



2023 Regional Transmission Plan (RTP) Economic Study Update

ERCOT Staff
May 16, 2023



Stability Interface Limits

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2023 RTP Stability Limit Summary – Valley

- The table below shows Valley-area stability constraints to be included in the 2023 RTP that are directly analogous to current Generic Transmission Constraints (GTCs).

GTC	Location	UPLAN Limit Type ^[1]	UPLAN Limit ^{[2][3]}	
			2025 ^[4]	2028 ^[5]
Nelson Sharpe – Rio Hondo	Valley	Static	972	-
North Edinburg – Lobo	Valley	Static	1,377	-
Valley Export	Valley	Static	635	-
Valley Import	Valley	Hourly profile ^[6]	1,678	-

[1] GTCs with real-time VSAT will have UPLAN hourly profiles using historical data.

[2] Limits used in economic analysis will be 90% of calculated stability limits to be consistent with the [ERCOT Transmission and Security Operating Procedure](#).

[3] Limits are for no prior outages.

[4] 2025 limits are taken from MIS GTC Methodology.

[5] Lower Rio Grande Valley project included in case. Limits reflect the expectation that the constraints would not be binding in the planning timeframe based on recent planning studies. Future changes in generation and/or topology could change that expectation.

[6] Hourly multipliers developed from historical data will be applied to base rating.

2023 RTP Stability Limit Summary – Non-Valley

- The table below shows stability constraints outside of the Valley to be included in the 2023 RTP that are directly analogous to current GTCs.

GTC	Location	UPLAN Limit Type ^[1]	UPLAN Limit ^{[2][3]}	
			2025	2028
North to Houston	Houston	Hourly profile ^[4]	3,913	3,913
McCamey	West Texas	Static ^[5]	2,889	2,889
West Texas Export	West Texas	Static ^[6]	11,016	11,016

[1] GTCs with real-time VSAT will have UPLAN hourly profiles using historical data.

[2] Limits used in economic analysis will be 90% of calculated stability limits to be consistent with the [ERCOT Transmission and Security Operating Procedure](#).

[3] Limits are for no prior outages.

[4] Hourly multipliers developed from historical data will be applied to base ratings from MIS GTC Methodology.

[5] Limits from MIS GTC Methodology.

[6] Limits from Long-Term West Texas Export Study – Study Year 2023

2023 RTP Stability Limit Summary

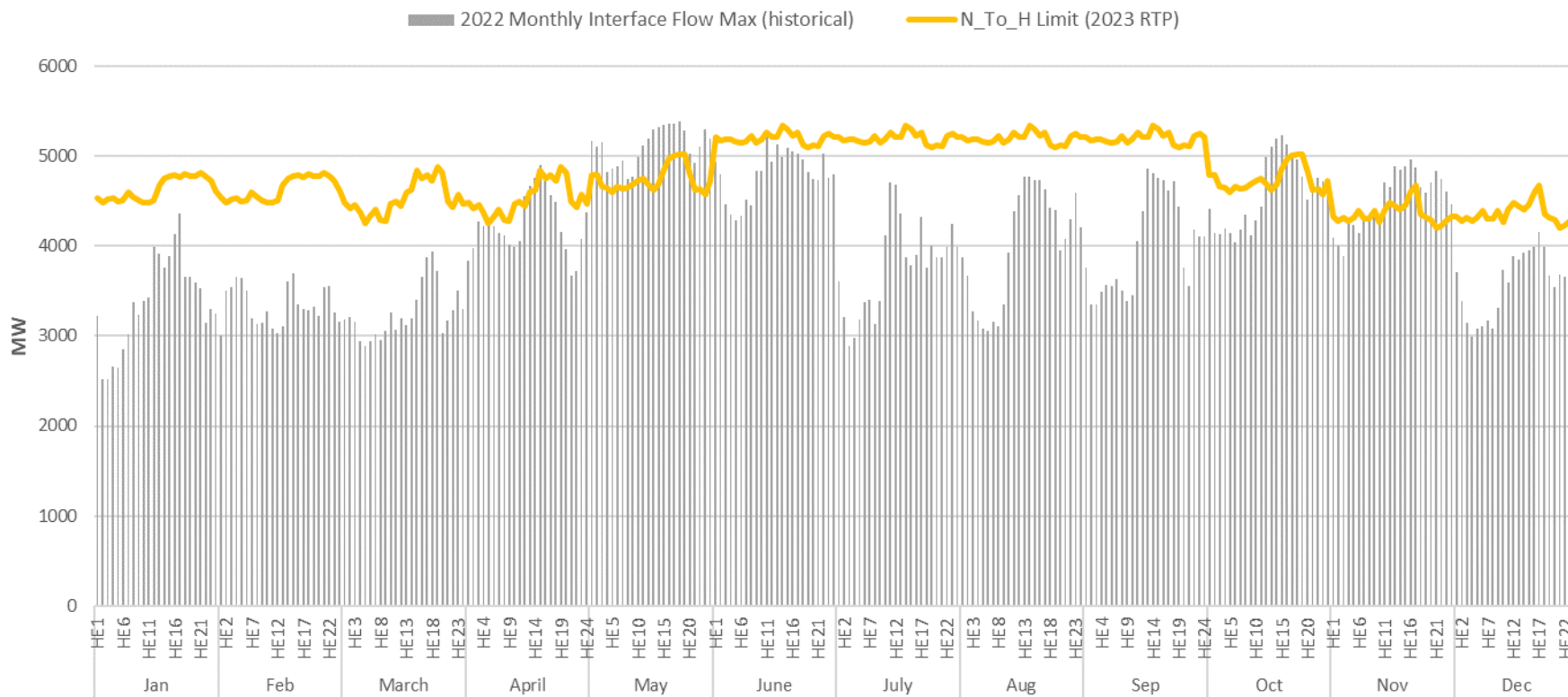
- The table below shows current GTCs that will not be included in 2023 RTP base analysis.
- Stability constraints related to these GTCs may be considered for outage sensitivity analysis.

