

**BEFORE THE PUBLIC UTILITIES COMMISSION OF THE  
STATE OF CALIFORNIA**

Order Instituting Investigation on the  
Commission's Own Motion into Natural  
Gas Prices During Winter 2022-2023 and  
Resulting Impacts to Energy Markets.

Investigation 23-03-008

(Filed March 20, 2023)

**COMMENTS OF THE CALIFORNIA INDEPENDENT SYSTEM  
OPERATOR CORPORATION**

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Dated: April 19, 2023

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CORPORATION**

The California Independent System Operator Corporation (CAISO) submits the following comments discussing the CAISO's Gas Conditions and CAISO Markets report issued on February 6, 2023 (Report). The CAISO provides this Report as an attachment to its comments.

**I. The CAISO's Report Identifies Natural Gas Price Impacts in the Wholesale Electricity Market.**

In its Order Instituting Investigation (OII), the Commission asks whether there is information it should collect or examine to further understand market dynamics.<sup>1</sup> The CAISO offers its Report as supplemental information on the impacts of natural gas prices on wholesale electricity markets. The Report covers the time period from November 2022 to January 2023, when natural gas prices sustained higher than normal seasonal levels. This recent period of high natural gas prices did not affect the reliable operation of the electric system. The main impact of the high natural gas prices this past winter on the CAISO market was on wholesale electric prices and costs.

Typically, during winter months, natural gas prices increase during periods of colder weather due to increased natural gas demand for heating. However, this past winter, natural gas prices remained atypically high in California and at other Western hubs during the study period.<sup>2</sup>

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<sup>1</sup> OII at 11.

<sup>2</sup> Report at 9.

Suppliers in the CAISO market reflect natural gas fuel costs as inputs to market bids. The CAISO market-clearing process determines optimal schedules and prices for resources. Any resource type, including natural gas resources, can set the prices on the system. Given the relatively significant share of natural gas generation in the CAISO system, it is common for these resources to be the marginal resources, where their bid-in costs will set the system energy price. As a result, higher natural gas prices reflected in bid-in prices for gas resources may set higher wholesale electric prices in the CAISO markets. The Report provides a review of the impact of natural gas prices on wholesale electric prices and costs during the months studied.

## **II. Conclusion**

The CAISO appreciates the opportunity to offer this Report into the record and looks forward to continued engagement with the Commission and parties on natural gas issues in this proceeding. The CAISO will continue to monitor natural gas prices and their impact on wholesale electricity costs, and will remain engaged with others in the regulatory community who have responsibility for ensuring rates remain just and reasonable.

Respectfully submitted,  
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Dated: April 19, 2023

**ATTACHMENT**

**Comments of the California Independent System Operator Corporation**

**Order Instituting Investigation on the Commission's Own Motion into Natural Gas Prices  
During Winter 2022-2023 and Resulting Impacts to Energy Markets.**

**April 19, 2023**



# Gas Conditions and CAISO Markets

February 6, 2023

Prepared by  
Market Analysis

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## Executive Summary

Since late November 2022 through the end of January 2023, natural gas prices have sustained at higher than normal seasonal levels. Natural gas prices are used to estimate costs for generation units, which have a direct impact on the CAISO's energy market. This report provides a review of these gas prices and their impact.

### Highlights

- **Next-day natural gas prices for Western hubs reached a maximum value of about \$57/MMBtu on Dec. 22.** Prices for other Western hubs traded at similarly elevated levels across the month of December, though certain hubs such as El Paso Permian traded at comparatively lower levels. Henry Hub prices remained comparatively low during the months of December 2022 and January 2023.
- **Across the West, natural gas futures prices spiked for January 2023 but have since traded at lower prices for February 2023.** January 2023 futures prices spiked twice during trading in December 2022, corresponding to spikes in next-day or spot market prices, and reached a maximum of \$52/MMBtu at the SoCal Citygate hub. Futures gas prices at hubs including Henry Hub, Alberta AECO, and El Paso Permian stayed relatively insulated from price spikes observed in the West.
- **Next-day and future bilateral power prices experienced price spikes during December 2022 between \$400/MWh and \$500/MWh,** depending on the commodity and trading hub. Next-day bilateral power prices at the Palo Verde and Mid-Columbia hubs did not trade at levels high enough to allow energy bid prices to exceed the maximum import bid price cap set at \$1,000/MWh.
- **CAISO electricity prices increased as a result of higher gas prices, with December seeing a fivefold increase since last year, at an average price of more than \$250/MWh.** Prices in all CAISO electric markets have trended higher during the period of high gas prices.
- **Wholesale costs in the CAISO's energy market saw additional costs of \$3 billion in December and about \$0.9 billion for the first 25 days of January.** These wholesale costs reflect the impact of higher electricity and gas prices. Market participants may have different mechanisms to hedge and manage these volatile prices and costs.
- **A total of 110 requests for changes to cost-based bids (Reference Level Change Requests or RLCRs) were submitted** by scheduling coordinators to the CAISO for the period of December 2022 through mid-January 2023. RLCRs allow generators to better reflect their fuel costs in

their bids. RLCRs submitted since December 2022 comprise 99% of the submitted RLCRs since September 2022.

## Gas Conditions Report

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## Acronyms

BAA	Balancing Authority Area
CAISO	California Independent System Operator
DAM	Day ahead market
DLAP	Default Load Aggregated Point
EIM	Energy Imbalance Market
GMC	Grid Management Charge
MIBP	Maximum Import Bid Price
MIDC	Mid-Columbia
MMBtu	Million British Thermal Unit
MW	Megawatt
MWh	Megawatt-hour
PG&E	Pacific Gas and Electric
PV	Palo Verde
RLCR	Reference Level Change Request
SMEC	System Marginal Energy Cost

## 1 BACKGROUND

In late November, gas prices in the West began to increase steeply, which has a direct impact on the CAISO markets because generation resources reflect these higher prices into their bid-in costs. Gas prices reached their highest levels of 2022 in the second half of December, with these peak prices subsiding in January 2023 and stabilizing at a lower but still high level from a historical perspective. Gas prices in the West and in California in particular remain high relative to prices in the East such as at the Henry Hub.

