



**The Reliability and Markets (R&M) Committee  
is expected to consider  
R&M Committee Agenda Item 5:**

***Recommendation regarding Day-Ahead  
Market Price Correction for Certain Days in  
February-March 2023 - Inclusion of ESR CLR  
in Load Zone Pricing***

**at its meeting on June 19, 2023.**

**The Board of Directors is expected to hear  
the R&M Committee's recommendation on  
this matter at the Board meeting on  
June 20, 2023.**

**Attached are the Board and Committee  
materials in relation to these agenda items.**



## **Item 5: Recommendation regarding Day-Ahead Market Price Correction for Certain Days in February-March 2023 – Inclusion of ESR CLR in Load Zone Pricing**

*Kenan Ögelman*

Vice President, Commercial Operations

Reliability and Markets Committee Meeting

ERCOT Public

June 19, 2023

# Reliability and Markets Committee Request

Why this is being presented today:

ERCOT staff requests that the Reliability and Markets Committee recommend approval of, and the ERCOT Board of Directors (Board) approve, the proposed correction of Day-Ahead Market (DAM) prices for certain Operating Days in February and March 2023 (Board Decision Template Attachments A through B).

Key determinants are:

- Incorrect incorporation of Energy Storage Resource (ESR) charging, or load in the calculation of Load Zone pricing is the principal cause.
- The error was introduced during a Market Management System (MMS) upgrade.
- ERCOT implemented additional MMS model validation steps to ensure this doesn't happen in the future.
- The impact of the correction is relatively small – The highest payment is \$305,890 and the highest charge is \$299,440.

# Background on Incorrect Load Zone Calculations

- On March 9, 2023, ERCOT discovered an error in the ERCOT Market Management System (MMS) that impacted Load Zone calculations for both the Real-Time Market (RTM) and the DAM. Market Notice [M-C030923-01](#) was issued on March 9, 2023, at 4:14 PM, notifying the market of the issue and ERCOT's intent to seek Board approval for price correction for Operating Days (ODs) meeting the criteria for significance, as specified by ERCOT Protocol Sections 6.3(7)(b) and 4.5.3(6)(b).
- ERCOT Protocol Sections 6.6.1.2 and 6.6.1.4 require that, for the RTM, the calculation of Load Zone prices exclude the Controllable Load Resources (CLRs) associated with Energy Storage Resources (ESRs). Contrary to ERCOT Protocol Sections 6.6.1.2 and 6.6.1.4, an error identified by ERCOT resulted in the ERCOT MMS including those CLRs in the calculation of Real-Time Load Zone prices.
- Due to the same error, the DAM was also impacted where CLRs associated with ESRs were incorrectly mapped to a Load Zone. As a result of this, the Load Distribution Factors for those CLRs were included in the calculation of Day-Ahead Shift factors for certain Load Zones.

# Root Cause Analysis and Communication

- ERCOT determined that the error was related to the method in which MMS determines if an Electrical Bus is associated with an ESR Load Resource. The MMS relies on a set of tables from the Network Model Management System (NMMS) to determine if an Electrical Bus is associated with an ESR Load Resource. Those associated Electrical Buses are then excluded from Load Zone Price calculations. However, this table dependency and a recent change to one of those NMMS tables resulted in the MMS incorrectly including those Electrical Buses in the Load Zone calculations.
- ERCOT staff implemented a fix to the MMS on March 8, 2023, that resolved this issue. This took effect for the RTM for Operating Day (OD) March 8, 2023, and for the DAM for OD March 9, 2023.
- Potential impact to the RTM was limited to February 8, 2023 through March 7, 2023.
- Potential impact to the DAM was limited to February 9, 2023 through March 8, 2023.
- Upon completion of the investigation, an update notice, [M-C030923-02](#), was sent on April 25, 2023 @ 3:56 PM.
- ERCOT has since implemented additional MMS model validation steps to ensure this doesn't happen in the future.

# Analysis of Settlement Impacts

- ERCOT Protocol Sections 6.3(7)(b) and 4.5.3(6)(b) require that the absolute value impact to any single Counter-Party (CP) meet one of the following two criteria before seeking approval from the Board.
  - i. 2% and also greater than \$20,000; or
  - ii. 20% and also greater than \$2000.
- ERCOT has concluded that there were zero ODs for the RTM that met the criteria for seeking Board approval for price correction.
- ERCOT has concluded that there were 16 ODs for the DAM that met the criteria for seeking Board approval for price correction.