GTC	Notes
Panhandle	No limit under N-1 conditions.
Red Tap	No limit under N-1 conditions.
East Texas	No limit under N-1 conditions.
Treadwell	No limit under N-1 conditions.
Raymondville – Rio Hondo	No limit under N-1 conditions.
Bearkat	No limit under N-1 conditions.
Zapata Starr	No limit under N-1 conditions.
Williamson – Burnet	No limit under N-1 conditions.
Culberson	No limit under N-1 conditions.
Wharton	No limit under N-1 conditions.
Hamilton	No limit under N-1 conditions.

Stability Interface Limit for 2023 RTP – Hourly Profile

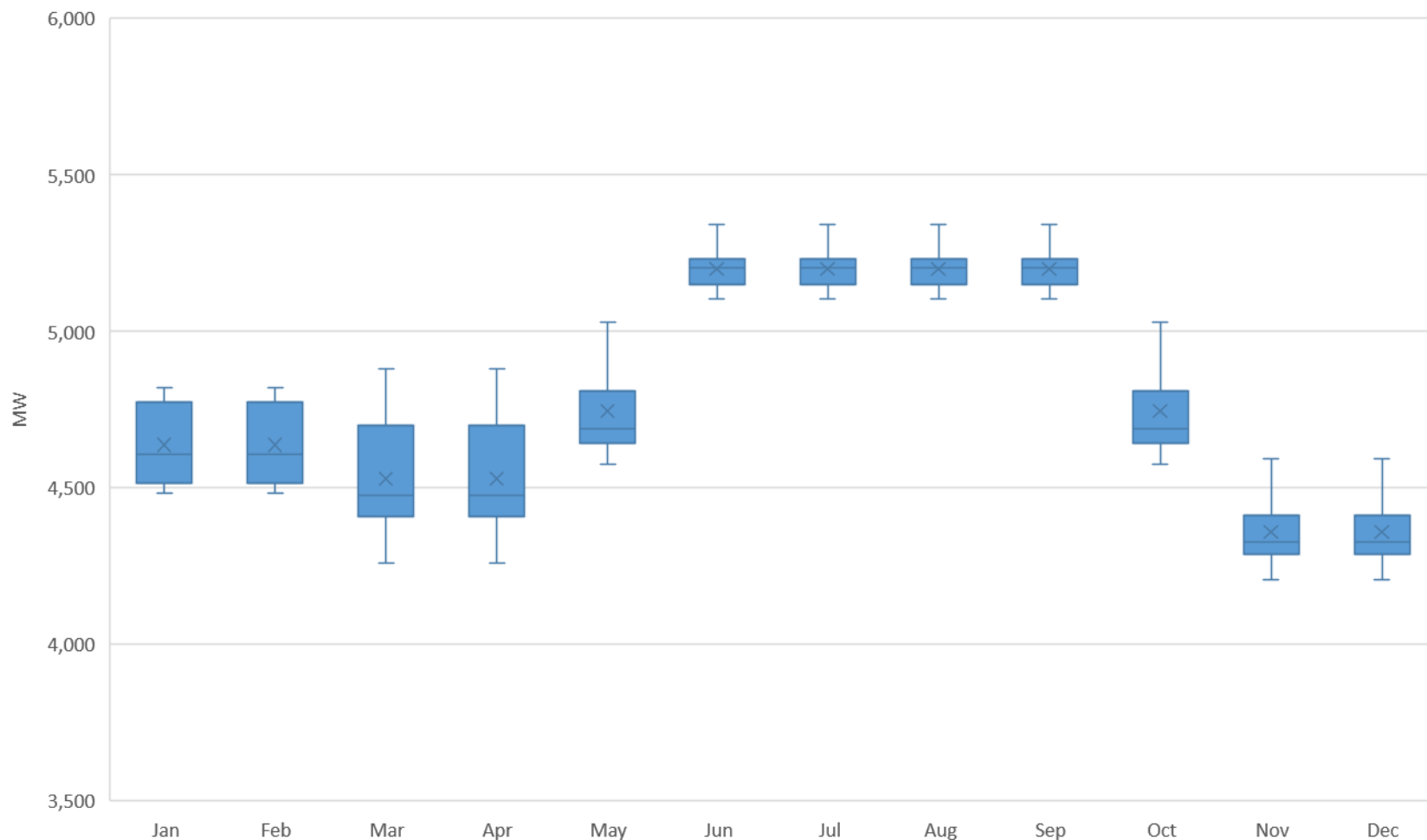
- Historical real-time VSAT data for the respective interface limits was extracted for the whole 12 months of the selected year. The 12-month data was then clustered into 5 groups, i.e., (Jan, Feb), (March, April), (May, Oct), (June-Sep), (Nov. Dec).
- The maximum interface limit value was identified for every hour within each group.
- These hourly maximum limits were applied to the respective hours of every day within the same group for the selected year.
- The same process was repeated for each hour of each group for the selected year.
- The same process was repeated for the past 3 years and the final interface limit for each hour will be the minimum of those limits previously determined for the same hour among 3 past years.

