



**Item 10: Real-Time Market Price Correction for Software Error on Operating Day February 15, 2021 regarding Deployed Emergency Response Service (ERS)**

*Dave Maggio*

Director, Market Design & Analytics

Urgent Board of Directors Meeting

ERCOT Public

April 13, 2021

## Summary

- Real-Time Market (RTM) prices on Operating Day (OD) February 15, 2021, were impacted by internal software errors in estimated Emergency Response Service (ERS) deployment amounts used to determine Real-Time On-Line Reliability Deployment Price Adders (RTORDPAs).
- Because the deadline for ERCOT to correct prices for the OD has passed, ERCOT is seeking Board determination as to whether prices should be corrected, and direction/authorization from the Board for ERCOT to correct prices for certain Settlement Intervals on OD February 15, 2021.
  - Note: A price correction will not change awarded quantities

# ERCOT Recommendation

ERCOT requests that the Board:

- a) Review Real-Time On-Line Reliability Deployment Price Adders (RTORDPAs), Real-Time On-Line Reliability Deployment Prices (RTRDPs), Real-Time Settlement Point Prices (RTSPPs), and Real-Time Price for Energy Metered for Resources (RTRMPRs) for certain Settlement Intervals on OD February 15, 2021;
- b) Make a determination as to whether such prices were significantly affected by a software error; and
- c) Direct ERCOT to correct some or all such prices for RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for OD February 15, 2021.

# Background

- At 00:17 on February 15, 2021, ERCOT began sending Extensible Markup Language (XML) messages to deploy ERS Resources due to Energy Emergency Alert (EEA) conditions.
- The Market Management System (MMS) began estimating the amount of ERS deployed in order to allow the software to determine the RTORDPAs at the 00:20 Security-Constrained Economic Dispatch (SCED) interval.
  - Per Protocol 6.5.7.3.1(1)(d), estimated ERS deployment is a component that feeds the pricing run used to determine RTORDPAs.
  - ERS deployment estimations are based on:
    - contracted ERS capacities;
    - type of ERS being provided;
    - the relevant time period; and
    - an approximated restoration that is linearly ramped over a 4.5 hour period.
- Because of the duration of the EEA event, ERS Resources remained deployed until their deployment obligations were exhausted entirely.

# Software Errors

- The MMS software contains programming errors that resulted in incorrect MW amounts used for the estimated deployed ERS component of RTORDPA for certain intervals on OD February 15, 2021. Specifically, the logic for estimating the exhaustion of ERS deployment obligations:
  1. Incorrectly calculated ERS-10 and ERS-30 deployments starting from the XML deployment instruction, rather than the end of the 10-minute (for ERS-10) or 30-minute (for ERS-30) ramp times;
  2. Improperly treated Weather-Sensitive (WS) ERS as having the same deployment obligation time as Non-Weather-Sensitive (NWS) ERS; and
  3. Did not properly account for the fact that some ERS Resources may have an obligation for only a subset of the time periods within the overall ERS deployment timeframe.

# RTORDPA logic did not reflect actual ERS performance obligations

- Protocol Section 3.14.3.3(2) provides that ERS “[d]eployment obligation time does not include the ramp time.”
- For certain SCED intervals on OD February 15, 2021, the logic for exhaustion calculated ERS-10 and ERS-30 deployments starting from the XML deployment instruction, rather than the end of the 10-minute (for ERS-10) or 30-minute (for ERS-30) ramp times—i.e., the RTORDPA logic began accounting for deployed ERS MWs too early, and therefore didn’t include deployed ERS MWs in the RTORDPA during SCED intervals in which ERS Resources continued to have deployment obligations.
- **Result:** The RTORDPA calculation for SCED intervals on OD February 15, 2021 that fell towards the end of ERS deployment obligation times undercounted the estimated deployed ERS MWs.
- This error had the most significant impact on RTORDPAs.