# DAM Impact Analysis Details

- The number of Counter-Parties meeting one of the two criteria for significance are shown in the table below for each OD that met the criteria for seeking Board approval for price correction for the DAM:

Operating Day	Counter-Parties meeting criteria in Protocol Section 4.5.3(6)(b)(i)	Counter-Parties meeting criteria in Protocol Section 4.5.3(6)(b)(ii)
2/10/2023	3	2
2/11/2023	2	2
2/13/2023	4	0
2/15/2023	1	2
2/16/2023	5	6
2/18/2023	2	5
2/19/2023	0	1
2/20/2023	2	7
2/22/2023	3	4
2/27/2023	0	1
2/28/2023	1	5
3/1/2023	0	2
3/2/2023	5	3
3/3/2023	1	2
3/5/2023	0	1
3/8/2023	0	1

# DAM Impact Analysis Details

- For each OD that met the criteria for DAM, the table below has the maximum estimated change in charges due to ERCOT. Negative amounts are increased payments to Market Participants; positive amounts are increased charges. The percent amount is the absolute value of the percent impact to the previously settled net amount due to/from ERCOT.

Operating Day	Change in Statement Charges Due to ERCOT (\$ thousands)	
2/10/2023	\$(152.36)	1.40%
2/11/2023	\$(7.58)	0.10%
2/13/2023	\$121.90	1.73%
2/15/2023	\$(84.39)	1.06%
2/16/2023	\$(133.77)	1.35%
2/18/2023	\$(305.89)	3.67%
2/19/2023	\$49.50	0.75%
2/20/2023	\$31.63	0.43%
2/22/2023	\$(193.66)	1.65%
2/27/2023	\$(24.31)	0.30%
2/28/2023	\$(8.52)	0.08%
3/1/2023	\$24.34	0.20%
3/2/2023	\$299.44	2.78%
3/3/2023	\$32.34	0.37%
3/5/2023	\$108.96	1.16%
3/8/2023	\$70.74	0.43%



# Appendix: Load Zone Calculation Example

# Load Zone LMP Calculation

- The Load Zone LMP is calculated as the load weighted average of all Electrical Bus LMPs in the Load Zone.

## North Load Zone LMP (LZ\_NORTH)

● Bus 1	● Bus 2	● Bus 3
LMP: \$10	LMP: \$20	LMP: \$15
Load: 5 MW	Load: 15 MW	Load: 10 MW
Total Load = 30 MW		

$$Bus_1 = \$10 \times \frac{5 \text{ MW}}{30 \text{ MW}} = \$1.67$$

$$Bus_2 = \$20 \times \frac{15 \text{ MW}}{30 \text{ MW}} = \$10.00$$

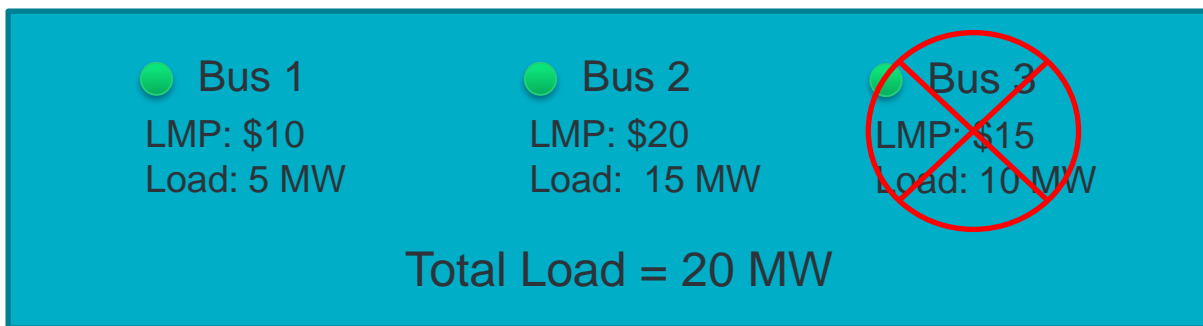
$$Bus_3 = \$15 \times \frac{10 \text{ MW}}{30 \text{ MW}} = \$5.00$$

$$LMP_{LZ\_NORTH} = \$1.67 + \$10 + \$5 = \$16.67$$

# Load Zone LMP Calculation Excluding ESR CLR

- Electrical Bus 3 is now mapped to a Controllable Load Resource associated with an Energy Storage Resource.