CAISO markets and the generators that participate in them rely on gas prices to estimate the fuel costs and reflect these costs in the market. The CAISO does not have detailed information to fully evaluate price formation in gas markets. Therefore, it relies on external sources to better understand the drivers and fundamentals for these sustained higher gas prices, through which, the CAISO has identified certain factors listed below that have likely shaped gas prices over recent months:

- Extreme and colder-than-average weather in December across the Western U.S. and Canada leading to higher gas demand;
- Low gas storage inventories in comparison to the East and to historical levels, exacerbated by higher gas usage during the extreme heatwave of summer 2022 and PG&E's 2021 reclassification of working gas to base gas to support storage operations;
- Lower hydro generation in the West and expectations that drought conditions will continue throughout the region, despite the recent winter storms;
- California's geographical position near the end of the interstate pipeline system and lack of native supply;
- Maintenance on the El Paso pipeline.

The higher gas prices have not affected the reliable operation of the electric system and the CAISO continues to monitor its market to address any unusual market results that may be caused gas conditions.

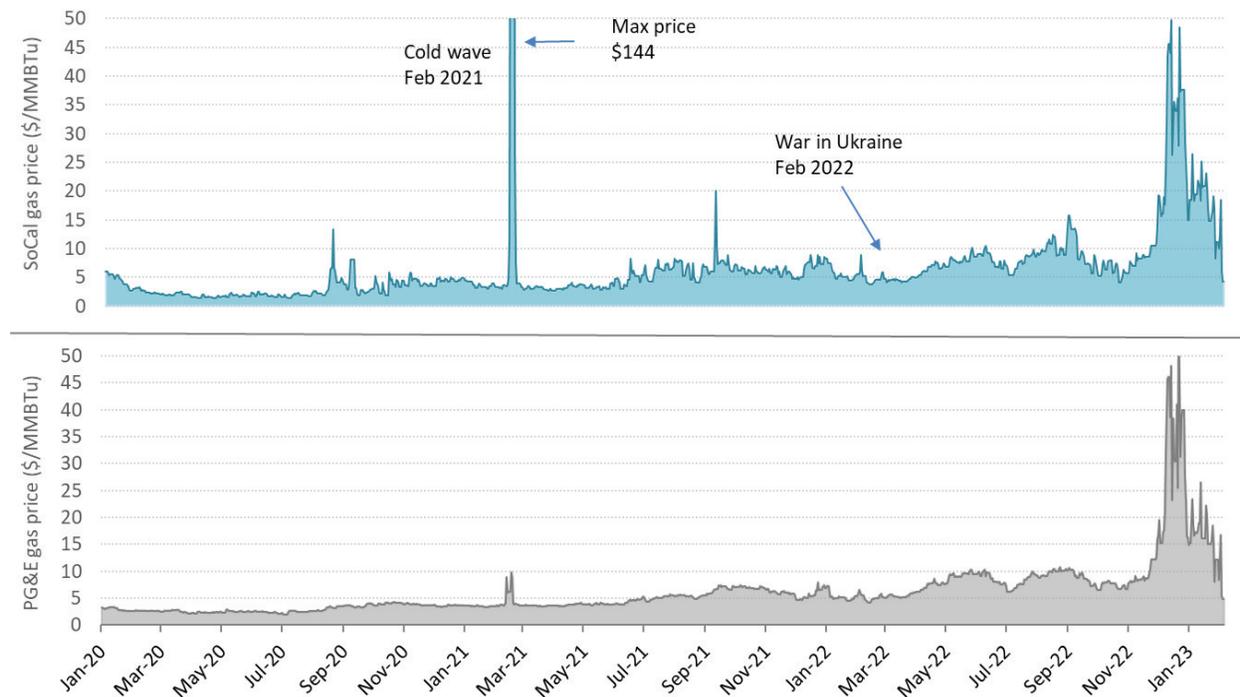
## 2 GAS PRICES AND CONDITIONS

Gas prices in CAISO area

Figure 1 shows the gas price trends of the two main gas hubs in the California area: SoCal Citygate reflecting the prices in the Southern part of the CAISO system and PG&E Citygate reflecting the prices in the Northern part of the CAISO system. Overall, gas prices have trended upward since summer 2020, and have stayed above \$5/MMBtu since mid-2021. Historically, SoCal Citygate hub prices

trended higher than the PG&E Citygate hub price, but for the last two years these have tracked more closely. Typically, during winter and the February timeframe, the CAISO has noticed that gas prices tend to spike due to colder weather. For example, the cold snap observed in February 2021 drove SoCal Citygate hub price to reach a maximum of \$144/MMBtu. More recently, gas prices exceeded the \$10/MMBtu mark during the extreme heatwave of late August and early September 2022 when generation supply, including gas units, were operating at high levels to meet historically high demand for electricity. This resulted in high utilization of gas units causing a high gas burn.