North to Houston (N_To_H) Limit Hourly Profile Used in UPLAN for 2023 RTP



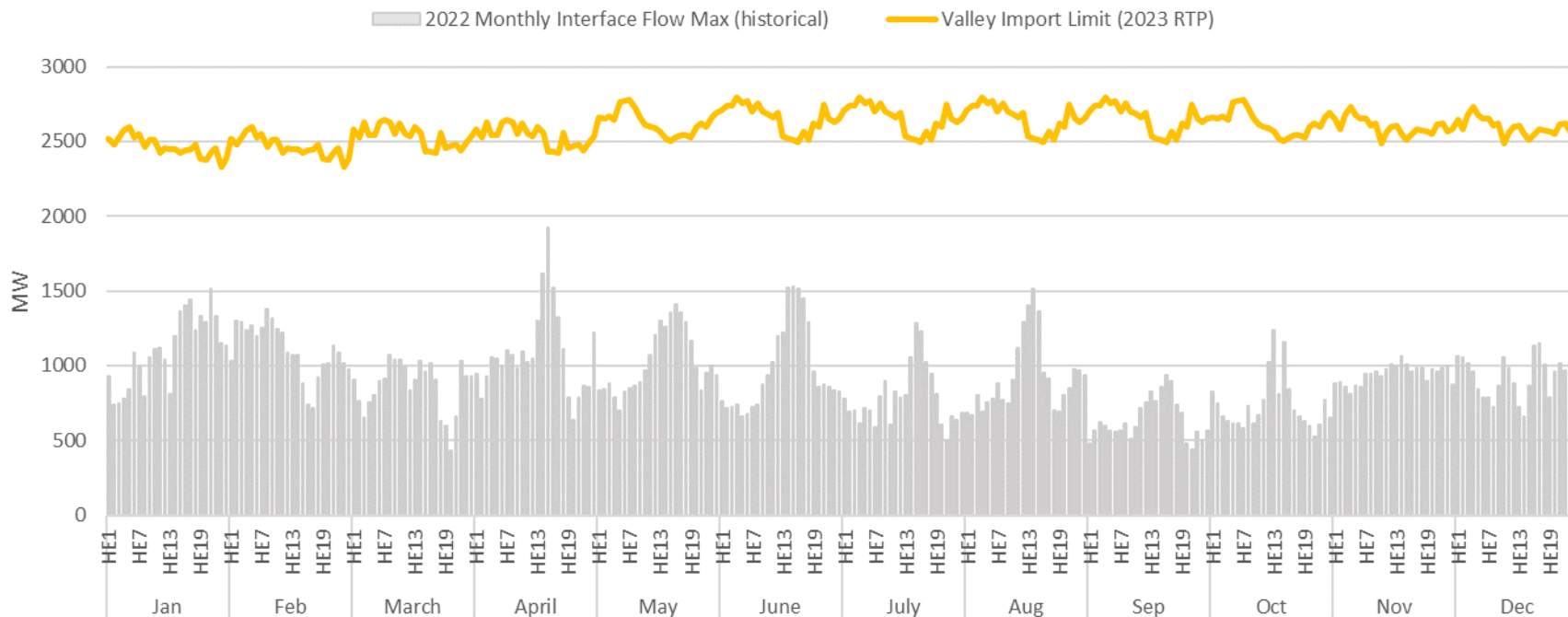
*Limits are shown as 90% of calculated stability limits