## North Load Zone LMP (LZ\_NORTH)



$$Bus_1 = \$10 \times \frac{5 \text{ MW}}{20 \text{ MW}} = \$2.50$$

$$Bus_2 = \$20 \times \frac{15 \text{ MW}}{20 \text{ MW}} = \$15.00$$

$$LMP_{LZ\_NORTH} = \$2.50 + \$15.00 = \$17.50$$



**Date:** June 13, 2023  
**To:** Board of Directors  
**From:** Bob Flexon, Reliability and Markets (R&M) Committee Chair  
**Subject:** Day-Ahead Market Price Correction for Certain Days in February-March 2023 – Inclusion of ESR CLRs in Load Zone Pricing

**Issue for the ERCOT Board of Directors**

**ERCOT Board of Directors Meeting Date:** June 20, 2023

**Item No.:** 13.1

**Issue:**

Pursuant to paragraph (6) of Protocol Section 4.5.3, Communicating DAM Results, whether the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) should approve price corrections for Day-Ahead Settlement Point Prices (DASPPs) and Day-Ahead Market Clearing Prices for Capacity (DAMCPCs) for certain Operating Days (ODs) in February and March 2023, that were affected by Controllable Load Resources (CLRs) associated with Energy Storage Resources (ESRs) being included in the calculation of Day-Ahead Market (DAM) Load Distribution Factors (LDFs).

**Background/History:**

ERCOT staff has identified the need to have the Board review prices for the DAM for certain ODs in February and March, 2023 for potential correction. The impacted prices include DASPPs and DAMCPCs, as well as the underlying Day-Ahead Locational Marginal Prices (DALMPs).

The ERCOT Protocols require ERCOT to correct prices when invalid prices are identified in an otherwise valid market solution. If ERCOT determines that prices are erroneous, ERCOT must correct the prices before they are final. DAM prices are final at 10 AM on the second Business Day following the OD. However, if ERCOT determines that prices are erroneous and need correction after they are final, then ERCOT shall seek Board review of such prices provided that the impact of the potential price correction meets the Protocol-specified criteria for significance and, within 30 days of the OD, ERCOT notifies Market Participants of the intention to seek Board review.

The Board may review and change prices if ERCOT gave timely notice to Market Participants and the Board finds that such prices should be corrected for an OD. In considering a correction of DAM prices, the Board may rely on the following reasons to find that prices should be corrected:

- Data Input Error: Missing, incomplete, stale, or incorrect versions of one or more data elements input to the market applications may result in an invalid market solution and/or prices.

- Software Error: Pricing errors may occur due to software implementation errors in DAM pre-processing, DAM clearing process, and/or DAM post processing.
- Inconsistency with the Protocols or Public Utility Commission of Texas (PUCT) Substantive Rules: Pricing errors may occur when specific circumstances result in prices that are in conflict with such Protocol language or the PUCT Substantive Rules.

See ERCOT Protocol Sections 4.5.3(4) – (6).

Similarly, in considering a correction of Real-Time Market (RTM) prices, the Board may rely on the following reasons to find that prices should be corrected:

- Data Input Error, as described above.
- Data Output error: These include: incorrect or incomplete data transfer, price recalculation error in post-processing, and Base Points inconsistent with prices due to the Emergency Base Point flag remaining activated even when the Security-Constrained Economic Dispatch (SCED) solution is valid.
- Hardware/Software Error: These include unpredicted hardware or software failures, planned market system or database outages, planned application or database upgrades, software implementation errors, and failure of the market run to complete.
- Inconsistency with the Protocols or PUCT Substantive Rules, as described above.

See ERCOT Protocol Sections 6.3(4) – (7).

On February 8, 2023, an error was introduced into the Market Management System (MMS) process used to determine if an Electrical Bus is associated with a CLR that is part of an ESR. By Protocol, these Electrical Buses are required to be excluded from the LDFs that are used as input into the DAM. They are also required to be excluded as inputs into Load Zone Settlement Point Prices (SPPs) for the RTM. This error resulted in these Electrical Buses not being excluded as required by Protocol, as just described.

On March 7, 2023, the error was discovered, and a fix to correctly map the CLRs associated with ESRs to specific Electrical Buses was implemented on March 8, 2023.

The scope of potential impact to the DAM was limited to February 9, 2023 through March 8, 2023.

The scope of potential impact to the RTM was limited to February 8, 2023 through March 7, 2023.