Figure 1: Gas prices for main gas hubs in California area

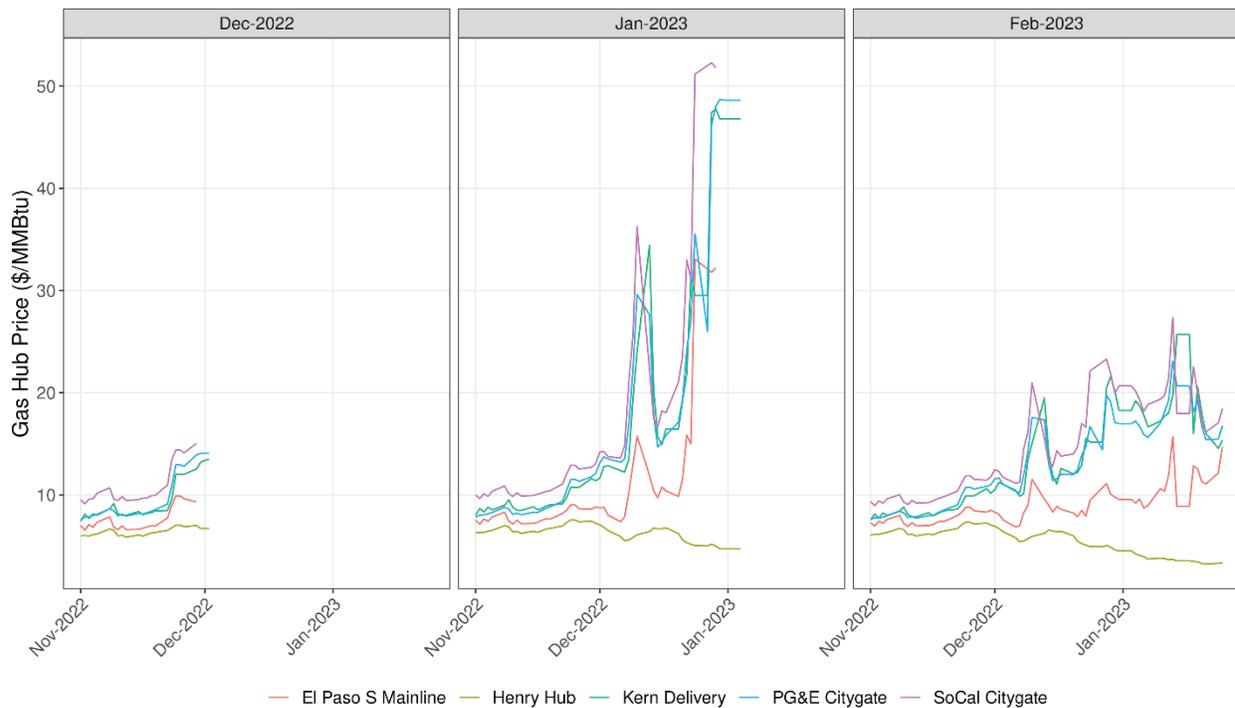


Gas prices after the Thanksgiving 2022 holiday rose quickly until reaching up to \$50/MMBtu. For the month of December, prices remained atypically high, not only in the two main California hubs but also in many other Western hubs.

In addition to next-day delivery of physical gas, gas is also traded as a future monthly financial product. Trading for the upcoming future month typically ends by the start of the future month in question. Figure 2 below shows future gas prices for four main California and California-adjacent gas hubs as well as the Henry Hub for the months of December 2022, January 2023, and February 2023. The figure shows future gas prices that started trading in November 2022 through the most recent trading date as of this report’s publication. The data shown is averaged across the various index vendors from which the CAISO receives pricing data.

The CAISO identified several trends in future gas prices that will be useful to keep in mind later in this report. SoCal Citygate future prices remained the highest across the various hubs shown below, spiking at a maximum value of \$52/MMBtu for January 2023 futures. Futures for December 2022 through February 2023 remained at or around \$10/MMBtu when trading during November, but started to rise toward the end of November. Futures for January 2023 spiked twice during trading in December, with the higher price spike occurring toward the end of the month. Futures for February 2023 spiked modestly at the beginning of December and remained relatively elevated throughout the trading months shown below, though at lower levels than what was traded for January 2023. In contrast, Henry Hub futures remained relatively isolated from the price spikes observed from the other hubs, staying well below \$10/MMBtu for all three futures months shown in the figure.

Figure 2. Future gas prices for CAISO area gas hubs and Henry Hub, Dec. 2022 through Feb. 2023



### Gas prices in the West

Prices at gas trading hubs across the West and outside the CAISO area also experienced volatility. Figure 3 shows the price trends for several of the main hubs across the West. In addition to SoCal Citygate and PG&E Citygate hubs, some generating resources in the CAISO area use the Kern River hub for their fuel region. Figure 3 compares these against Henry Hub which can be seen as a reference hub in the East. The Sumas hub is a reference hub for the Northwest while El Paso Blanco is a

reference hub for the Southwest. This chart covers the period of November 2022 through end of January 2023, the period in which gas prices in California sustained at high levels. For most of November, all of these hub prices tracked relatively close to each other under \$10/MMBtu which is typical based on historical trends. However, in early December, all three hubs in California (SoCal Citygate, PG&E Citygate, and Kern River) as well as the Sumas hub diverged from Henry Hub and began tracking close to each other at higher levels. The El Paso Blanco hub in the Southwest followed a similar trend but at lower price levels. All of these western hubs remained consistently higher than the price at Henry Hub which stayed below \$7/MMBtu. By the beginning of February, West hub prices came down to about \$5/MMBtu.