# RTORDPA logic improperly calculated WS ERS deployment obligation times

- Protocol Section 3.14.3.3(3)(b)(ii) provides, “The duration of a Weather-Sensitive ERS Load’s deployment obligation time for a single event shall be a maximum of three hours.”
- For certain SCED intervals on OD February 15, 2021, the RTORDPA logic improperly treated WS ERS as having the same deployment obligation time as NWS ERS.
  - WS ERS has a shorter maximum obligation time in a single event (3 hours) than NWS ERS (12 hours).
- **Result:** WS ERS MWs were included in the RTORDPA calculation for certain intervals on February 15, 2021, when there were no WS ERS deployment obligations.

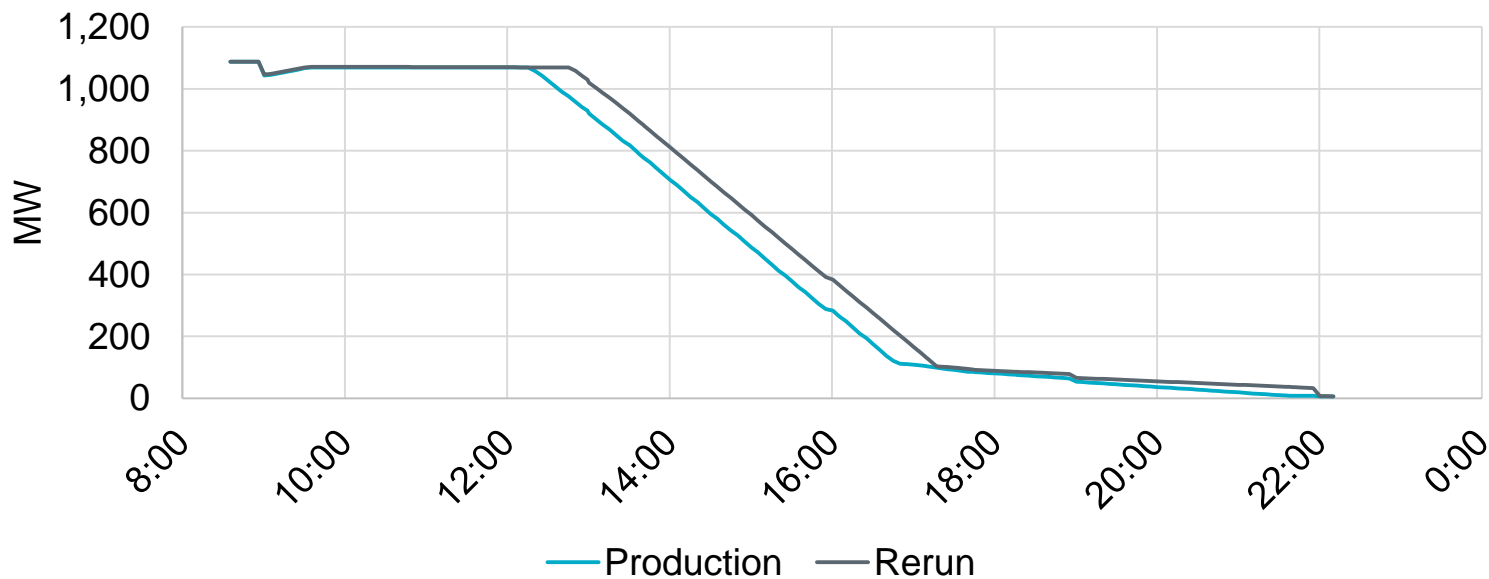
## Other RTORDPA logic errors

- For certain intervals on OD February 15, 2021, the RTORDPA logic did not properly account for the fact that some ERS Resources may have had an obligation for only a subset of the time periods within the overall ERS deployment timeframe.
- **Result:** The RTORDPA calculation for intervals on OD February 15, 2021, that fell towards the end of ERS deployment obligation times under-counted the estimated deployed ERS MWs.
- For certain SCED intervals on OD February 15, 2021, the logic used to estimate ERS deployments over time contained a numeral conversion error that impacted precision.
- **Result:** Minor errors in ERS MW values resulted as the ERS deployment persisted throughout OD February 15, 2021. These errors varied in direction and were ~2 MW or less in magnitude.