North to Houston (N_To_H) Limit Hourly Profile Used in UPLAN for 2023 RTP



*Limits are shown as 90% of calculated stability limits

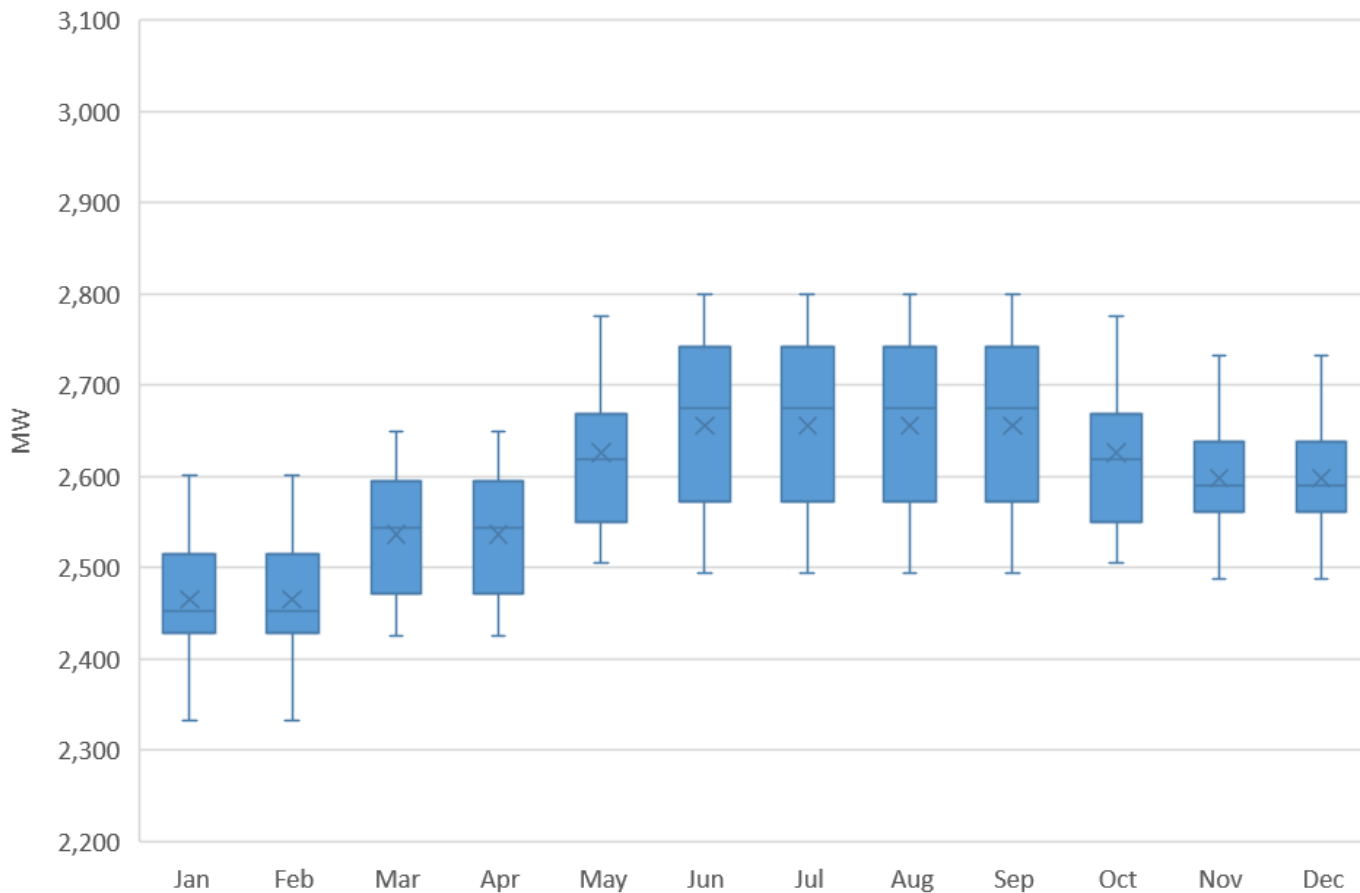
Valley Import Limit Hourly Profile Used in UPLAN for 2023 RTP



*Limits are shown as 90% of calculated stability limits



Valley Import Limit Hourly Profile Used in UPLAN for 2023 RTP



*Limits are shown as 90% of calculated stability limits

Appendix

Generic Transmission Constraints – Background

- Generic Transmission Constraints (GTCs) and their associated Generic Transmission Limits (GTLs) are operational tools for managing non-thermal System Operating Limits (SOLs) using market-based dispatch *
- GTC studies consider existing resources and resources with planned Initial Synchronization dates ~3-6 months in the future
- Planning studies evaluate system needs 2-6 years in the future (or beyond), and include planned resources meeting the requirements of Planning Guide Section 6.9
 - i.e., Planning studies include more resources further out in the future than GTC studies
- Stability interfaces and limits considered in planning studies may necessarily differ from current operational GTCs/GTLs

* For more information on GTCs and GTLs refer to the ERCOT white paper, *Use of Generic Transmission Constraints in ERCOT*, which can be found at http://www.ercot.com/content/wcm/key_documents_lists/209817/The_Use_of_GTCs_in_ERCOT_July_2020.pdf.

Current Generic Transmission Constraints

- ERCOT currently employs the following GTCs in the Operations Horizon*:
 - North to Houston (N_TO_H) – IROL
 - Rio Grande Valley Import (VALIMP) - IROL
 - Panhandle (PNHNDL) - IROL
 - West Texas (WESTEX) – IROL
 - McCamey (MCCAMY) - IROL
 - Nelson Sharpe – Rio Hondo (NELRIO)
 - North Edinburg – Lobo (NE_LOB)
 - Red Tap (REDTAP)
 - East Texas (EASTEX)
 - Treadwell (TRDWEL)
 - Raymondville – Rio Hondo (RV_RH)
 - Bearkat (BEARKT)
 - Valley Export (VALEXP)
 - Zapata Starr (ZAPSTR)
 - Culberson (CULBSN)
 - Williamson – Burnet (WILBRN)
 - Wharton (WHARTN)
 - Hamilton (HMLTN)

*Generic Transmission Constraint Definitions
posted to MIS Secure as of April 5, 2023