Figure 3. Gas prices at different West hubs

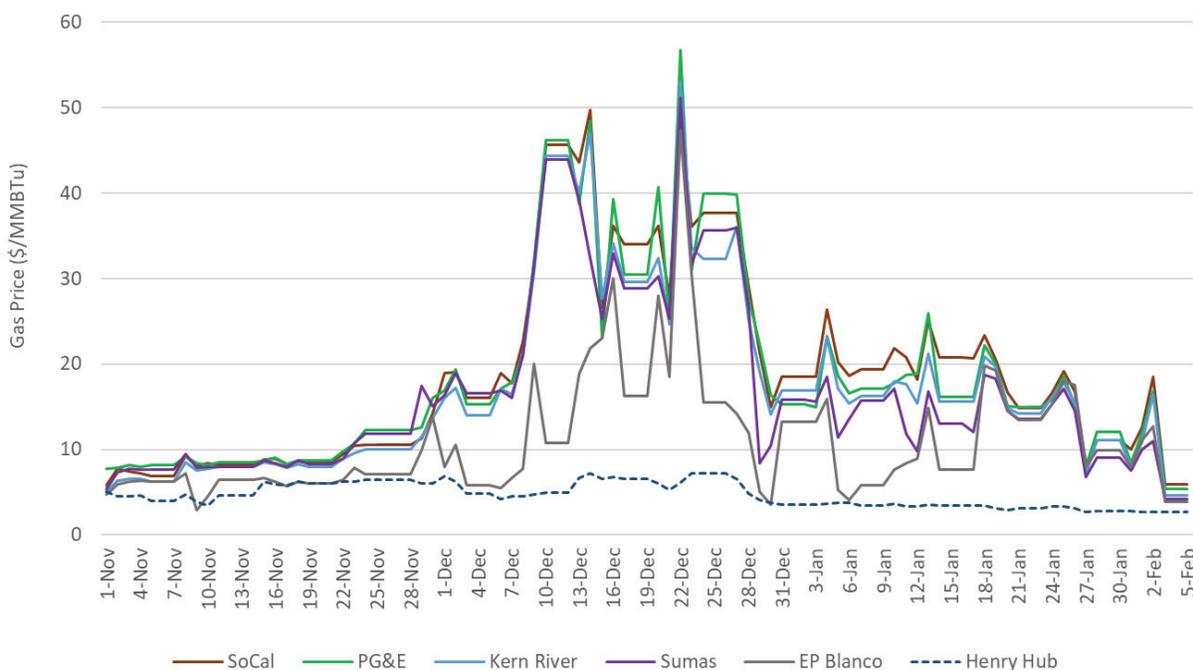
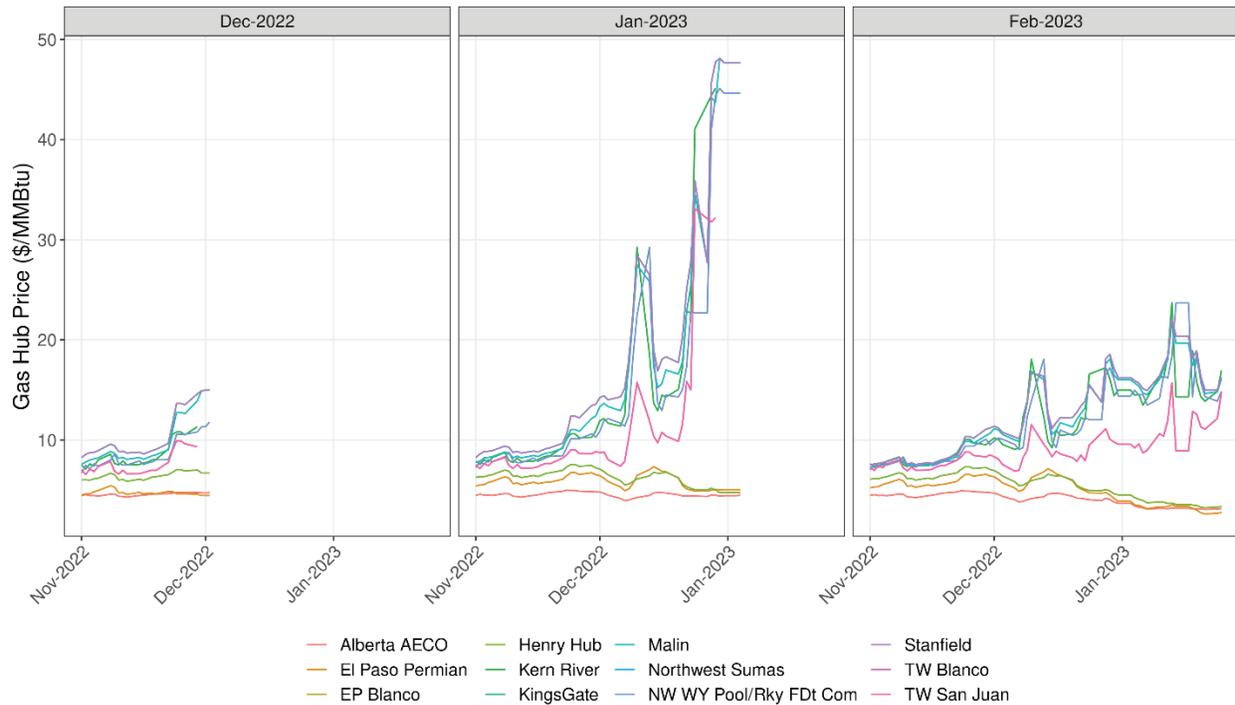


Figure 4 below shows future gas prices for hubs across the West as well as the Henry Hub for the months of December 2022, January 2023, and February 2023. The figure shows future gas prices that started trading in November 2022 through the most recent trading date as of this report’s publication. The data shown is averaged across the various index vendors from which the CAISO receives pricing data.

Pricing trends for the Western gas hubs follow a similar trend for the CAISO and CAISO-adjacent hubs discussed above, with two price spikes observed in December 2022 for January 2023 futures. The highest price of \$48/MMBtu occurred at the Sumas hub in the Northwest for January 2023 futures.

Three hubs stayed relatively insulated from this price volatility and remained well below \$10/MMBtu during the trading months: Henry Hub, Alberta AECO, and El Paso Permian.