# Estimated ERS deployment differences for OD February 15, 2021

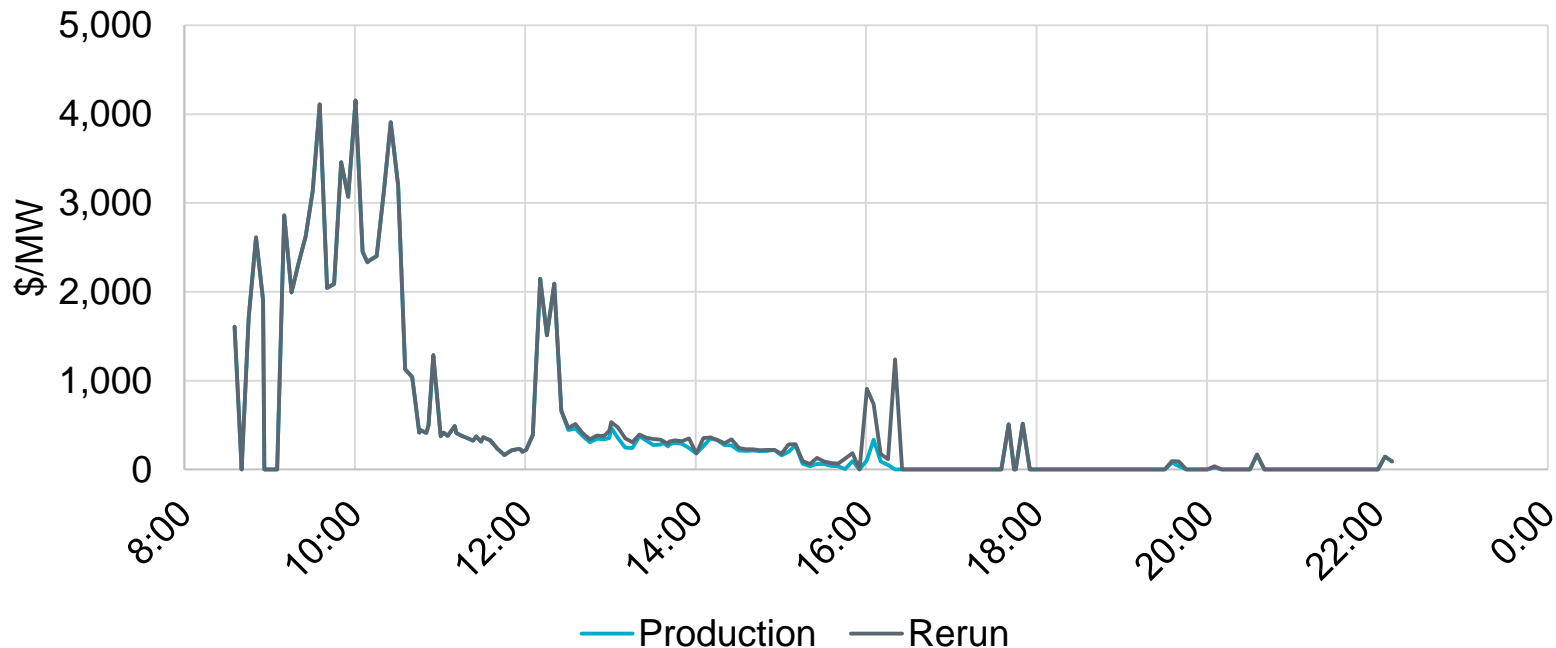
ERS Deployment Modeling for the Pricing Run for  
OD February 15, 2021  
*Production vs. Rerun*



- SCED intervals with estimated ERS deployment differences on OD February 15, 2021, up until adjustments were made to the RTORDPA process per the Public Utility Commission of Texas order issued on February 15, 2021 in Project No. 51617
  - Following the adjustments, any remaining incremental error in the ERS deployment estimation would not have impacted pricing.

