almost always because the ATC is insufficient to schedule (<4 MW) rather than because it is filled by a SEEM match. The data cannot reveal the extent to which these instances of insufficient ATC was constraining SEEM matches. This is because we cannot observe if SEEM would have matched a transaction had the ATC been available during that interval.

III. CONCLUSION

We reviewed the operation of SEEM for November 2022. We have developed operational procedures to validate the market rules and constraints of SEEM. Aside from the one instance where we the validation rule is errant, as we noted, all our screens have been validated and we conclude the SEEM had operated within the rules and constraints. We also have evaluated the SEEM outcomes and have not identified significant market issues.

APPENDIX A

Segment	ATC			MWs	Loading Factor	Partially Used		Fully Used		Unavailable		Uncleared	
	Min	Median	Max			Intervals	%	Intervals	%	Intervals	%	Intervals	%
P/LGEE/LGEE-TVA//	0	1,382	1,623	18,393	3.27%	773	37%	1	0%	406	20%	891	43%
S/TVA/LGEE-SOCO//	0	2,828	2,828	9,215	0.67%	447	22%	0	0%	104	5%	1520	73%
SS/SOCO/TVA-SOCO//	307	836	1,289	6,179	1.45%	245	12%	0	0%	0	0%	1826	88%
S/TVA/LGEE-DUK//	0	355	355	5,136	2.94%	325	16%	0	0%	104	5%	1642	79%
S/SC/SOCO-SC//	0	1,244	2,111	4,205	0.73%	329	16%	5	0%	114	6%	1623	78%
S/TVA/LGEE-TVA//	237	2,828	2,828	3,889	0.27%	333	16%	0	0%	0	0%	1738	84%
S/SC/DUK-SC//	0	1,707	2,772	2,747	0.32%	196	9%	2	0%	24	1%	1849	89%
S/DUK/TVA-DUK//	128	543	692	2,725	0.95%	210	10%	0	0%	0	0%	1861	90%
S/DUK/TVA-SC//	63	543	692	2,683	0.94%	181	9%	2	0%	0	0%	1888	91%
SS/SOCO/SOCO-SC//	52	416	665	1,390	0.70%	89	4%	0	0%	0	0%	1982	96%
SS/SOCO/TVA-SC/MULTIPATH//	52	416	665	1,274	0.64%	131	6%	0	0%	0	0%	1940	94%
S/AECI/AECI-TVA//	0	401	449	1,151	0.78%	241	12%	3	0%	472	23%	1355	65%
S/DUK/SOCO-DUK//	0	2,019	2,219	919	0.09%	69	3%	0	0%	40	2%	1962	95%
SS/SOCO/SOCO-DUK//	490	903	1,235	889	0.19%	67	3%	0	0%	0	0%	2004	97%
SS/SOCO/SOCO-SOCO	40,482	41,073	41,351	600	0.00%	30	1%	0	0%	0	0%	2041	99%
S/TVA/AECI-SOCO//	0	10	280	564	1.56%	46	2%	81	4%	800	39%	1144	55%
S/TVA/AECI-DUK//	0	10	280	521	1.46%	26	1%	81	4%	808	39%	1156	56%
S/CPL/CPL-SC//	1,111	3,850	4,319	434	0.02%	41	2%	0	0%	0	0%	2030	98%
S/SC/CPL-SC//	48	1,792	2,874	430	0.05%	35	2%	0	0%	0	0%	2036	98%
S/CPL/SC-CPL-SC//	31	2,082	4,549	389	0.03%	34	2%	0	0%	0	0%	2037	98%
S/SC/SOCO-CPL-SC//	0	1,925	2,399	384	0.05%	29	1%	0	0%	120	6%	1922	93%
SS/SOCO/SC-SOCO//	182	386	452	267	0.14%	26	1%	0	0%	0	0%	2045	99%
S/MEAG/MEAG-SOCO	2,401	2,601	2,761	260	0.02%	11	1%	0	0%	0	0%	2060	99%
S/SC/CPL-SOCO//	2,807	3,307	3,847	258	0.01%	18	1%	0	0%	0	0%	2053	99%
S/CPL/DUK-SC//	22	3,008	4,319	254	0.02%	10	0%	0	0%	0	0%	2061	100%