Figure 4. Future gas prices for Western gas hubs and Henry Hub, Dec. 2022 through Feb. 2023



### Gas hub liquidity

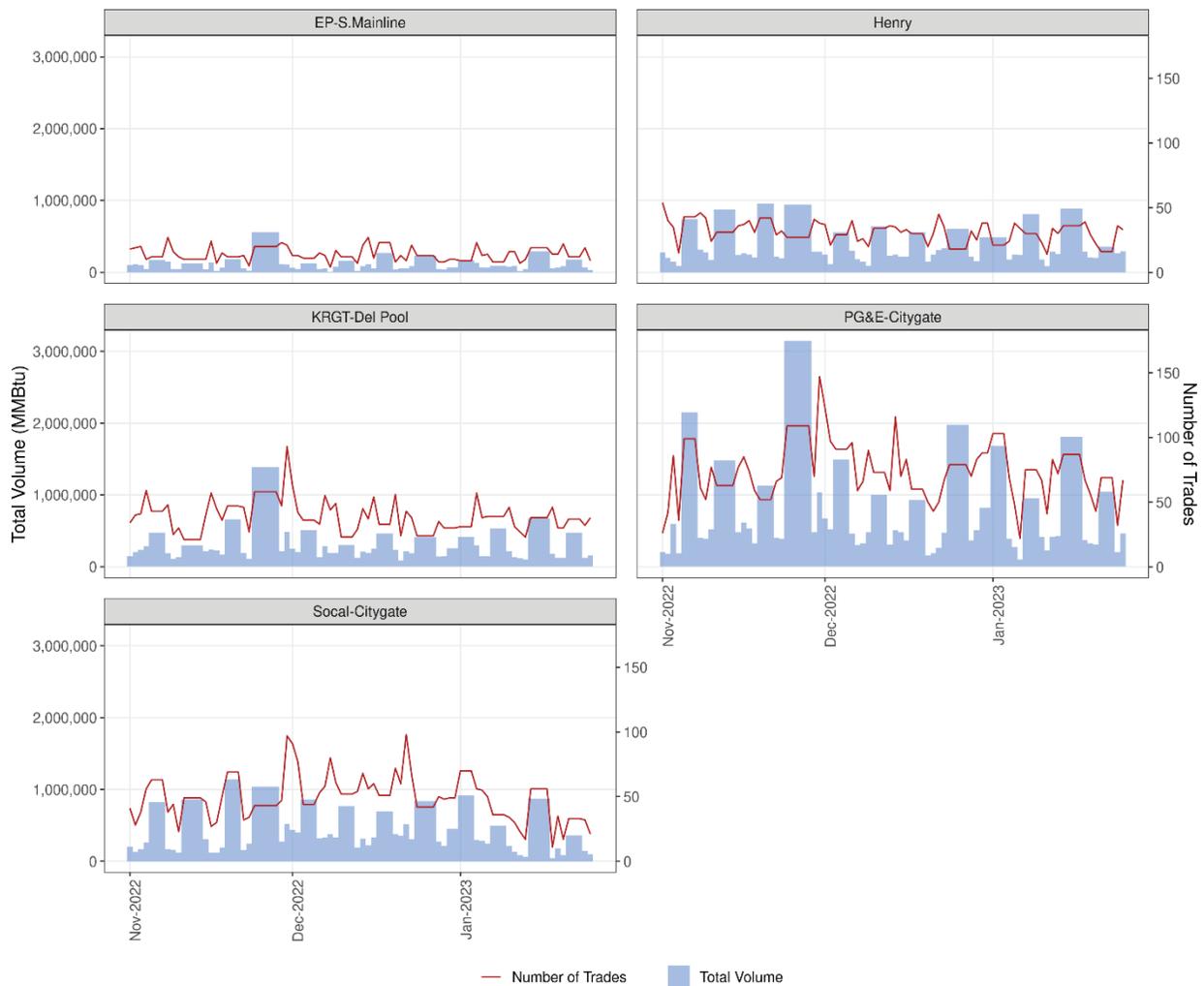
The level of activity at each natural gas trading hub, *i.e.* the volume of gas traded and number of transactions, varies among hubs and over time. This level of activity, or liquidity, is an important metric to assess competition and price formation at gas-trading hubs. Figure 5 below shows a summary of total volume in blue and number of trades<sup>1</sup> in red for next-day gas at CAISO area gas hubs and the Henry Hub for the period of November 2022 through the most recent January 2023 trading date as of this report’s publication. Next-day gas does not trade over weekends and holidays as indicated by the static nature of the data during those times.

Across the five hubs shown below, PG&E Citygate experienced the largest volume of gas trading prior to, during, and following the period of gas price volatility in December 2022. The largest volume of gas traded at PG&E Citygate was approximately 3,000,000 MMBtu for the period of November 11

<sup>1</sup> Number of trades refers to the total amount of bid and offer transactions for a specific gas flow date or period, derived from external vendor feed data available to the CAISO.

through November 28, or the Thanksgiving holiday weekend. During the December timeframe, the next-largest volume of gas was also traded at PG&E Citygate for approximately 2,000,000 MMBtu for the period of December 24 through December 27, or the Christmas holiday weekend. The higher volume of gas traded during these weekends is expected to some extent because the time period covers more days than a typical weekend. The lowest traded volume of gas occurred at the El Paso South Mainline hub for approximately 12,000 MMBtu for gas trading day December 8.