# Estimated RTORDPA differences for OD February 15, 2021

RTORDPA for OD February 15, 2021  
*Production vs. Rerun*



- For the relevant time window, only a subset of the SCED intervals saw a change in price (79 of 186 SCED intervals).
- For the 79 identified SCED intervals, the average change in RTORDPA was an increase of ~\$58/MWh.

# Price Correction Analysis Summary

- **Market:** RTM
- **Impacted OD:** February 15, 2021
- **Impacted Intervals:** Certain SCED intervals between 09:45 and 20:35
- **Price Correction Methodology:** ERCOT reran the impacted intervals with corrected ERS deployment estimations to determine the correct RTORDPAs. These values were then used to recalculate RTRDPs, RTSPPs, RTRMPRs and PNM for the impacted Settlement Intervals.
- The following slides include an analysis of price and Settlement impacts of a RTM price correction for certain intervals on OD February 15, 2021, using revised price adders.
  - All Settlement amounts are net amounts due to/from ERCOT. Negative amounts are increased payments to Market Participants; positive amounts are increased charges.
  - The % amount is the absolute value of the % of impact to the previously settled net amount due to/from ERCOT.

# Estimated Settlement Impacts

OD	Change in the Sum of all Statements Due to ERCOT	
2/15/2021	\$6.2M	0.21%

OD	Maximum Impact to a Counter-Party	
	Maximum Amount*	Maximum Percentage**
2/15/2021	\$856k	3.24%

\* The largest absolute impact to any single Counter-Party

\*\* The largest percent change to any single Counter-Party with impact more than \$20,000

OD	Energy Imbalance		Ancillary Service Imbalance		DC Tie Imports		RENA		Base Point Deviation Charge	
2/15/2021	\$271k	0.095%	\$404k	2.03%	\$(269k)	0.17%	\$(696)	0.002%	\$17k	0.39%

The table above is a subset of the RTM charge types



# NPRR 1024, Determination of Significance with Respect to Price Corrections

- NPRR1024 was approved by the Board in February 2021 and became effective on April 1, 2021.
- NPRR1024 requires ERCOT to seek 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.
- While NPRR1024 was not in effect for the OD and price correction at issue the significance threshold was met by two Counter-Parties (i.e., 2% and also greater than \$20,000).



**Date:** April 6, 2021  
**To:** Board of Directors  
**From:** Kenan Ögelman  
**Subject:** Real-Time Market Price Correction for Operating Day February 15, 2021 regarding Deployed Emergency Response Service (ERS)

**Issue for the ERCOT Board of Directors**

**ERCOT Board of Directors Meeting Date:** April 13, 2021

**Item No.:** 10

**Issue:**

Pursuant to paragraph (6) of Protocol Section 6.3, Adjustment Period and Real-Time Operations Timeline, whether the ERCOT Board of Directors (Board) should approve price corrections for Real-Time On-Line Reliability Deployment Price Adders (RTORDPAs), Real-Time On-Line Reliability Deployment Prices (RTRDPs), Real-Time Settlement Point Prices (RTSPPs), and Real-Time Prices for Energy Metered for Resources (RTRMPRs) for certain Settlement Intervals on Operating Day (OD) February 15, 2021, that were affected by software errors.

**Background/History:**

ERCOT staff has identified the need to correct prices in the Real-Time Market (RTM) for certain Settlement Intervals on OD February 15, 2021. The impacted prices include:

- RTORDPAs;
- RTRDPs;
- RTSPPs; and
- RTRMPRs.

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. Prices are final at 1600 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 can seek Board review of such prices if, within 30 days of the OD, ERCOT notifies Market Participants of the need for correction and that ERCOT intends to seek Board approval of the correction.