Economic Assumptions for 2023 Regional Transmission Plan (RTP) Economic Study

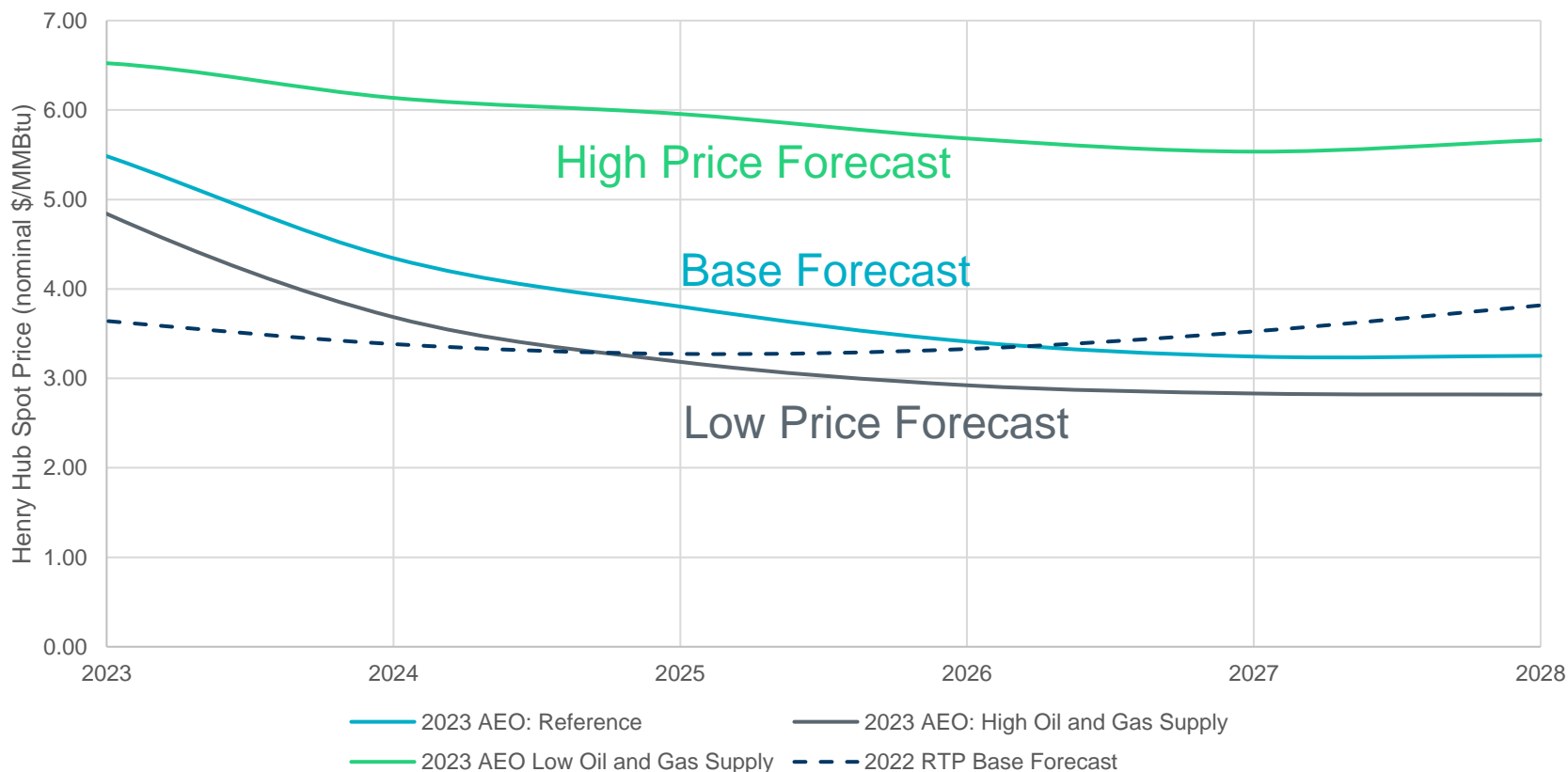
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Agenda

- Natural Gas Forecast
- Weather Year Selection
- Emissions Costs
- Large Flexible Loads
- Rooftop Solar Growth
- Electric Vehicle Charging Profile

Natural Gas Forecast

- The 2023 Energy Information Administration (EIA) Annual Energy Outlook (AEO) reference natural gas forecast will be used in the 2023 RTP economic analysis.



Weather Year Selection

- 15 weather year scenarios are ranked by demand energy, peak demand, wind energy (Coastal/Panhandle and other), wind capacity factor, solar energy, and solar capacity factor.
- The 2013 weather year, which represents an average weather year measured by the metrics above, is selected as the base weather year for the 2023 RTP economic analysis.

Weather Year Selection

Year	Demand Energy (GWh)	Peak Demand (MW)	Coastal Wind MW	Panhandle Wind MW	Other Wind MW	Coastal Wind (%)	Panhandle Wind (%)	Other Wind (%)	Solar MW	Solar (%)
2011	1	2	1	2	1	1	2	1	1	1
2008	10	12	4	1	2	4	1	3	2	2
2010	2	4	6	8	4	6	8	4	3	3
2014	7	14	2	3	3	2	3	2	9	9
2012	8	3	13	7	6	13	7	6	4	4
2013	5	6	5	11	12	5	11	11	5	5
2018	3	5	7	4	9	7	4	9	14	14
2009	9	8	3	12	8	3	12	8	7	7
2017	13	15	8	10	5	8	10	5	6	6
2020	11	9	10	6	7	11	6	7	10	10
2019	4	10	9	9	10	9	9	10	13	13
2016	12	11	15	5	11	15	5	12	8	8
2021	14	1	14	14	13	14	14	13	11	11
2015	6	7	12	13	14	12	13	14	15	15
2007	15	13	11	15	15	10	15	15	12	12

*2013 will be used as the base weather year.