Figure 5. Total volume and trades at different gas hubs, Nov. 2022 through Jan. 2023



PG&E Citygate also saw the highest number of trades when comparing across these five hubs for the three month period shown below. The number of trades trended somewhat closely with volume, with a few significant exceptions. For example, the highest number of trades for next-day gas during the three month period occurred at PG&E Citygate for gas trading day November 30 at 147

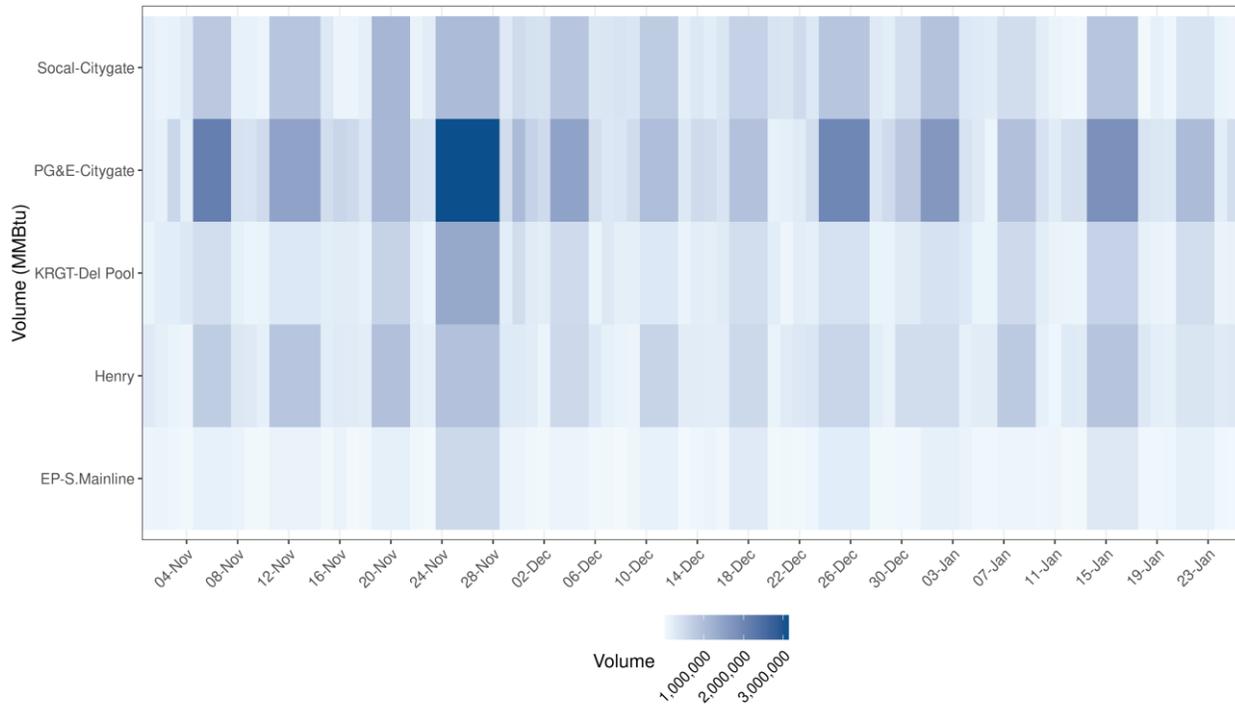
transactions. This high number of trades corresponded with a total traded volume of approximately 1,040,000 MMBtu which is on the lower end of traded volume at PG&E Citygate during the three-month period. However, the volume traded for November 30 was the highest of any single day total volumes at the hub; that is, all of the other instances of high total volume at PG&E Citygate corresponded to multi-day periods like weekends or holidays. During the month of December, the next-highest number of trades occurred at PG&E Citygate for December 1 at 123 transactions.

Figure 6 below shows a heat map of total volume of next-day gas traded from November 2022 through the most recent January 2023 trading date as of this report's publication for the four main CAISO area gas hubs as well as the Henry Hub for comparison. A darker blue color indicates a higher volume of gas traded. As discussed above, natural gas does not typically trade on weekends or holidays, as shown by the static blocks of volume data below, and trades for the entire weekend/holiday block. Thus, higher volumes are somewhat expected for weekends or longer holiday weekends like for the Thanksgiving weekend of November 24 through November 28.

# Gas Conditions Report

Figure 7 shows a scatterplot of weighted average gas prices across the time period for each of the main CAISO area hubs and the Henry Hub. The associated total traded volume is shown with a color gradient on each of the points, with blue representing a lower volume and pink representing a higher volume. While some of the higher-priced days saw associated higher volumes, for example over the holiday weekend of December 24 through December 27 at PG&E Citygate, the high total volumes traded at each hub did not always correlate with a high \$/MMBtu gas price.

Figure 6. Total volume of next-day gas traded by hub, Nov. 2022 through Jan. 2023



# Gas Conditions Report

Figure 7. Weighted average price and volume gradient by hub, Nov. 2022 through Jan. 2023