SS/SOCO/SOCO-TVA//	65	1,457	2,286	233	0.03%	24	1%	0	0%	0	0%	2047	99%
SS/GTC/SOCO-GTC//	11,655	12,117	13,094	231	0.00%	10	0%	0	0%	0	0%	2061	100%
S/TVA/SOCO-TVA//	86	2,440	2,940	229	0.02%	21	1%	0	0%	0	0%	2050	99%
S/DUK/TVA-CPL-SC//	0	539	692	198	0.07%	12	1%	0	0%	74	4%	1985	96%
S/MEAG/SOCO-MEAG	2,840	3,000	3,200	158	0.01%	12	1%	0	0%	0	0%	2059	99%
S/DUK/DUK-SOCO//	0	2,031	2,335	151	0.01%	18	1%	0	0%	4	0%	2049	99%
S/MEAG/TVA-MEAG//	41	52	153	149	0.46%	6	0%	9	0%	0	0%	2056	99%
S/CPL/TVA-DUK//	0	276	276	145	0.11%	6	0%	0	0%	64	3%	2001	97%
S/DUK/CPLW-CPL-SC//	0	621	1,243	145	0.04%	6	0%	0	0%	74	4%	1991	96%
S/TVA/LGEE-CPLW//	0	276	276	143	0.11%	6	0%	0	0%	108	5%	1957	94%
SS/SOCO/DUK-SOCO//	0	609	914	134	0.05%	14	1%	0	0%	124	6%	1933	93%
S/SCEG/SCEG-SC//	1,071	2,938	6,100	124	0.01%	23	1%	0	0%	0	0%	2048	99%
S/SC/SCEG-SC//	897	1,522	2,753	118	0.02%	22	1%	0	0%	0	0%	2049	99%
S/SCEG/SCEG-SOCO//	953	2,588	4,460	109	0.01%	23	1%	0	0%	0	0%	2048	99%
S/CPL/DUK-CPL-SC//	12	3,634	7,698	101	0.00%	13	1%	0	0%	0	0%	2058	99%
SS/SOCO/SCEG-SOCO	19	128	151	100	0.16%	19	1%	0	0%	0	0%	2052	99%
S/DUK/SC-DUK//	0	1,586	2,803	100	0.01%	7	0%	0	0%	367	18%	1697	82%
S/SC/SOCO-DUK//	0	2,061	2,399	99	0.01%	6	0%	0	0%	84	4%	1981	96%
S/DUK/DUK-SC//	0	2,317	2,821	92	0.01%	43	2%	0	0%	8	0%	2020	98%
S/SCEG/SOCO-SCEG//	0	1,183	2,728	91	0.02%	21	1%	0	0%	102	5%	1948	94%
S/TVA/AECI-TVA//	0	10	280	64	0.16%	9	0%	5	0%	732	35%	1325	64%
S/MEAG/DUK-MEAG//	0	98	173	59	0.12%	7	0%	0	0%	52	3%	2012	97%
S/AECI/TVA-AECI//	0	0	651	53	0.07%	10	0%	0	0%	1,560	75%	501	24%
S/SCEG/SC-SCEG//	607	3,891	6,106	45	0.00%	14	1%	0	0%	0	0%	2057	99%
S/SC/SOCO-SCEG//	637	1,114	2,391	44	0.01%	13	1%	0	0%	0	0%	2058	99%
S/TVA/SOCO-AECI//	0	622	622	43	0.01%	8	0%	0	0%	145	7%	1918	93%
S/SCEG/DUK-SCEG//	0	325	338	39	0.03%	9	0%	0	0%	98	5%	1964	95%
S/MEAG/MEAG-TVA//	0	101	121	38	0.09%	4	0%	0	0%	100	5%	1967	95%
S/MEAG/MEAG-DUK//	0	155	240	37	0.05%	4	0%	0	0%	6	0%	2061	100%
S/MEAG/SC-MEAG//	1	40	96	33	0.15%	1	0%	3	0%	4	0%	2063	100%
SS/SOCO/TVA-SCEG/M	3	195	238	32	0.03%	8	0%	0	0%	12	1%	2051	99%
S/SC/DUK-SOCO//	111	3,307	3,657	28	0.00%	5	0%	0	0%	0	0%	2066	100%
S/DUK/TVA-SCEG//	0	262	263	27	0.02%	5	0%	0	0%	4	0%	2062	100%
SS/GTC/TVA-GTC//	26	222	335	25	0.02%	3	0%	0	0%	0	0%	2068	100%
S/DUK/TVA-SOCO//	128	543	692	24	0.01%	3	0%	0	0%	0	0%	2068	100%
S/DUK/CPL-SCOCO//	1,150	2,037	2,335	23	0.00%	3	0%	0	0%	0	0%	2068	100%
S/CPL/CPL-SCOCO//	823	6,238	7,338	23	0.00%	3	0%	0	0%	0	0%	2068	100%
S/MEAG/SCEG-MEAG//	10	15	17	12	0.16%	0	0%	4	0%	0	0%	2067	100%
S/DUK/DUK-SCEG//	0	262	263	12	0.01%	4	0%	0	0%	4	0%	2063	100%
S/SC/SC-SOCO//	1,397	2,562	3,703	11	0.00%	11	1%	0	0%	0	0%	2060	99%
S/TVA/LGEE-AECI//	0	622	622	10	0.00%	3	0%	0	0%	93	4%	1975	95%