Emissions Costs

- Texas is a part of Cross-State Air Pollution Rule (CSAPR) Group 2 and only subject to seasonal NOx limits
 - Seasonal NOx apply to the months during "Ozone Season" which are generally March - November in most of Texas according to EPA and TCEQ's website:
 - https://aqs.epa.gov/aqsweb/documents/codetables/ozone_seasons.html
 - <https://www.tceq.texas.gov/airquality/monops/ozonefacts.html>
- \$166 per ton for seasonal NOx for 2023 RTP study
 - https://www3.epa.gov/airmarkets/progress/reports/market_activity_figures.html

Large Flexible Loads

- Large flexible loads (LFLs) added to economic cases will be consistent with those added to reliability cases and presented at March RPG^[1]

Study Year	Total Approved Large Load Addition (MW)
2025	5,037
2028	6,290

- LFLs, except large industrial load, will be modeled as price-responsive demand
 - 60% of LFL at \$100/MWh, this is an energy only curtailment for the standard mining equipment
 - 30% of LFL at \$200/MWh, this is also an energy only curtailment targeted toward LFLs with more efficient/newer crypto mining equipment that can curtail at higher price
 - 10% of LFL at \$1,000/MWh, this is for miners that are less price responsive to real time price swings

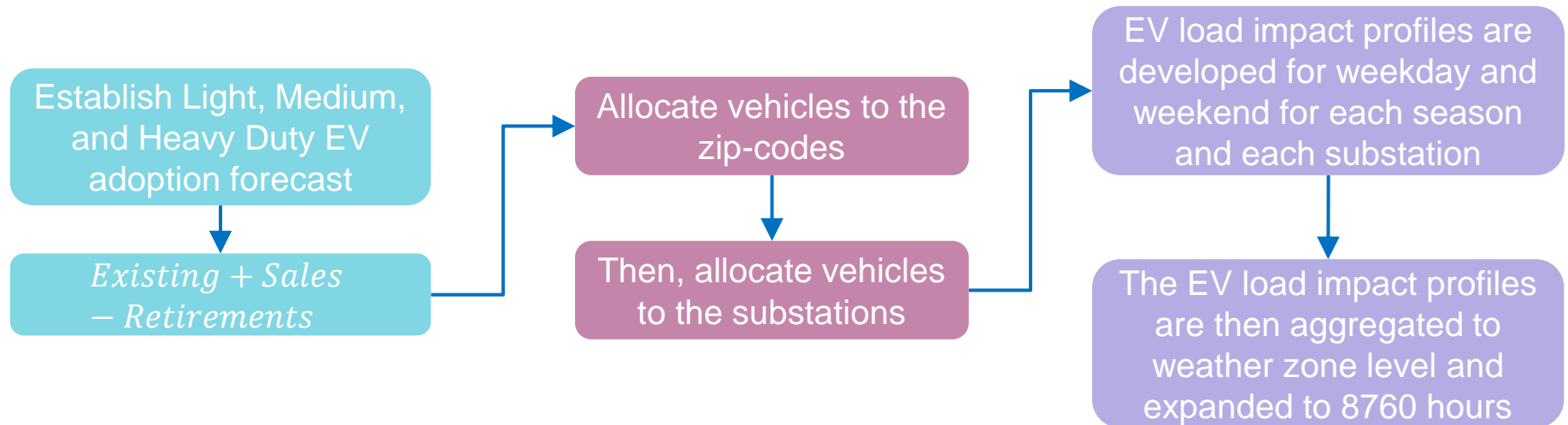
Rooftop Solar

- Rooftop solar profile has been created as the hourly power production forecast based on the 2013 weather year.
- This forecast represents the anticipated rooftop solar growth by the study year dates.
- The rooftop solar hourly profile was subtracted from the hourly gross load forecast to calculate the net load forecast.

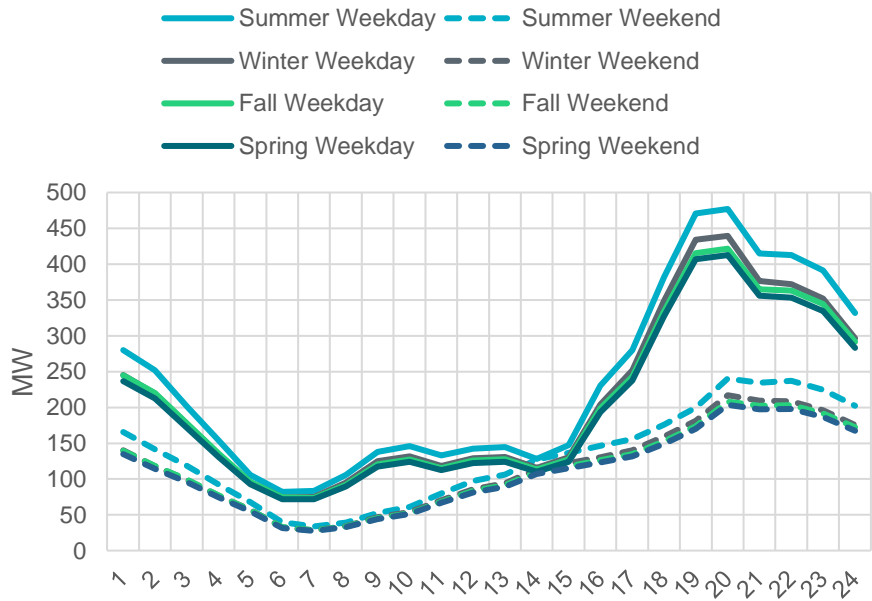
Study Year	Total Installed Rooftop Solar Capacity (MW)
2025	3,200
2028	5,000