The Board may review and change prices if the Board finds that such prices are “significantly affected by an error,” and ERCOT gave timely notice to Market Participants. The Board may rely on the following reasons to find that prices were significantly affected by an error:

- 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.

- Data Output Error: These include: (i) incorrect or incomplete data transfer, (ii) price recalculation error in post-processing, and (iii) Base Points inconsistent with prices due to the Emergency Base Point flag remaining activated even when the 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 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 6.3(4) – (6).

At 00:17 on February 15, 2021, ERCOT began sending Extensible Markup Language (XML) messages to deploy ERS Resources due to Energy Emergency Alert (EEA) conditions. Following those deployments, ERCOT's Market Management System (MMS) began estimating the amount of ERS deployed in order to allow the software to determine the RTORDPAs. As set forth in paragraph (1)(d) of Protocol 6.5.7.3.1, Determination of Real-Time Reliability Deployment Price Adders, estimated ERS deployment is a component that feeds the pricing run used to determine RTORDPAs. Due to the duration of the EEA event, ERS Resources remained deployed until their deployment obligations were fully exhausted.

In reviewing the market outcomes of the EEA event, ERCOT has discovered that the MMS software contains programming errors that resulted in incorrect MW amounts being used for the estimated deployed ERS component of the RTORDPA for certain Security-Constrained Economic Dispatch (SCED) intervals on OD February 15, 2021. ERCOT has identified three specific errors related to estimating the exhaustion of ERS deployment obligations:

1. The logic for exhaustion calculated ERS-10 and ERS-30 deployments starting from the XML deployment instruction, rather than the end of the 10-minute (for ERS-10) or 30-minute (for ERS-30) ramp times. Per paragraph (2) of Protocol Section 3.14.3.3, Emergency Response Service Provision and Technical Requirements, the ERS "[d]eployment obligation time does not include the ramp time." This resulted in the RTORDPA calculation under-counting the estimated deployed ERS MWs for SCED intervals on OD February 15, 2021 that fell towards the end of ERS deployment obligation times of individual Resources.
2. The logic for exhaustion improperly treated Weather-Sensitive (WS) ERS as

having the same deployment obligation time as Non-Weather-Sensitive (NWS) ERS. Per paragraph (3)(b)(ii) of Protocol Section 3.14.3.3, “The duration of a Weather-Sensitive ERS Load’s deployment obligation time for a single event shall be a maximum of three hours.” This makes the WS ERS deployment obligation time distinct from the NWS ERS deployment obligation time, which may be up to twelve hours. This resulted in the RTORDPA calculation including WS ERS MWs for certain SCED intervals on February 15, 2021 when there were no WS ERS deployment obligations.

3. The logic for exhaustion did not properly account for the fact that some ERS Resources may have an obligation for only a subset of the time periods within the overall ERS deployment timeframe. Like the first issue above, this resulted in the RTORDPA calculation under-counting the estimated deployed ERS MWs for SCED intervals on OD February 15, 2021 that fell towards the end of ERS deployment obligation times of individual resources.

In addition to these errors related to the estimating of exhaustion of ERS deployment obligations, the logic used to estimate ERS deployments over time contained a numeral conversion error that impacted precision. This small loss in precision resulted in minor errors in the estimated ERS MW values as the ERS deployment persisted throughout OD February 15, 2021.

On March 17, 2021, ERCOT notified Market Participants of the software errors that impacted RTM prices on OD February 15, 2021, and its intent to seek Board review of RTM prices for OD February 15, 2021. See Market Notice M-A070820-01.

Accordingly, ERCOT requests that the Board:

- (a) Review RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for OD February 15, 2021;
- (b) Make a determination as to whether such prices were significantly affected by a software error; and
- (c) Direct/authorize ERCOT to correct some or all RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for OD February 15, 2021.

If the Board directs ERCOT to correct some or all RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for OD February 15, 2021, the corrected prices will be applied to previously-awarded quantities. Award quantities are not changed as part of a price correction.