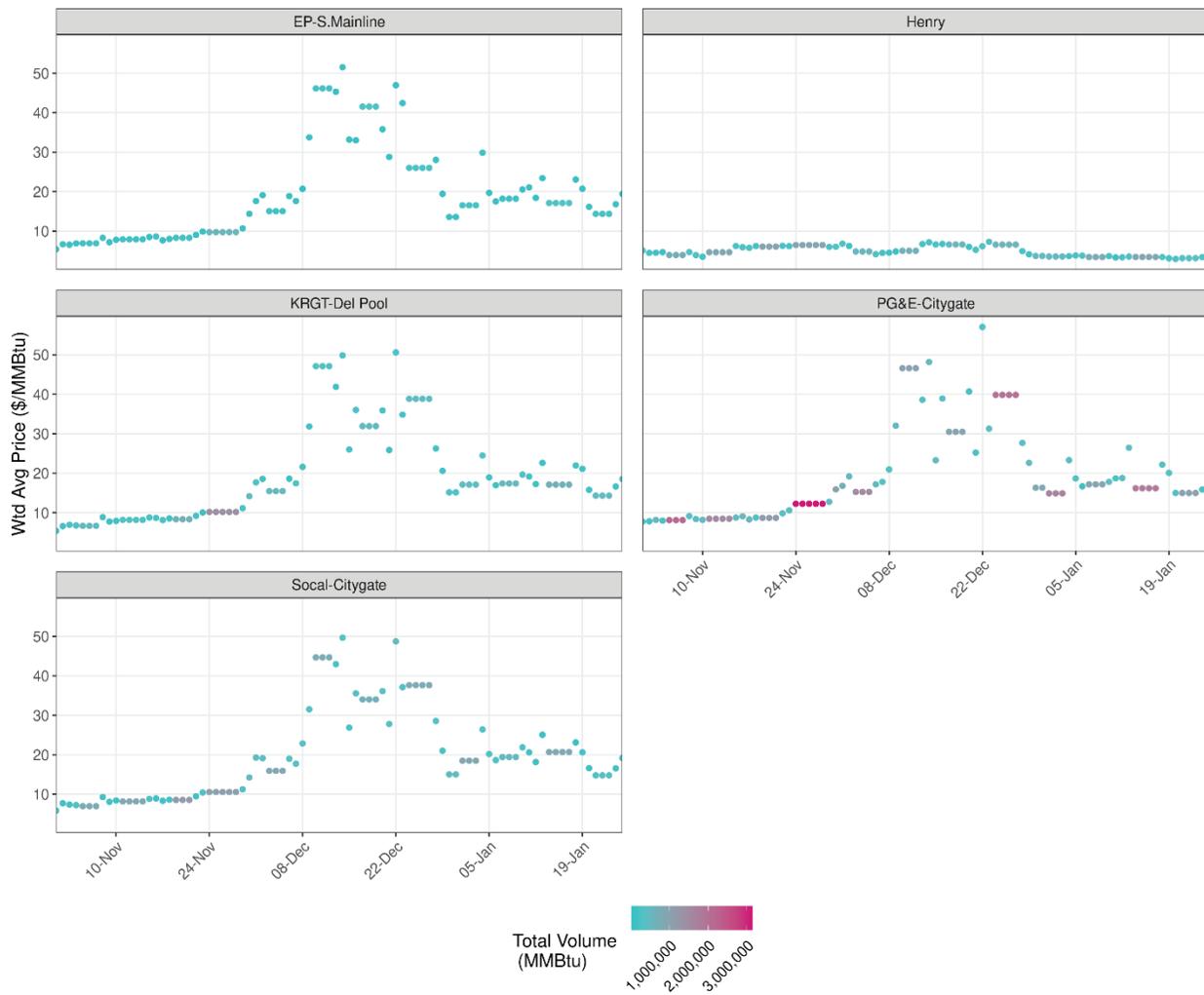


Figure 8 below shows a heat map of total number of trades for next-day gas traded from November 2022 through the most recent January 2023 trading date as of this report’s publication for the four main CAISO area gas hubs as well as the Henry Hub for comparison. A darker blue color indicates a higher number of trades observed. As discussed above, gas does not typically trade on weekends or holidays, as shown by the static blocks of volume data below, and trades for the entire weekend/holiday block. The highest number of trades at PG&E Citygate occurred just after the Thanksgiving holiday weekend on November 30. The number of trades is generally lower for all hubs in January 2023 as compared to peaks from November and December 2022.

Figure 9 shows a scatterplot of weighted average gas prices across the time period for each of the main CAISO area hubs and the Henry Hub. The associated total number of trades is shown with a color gradient on each of the points, with blue representing a lower volume and pink representing a higher volume. Similar to the trend discussed above for high prices and high volumes, there was not always a strong correlation between \$/MMBtu prices and number of trades, especially during higher-priced periods in December 2022.

Figure 8. Total number of trades of next-day gas by hub, Nov. 2022 through Jan. 2023