EV Charging Profile

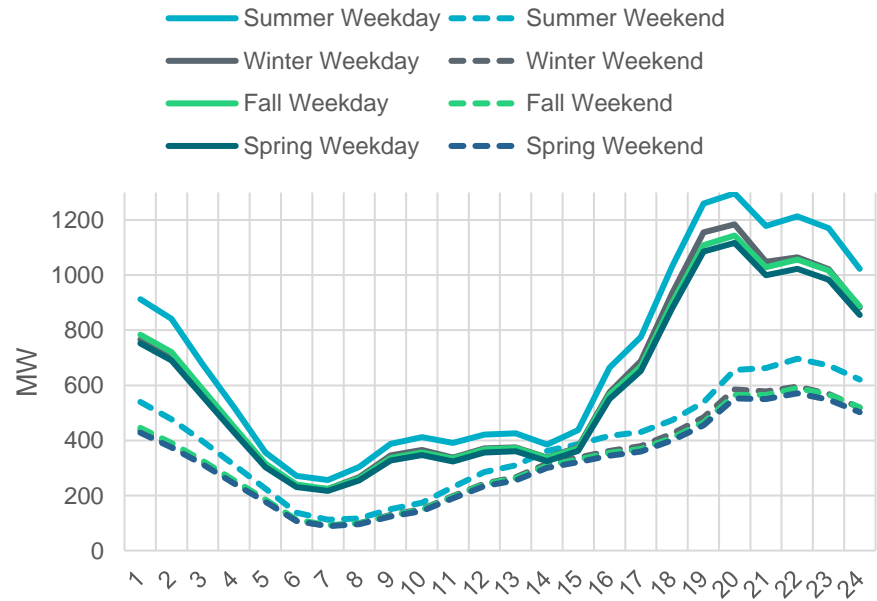
- At October 2022 RPG meeting, Brattle presented the [EV Allocation Study](#), which developed the methodology for determining EV load impact at the substation level.
- ERCOT will incorporate the EV load impact in 2023 RTP.