On March 9, 2023, ERCOT notified Market Participants of the error and, upon completion of an impact analysis, its intent to seek Board review for price correction for any ODs within the affected time period that were found to meet the criteria for significance, in accordance with ERCOT Protocol Section 4.5.3(6)(b) or 6.3(7)(b). See Market Notice M-C030923-01.

On April 25, 2023, ERCOT notified Market Participants of the results of the impact analysis, which identified zero ODs for the RTM and sixteen ODs for the DAM that met criteria for seeking Board approval for price correction. See Market Notice M-C030923-02.

Accordingly, ERCOT requests that the Board:

- (a) Review DASPPs and DAMCPCs for the following ODs:
  - February 10, 2023
  - February 11, 2023
  - February 13, 2023
  - February 15, 2023
  - February 16, 2023
  - February 18, 2023
  - February 19, 2023
  - February 20, 2023
  - February 22, 2023
  - February 27, 2023
  - February 28, 2023
  - March 1, 2023
  - March 2, 2023
  - March 3, 2023
  - March 5, 2023
  - March 8, 2023
- (b) Make a determination as to whether such prices were significantly affected by the error; and
- (c) Direct/authorize ERCOT to correct some or all impacted DASPPs and DAMCPCs for the specified ODs.

Attached hereto are documents containing corrected DASPPs and DAMCPCs for certain ODs in February and March, 2023, as follows:

- **Attachment A** - Corrected DASPPs
- **Attachment B** - Corrected DAMCPCs

**Relevant Protocol Sections:**

**4.5.3 Communicating DAM Results**

- (4) ERCOT shall correct prices for an Operating Day when a market solution is determined to be invalid or invalid prices are identified in an otherwise valid market solution, accurate prices can be determined, and the impact of the price correction is significant. The following are some reasons that may cause an invalid market solution or invalid prices in a valid market solution.
- (a) Data Input error: Missing, incomplete, or incorrect versions of one or more data elements input to the DAM application may result in an invalid market solution and/or prices.
  - (b) Software error: Pricing errors may occur due to software implementation errors in DAM pre-processing, DAM clearing process, and/or DAM post processing.
  - (c) Inconsistency with these Protocols or the Public Utility Commission of Texas (PUCT) Substantive Rules: Pricing errors may occur when specific circumstances result in prices that are in conflict with such Protocol language or the PUCT Substantive Rules.
- (5) For purposes of a price correction performed prior to 1000 on the second Business Day after the Operating Day, the impact of a price correction is considered significant, as that term is used in paragraph (4) above, for the Operating Day when:
- (a) The absolute value change to any single DAM Settlement Point Price at a Resource Node or Day-Ahead MCPC is greater than \$0.05/MWh;
  - (b) The price correction would require ERCOT to change more than ten DAM Settlement Point Prices and Day-Ahead MCPCs; or
  - (c) The absolute value change to any DAM Settlement Point Price at a Load Zone or Hub is greater than \$0.02/MWh.
- (6) All DAM LMPs, MCPCs, and Settlement Point Prices are final at 1000 of the second Business Day after the Operating Day.
- (a) However, after DAM LMPs, MCPCs, and Settlement Point Prices are final, if ERCOT determines that prices qualify for a correction pursuant to paragraph (4) above and that ERCOT will seek ERCOT Board review of such prices, it shall notify Market Participants and describe the need for such correction as soon as practicable but no later than 30 days after the Operating Day. Failure to notify Market Participants within this timeline

precludes the ERCOT Board from reviewing such prices. However, nothing in this section shall be understood to limit or otherwise inhibit any of the following:

- (i) ERCOT's duty to inform the PUCT of potential or actual violations of the ERCOT Protocols or PUCT Rules and its right to request that the PUCT authorize correction of any prices that may have been affected by such potential or actual violations;
  - (ii) The PUCT's authority to order price corrections when permitted to do so under other law; or
  - (iii) ERCOT's authority to grant relief to a Market Participant pursuant to the timelines specified in Section 20, Alternative Dispute Resolution Procedure.
- (b) Before seeking ERCOT Board review of prices, ERCOT will determine if the impact of the price correction is significant, as that term is used in paragraph (4) above, by calculating the potential changes to the DAM Settlement Statement(s) of any Counter-Party on the given Operating Day. ERCOT shall seek ERCOT Board review of prices if the change in DAM Settlement Statement(s) would result in the absolute value impact to any single Counter-Party, based on the sum of all original DAM Settlement Statement amounts of Market Participants assigned to the Counter-Party, to be greater than:
- (i) 2% and also greater than \$20,000; or
  - (ii) 20% and also greater than \$2,000.
- (c) The ERCOT Board may review and change DAM LMPs, MCPCs, or Settlement Point Prices if ERCOT gave timely notice to Market Participants and the ERCOT Board finds that such prices should be corrected for an Operating Day.
- (d) In review of DAM LMPs, MCPCs, or Settlement Point Prices, the ERCOT Board may rely on the same reasons identified in paragraph (4) above to find that the prices should be corrected for an Operating Day.
- (7) As soon as practicable, but no later than 1330, ERCOT shall make available the Day-Ahead Shift Factors for binding constraints in the DAM and post to the Market Information System (MIS) Secure Area.