Attached hereto are documents containing corrected RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for OD February 15, 2021, as follows:

- **Attachment A** – Price Correction RTSPPs;



- **Attachment B** – Price Correction RTRDPs;
- **Attachment C** – Price Correction RTRMPRs; and
- **Attachment D** – Price Correction RTORDPAs.

ERCOT has also attached information containing changes to the Peaker Net Margin (PNM) as a result of correcting prices as described herein. See **Attachment E** – Price Correction PNM.

**Relevant Protocol Sections:**

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

- (4) ERCOT shall correct prices when: (i) a market solution is determined to be invalid, (ii) invalid prices are identified in an otherwise valid market solution, (iii) the Base Points received by Market Participants are inconsistent with the Base Points of a valid market solution, unless accurate prices cannot be determined, or (iv) 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 (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.
- (6) 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 are in need of correction and seeks 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) 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 are significantly affected by an error.
- (c) 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 are significantly affected by an error.

**Key Factors Influencing Issue:**

Due to internal software errors, RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs on OD February 15, 2021, were incorrect and cannot be corrected by ERCOT without authorization from the Board.

Analysis suggests that, resulting from a RTM price correction for OD February 15, 2021, the largest dollar impact to a Counter-Party would be approximately \$856K, and the largest percentage impact to a Counter-Party would be 3.2%.

Notably, Nodal Protocol Revision Request (NPRR) 1024, Determination of Significance with Respect to Price Corrections, was approved by the Board on February 9, 2021 and became effective on April 1, 2021. NPRR1024 requires ERCOT to seek 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 2% and also greater than \$20,000, or 20% and also greater than \$2,000. While the significance criteria set forth in NPRR1024 does not apply to the price correction under consideration by the Board because NPRR1024 was not effective on the OD at issue, the impact of the price correction would have met the threshold significance criteria set forth therein—i.e., the change in RTM Settlement Statements 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 2% and also greater than \$20,000.

**Conclusion/Recommendation:**

ERCOT recommends that the Board make a determination that some or all RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for certain Settlement Intervals on OD February 15, 2021, were significantly affected by an internal software error, and direct ERCOT to correct some or all such prices for the OD at issue.



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

WHEREAS, paragraph (6) of Protocol Section 6.3, Adjustment Period and Real-Time Operations Timeline, authorizes the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) to approve a price correction for certain prices only upon a finding that such prices were significantly affected by an error;

WHEREAS, pursuant to paragraph (6) of Protocol Section 6.3, ERCOT gave timely notice to Market Participants that Real-Time Market (RTM) prices for OD February 15, 2021, were in need of correction, and ERCOT 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 some or all Real-Time On-Line Reliability Deployment Price Adders (RTORDPAs), Real-Time On-Line Reliability Deployment Prices (RTRDPs), Real-Time Settlement Point Prices (RTSPPs), and Real-Time Price for Energy Metered for Resources (RTRMPRs) for certain Settlement Intervals on Operating Day (OD) February 15, 2021, as such prices were significantly affected by internal software errors;

THEREFORE, BE IT RESOLVED, that the Board hereby (1) determines that RTORDPAs, RTRDPs, RTSPPs, and RTRMPRs for certain Settlement Intervals on OD February 15, 2021, were significantly affected by internal software errors, and (2) directs ERCOT staff to implement the appropriate price corrections pursuant to paragraph (6) of Protocol Section 6.3.

**CORPORATE SECRETARY'S CERTIFICATE**

I, Vickie G. Leady, Assistant Corporate Secretary of ERCOT, do hereby certify that, at its April 13, 2021 urgent meeting by teleconference, the ERCOT Board passed a motion approving the above Resolution by \_\_\_\_\_.

IN WITNESS WHEREOF, I have hereunto set my hand this \_\_\_\_ day of April, 2021.

\_\_\_\_\_  
Vickie G. Leady  
Assistant Corporate Secretary