EV Profile



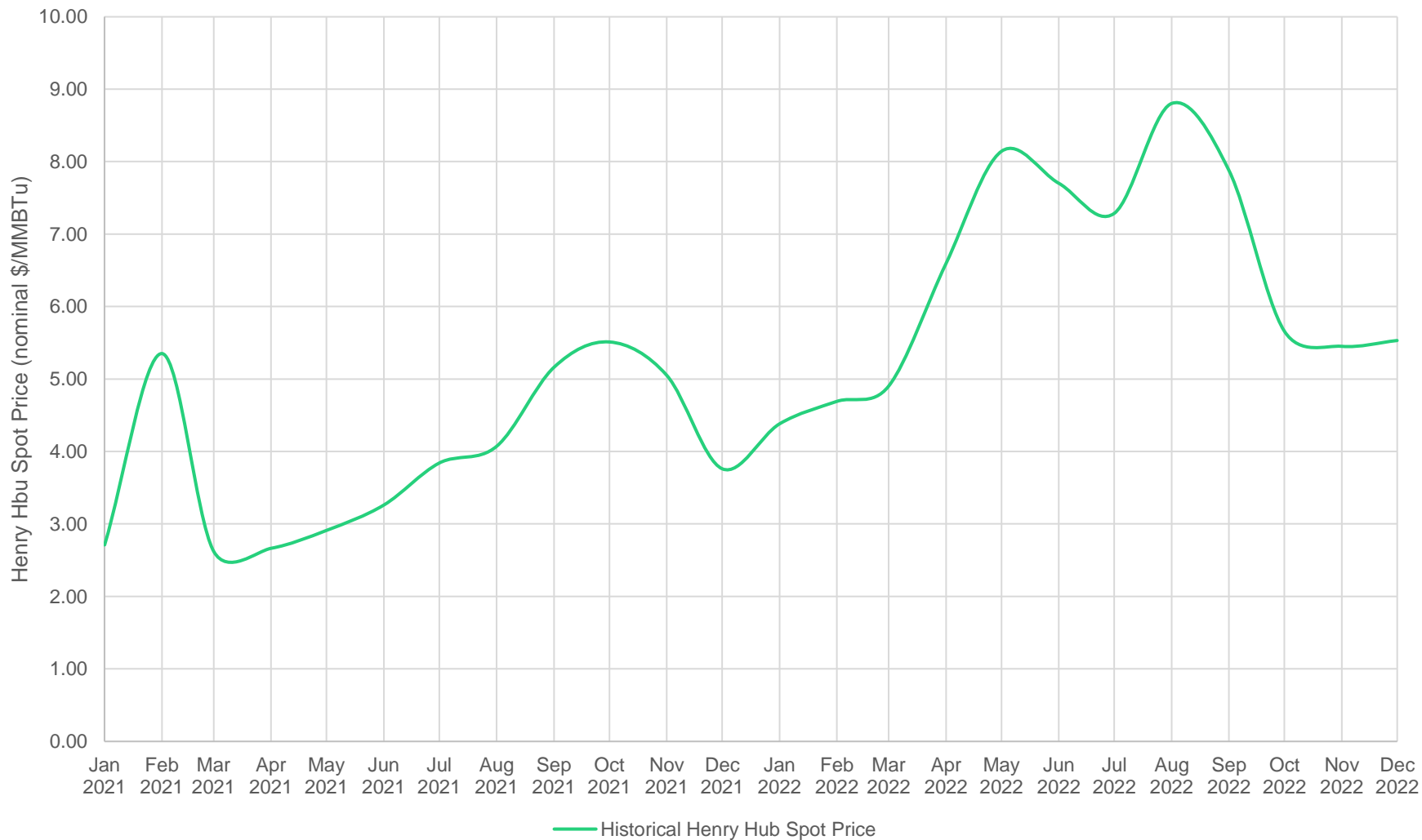
2025



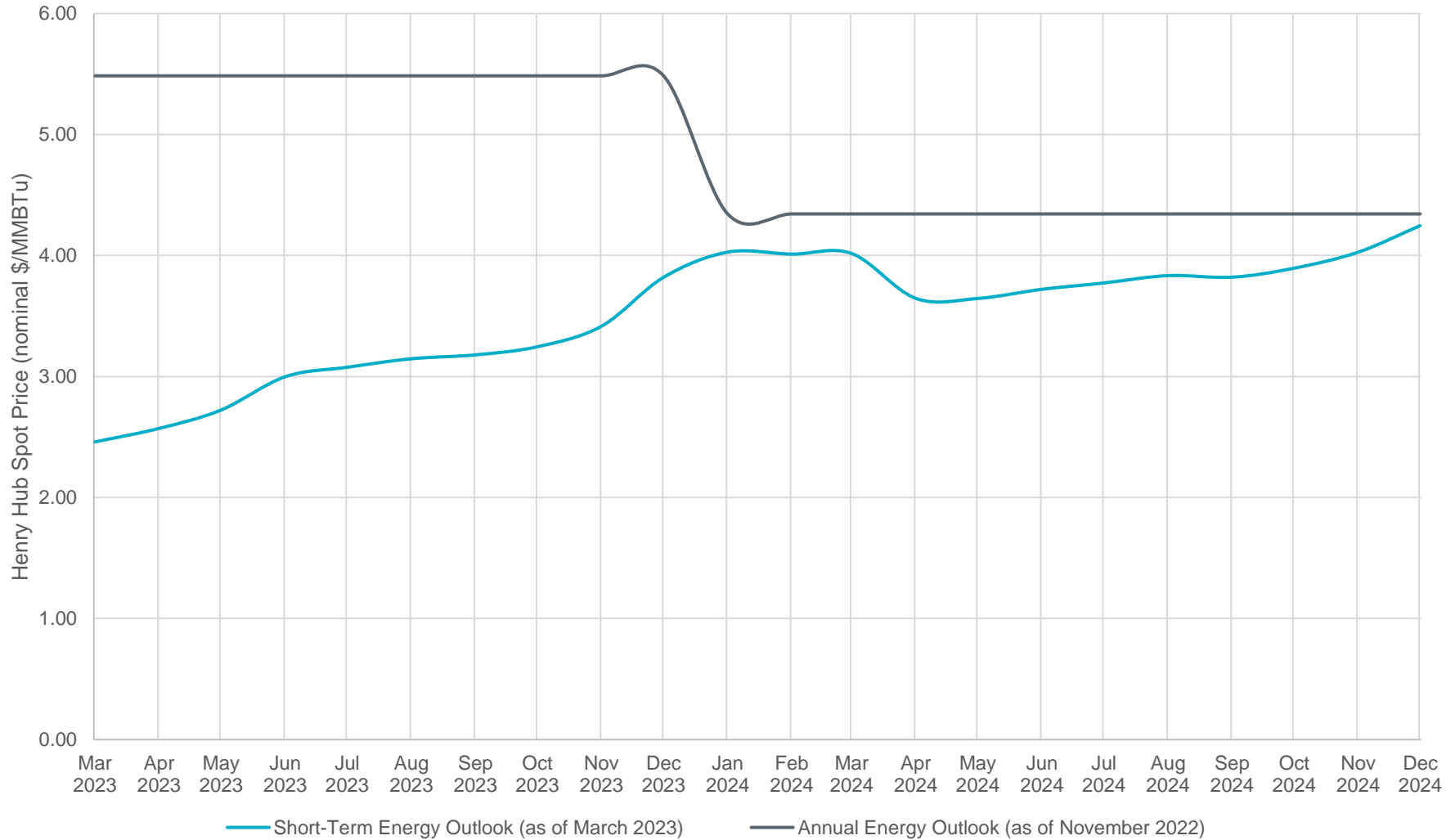
2028

Appendix

Natural Gas Price Historical Prices (2021-22)



Natural Gas Forecast – Short-Term v AEO



Questions

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