### **6.3 Adjustment Period and Real-Time Operations Timeline**

- (4) ERCOT shall correct prices for an Operating Day when accurate prices can be determined, the impact of the price correction is determined to be significant,



and one of the following conditions has been met: a market solution is determined to be invalid, invalid prices are identified in an otherwise valid market solution, the Base Points received by Market Participants are inconsistent with the Base Points of a valid market solution, or the Security-Constrained Economic Dispatch (SCED) process experiences a failure as described in Section 6.5.9.2, Failure of the SCED Process. The following are some reasons that may cause these conditions:

- (a) Data Input error: Missing, incomplete, stale, or incorrect versions of one or more data elements input to the market applications may result in an invalid market solution and/or prices.
  - (b) Data Output error: These include incorrect or incomplete data transfer, price recalculation error in post-processing, and Base Points inconsistent with prices due to the Emergency Base Point flag remaining activated even when the SCED solution is valid.
  - (c) Hardware/Software error: These include unpredicted hardware or software failures, planned market system or database outages, planned application or database upgrades, software implementation errors, and failure of the market run to complete.
  - (d) Inconsistency with the Protocols or Public Utility Commission of Texas (PUC) Substantive Rules: Pricing errors may occur when specific circumstances result in prices that are in conflict with such Protocol language or the PUC Substantive Rules.
- (7) All Real-Time LMPs, Real-Time Settlement Point Prices, Real-Time prices for energy metered, Real-Time On-Line Reliability Deployment Price Adders, Real-Time On-Line Reliability Deployment Prices, Real-Time Reserve Prices for On-Line Reserves, Real-Time Reserve Prices for Off-Line Reserves, Real-Time On-Line Reserve Price Adders, Real-Time Off-Line Reserve Price Adders and SASM MCPCs are final at 1600 of the second Business Day after the Operating Day.
- (a) However, after Real-Time LMPs, Real Time Settlement Point Prices, Real-Time prices for energy metered, Real-Time On-Line Reliability Deployment Price Adders, Real-Time On-Line Reliability Deployment Prices, Real-Time Reserve Prices for On-Line Reserves, Real-Time Reserve Prices for Off-Line Reserves, Real-Time On-Line Reserve Price Adders, Real-Time Off-Line Reserve Price Adders and SASM MCPCs are final, if ERCOT determines that prices qualify for a price correction pursuant to paragraph (4) above and that ERCOT will seek ERCOT Board review of such prices, it shall notify Market Participants and describe the

need for such correction as soon as practicable but no later than 30 days after the Operating Day. Failure to notify Market Participants within this timeline precludes the ERCOT Board from reviewing such prices. However, nothing in this section shall be understood to limit or otherwise inhibit any of the following:

- (i) ERCOT's duty to inform the PUCT of potential or actual violations of the ERCOT Protocols or PUCT Rules and its right to request that the PUCT authorize correction of any prices that may have been affected by such potential or actual violations;
  - (ii) The PUCT's authority to order price corrections when permitted to do so under other law; or
  - (iii) ERCOT's authority to grant relief to a Market Participant pursuant to the timelines specified in Section 20, Alternative Dispute Resolution Procedure.
- (b) Before seeking ERCOT Board review of prices, ERCOT will determine if the impact of the price correction is significant, as that term is used in paragraph (4) above, by calculating the potential changes to the Real-Time Market (RTM) Settlement Statement(s) of any Counter-Party on a given Operating Day. ERCOT shall seek ERCOT Board review of prices if the change in RTM Settlement Statement(s) would result in the absolute value impact to any single Counter-Party, based on the sum of all original RTM Settlement Statement amounts of Market Participants assigned to the Counter-Party, to be greater than:
- (i) 2% and also greater than \$20,000; or
  - (ii) 20% and also greater than \$2,000.
- (c) The ERCOT Board may review and change Real-Time LMPs, Real-Time Settlement Point Prices, Real-Time prices for energy metered, Real-Time On-Line Reliability Deployment Price Adders, Real-Time On-Line Reliability Deployment Prices, Real-Time Reserve Prices for On-Line Reserves, Real-Time Reserve Prices for Off-Line Reserves, Real-Time On-Line Reserve Price Adders, Real-Time Off-Line Reserve Price Adders and SASM MCPCs if ERCOT gave timely notice to Market Participants and the ERCOT Board finds that such prices should be corrected for an Operating Day.
- (d) In review of Real-Time LMPs, Real Time Settlement Point Prices, Real-Time prices for energy metered, Real-Time On-Line Reliability Deployment Price Adders, Real-Time On-Line Reliability Deployment Prices, Real-Time Reserve Prices for On-Line Reserves, Real-Time

Reserve Prices for Off-Line Reserves, Real-Time On-Line Reserve Price Adders, Real-Time Off-Line Reserve Price Adders and SASM MCPCs, the ERCOT Board may rely on the same reasons identified in paragraph (4) above to find that the prices should be corrected for an Operating Day.

**Key Factors Influencing Issue:**

- Due to the error of incorrectly including CLRs associated with ESRs in the calculation of DAM LDFs, DASPPs and DAMCPCs on the identified ODs were incorrect and cannot be corrected by ERCOT without authorization from the Board.
- Analysis of the impacts of the pricing error for the impacted ODs has shown that the largest dollar impact to any individual Counter-Party for a single OD is approximately \$117K. For Counter-Parties meeting the dollar impact criteria, the largest percentage impact to a Counter-Party for a single OD is 647.52%
- ERCOT Protocol Section 4.5.3(6)(b) requires ERCOT to seek Board review of prices if the change in DAM Settlement Statement(s) would result in the absolute value impact to any single Counter-Party, based on the sum of all original DAM Settlement Statement amounts of Market Participants assigned to the Counter-Party, to be greater than 2% and also greater than \$20,000, or 20% and also greater than \$2,000.

**Conclusion/Recommendation:**

ERCOT recommends, and the R&M Committee is expected to recommend, that the Board find that DASPPs and DAMCPCs for certain ODs in February and March 2023 were significantly affected by incorrect data being used in the calculation of DAM LDFs and should be corrected, and direct ERCOT to correct the impacted prices for the ODs at issue.



**ELECTRIC RELIABILITY COUNCIL OF TEXAS, INC.**  
**BOARD OF DIRECTORS RESOLUTION**

WHEREAS, paragraph (6) of Protocol Section 4.5.3, Communicating DAM Results, authorizes the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) to approve a price correction for certain prices if ERCOT has determined that such prices have been significantly affected by an error;

WHEREAS, paragraph (6) of Protocol Section 4.5.3, ERCOT staff gave timely notice to Market Participants that Day-Ahead Settlement Point Prices (DASPPs) and Day-Ahead Market Clearing Prices for Capacity (DAMCPCs) for certain Operating Days (ODs) in February and March 2023 were incorrect; that a price correction for each of those ODs met the criteria for “significance” in Protocol Section 4.5.3(6)(b); and ERCOT staff would be seeking Board review of such prices; and

WHEREAS, after due consideration of the alternatives, the Board deems it desirable and in the best interest of ERCOT to correct DASPPs and DAMCPCs for certain ODs in February and March 2023, that were affected by a process error, as recommended by the Reliability and Markets (R&M) Committee;

THEREFORE, BE IT RESOLVED, that the Board hereby (1) determines that DASPPs and DAMCPCs for certain ODs in February and March 2023, were affected by a process error, and (2) directs ERCOT staff to implement the appropriate price corrections pursuant to Protocol Section 4.5.3.

**CORPORATE SECRETARY’S CERTIFICATE**

I, Jonathan M. Levine, Assistant Corporate Secretary of ERCOT, do hereby certify that, at its June 20, 2023 meeting, the Board passed a motion approving the above Resolution by \_\_\_\_\_.

IN WITNESS WHEREOF, I have hereunto set my hand this \_\_\_\_ day of June, 2023.

\_\_\_\_\_  
Jonathan M. Levine  
Assistant Corporate Secretary