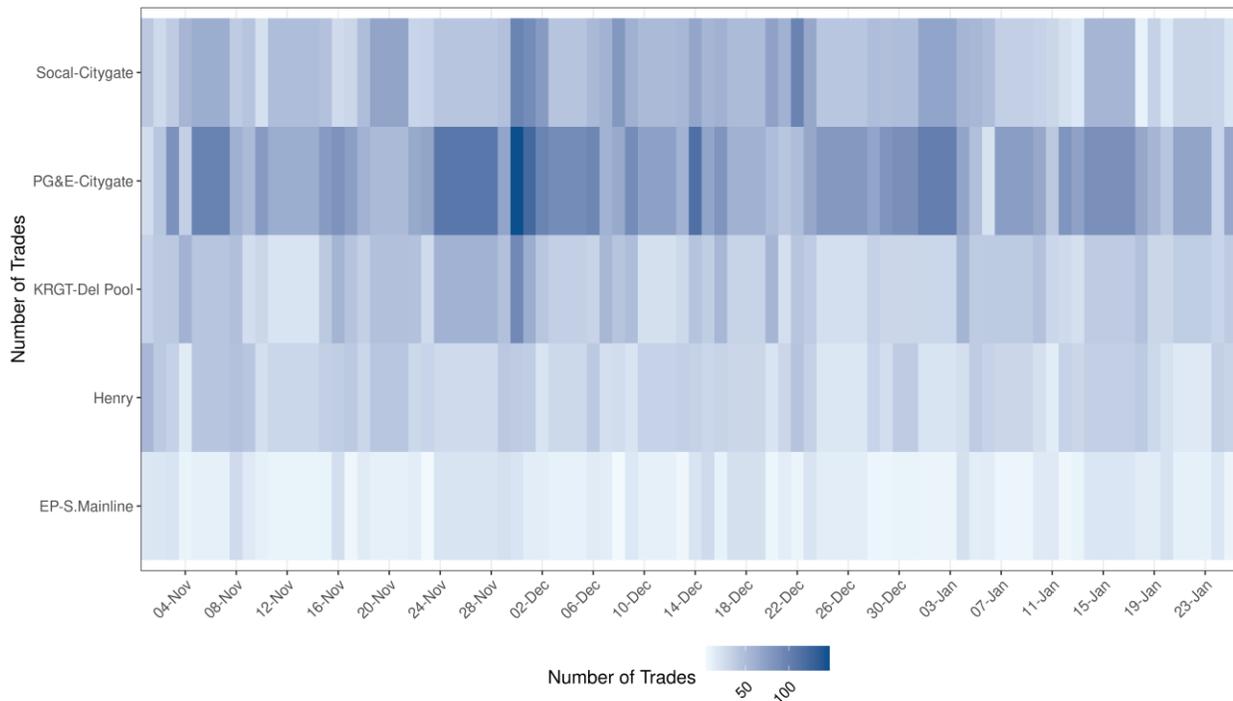
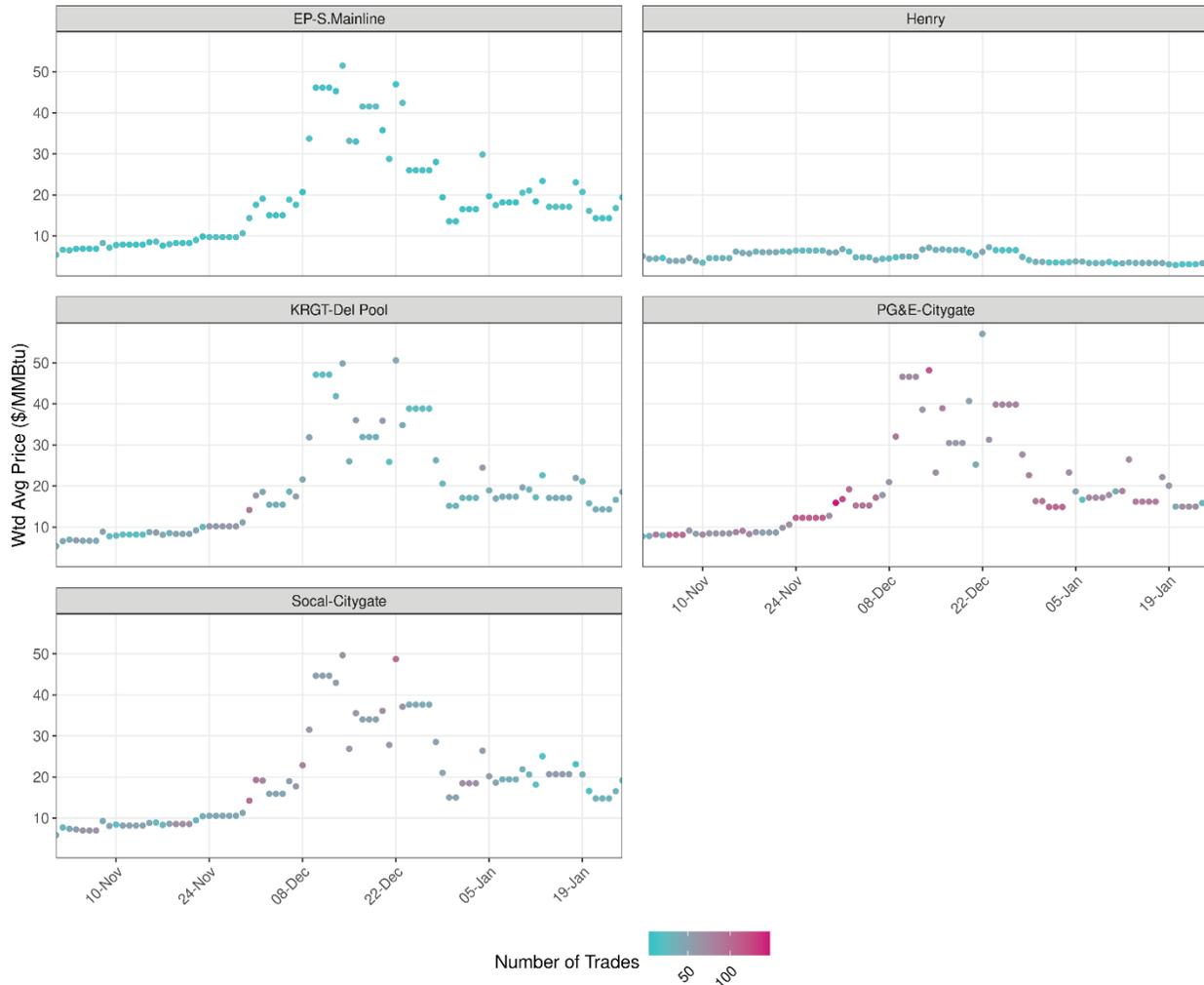


Figure 9. Weighted average price and trades gradient by hub, Nov. 2022 through Jan. 2023



### Gas system conditions

From November 2022 to January 2023, there have not been major gas pipeline outages impacting gas system reliability in the West. In December 2022, Kinder Morgan El Paso (EPNG) was able to increase capacity on L2000 from a 30% reduction to 20%. Work on L2000 was completed in January 2023 in accordance with Pipeline and Hazardous Material and Safety Administration (PHMSA's) corrective action order (CAO) and EPNG's remedial work plan (RWP). El Paso submitted a request to PHMSA in January 2023 to lift the pressure restriction so that the line can return to commercial service. PHMSA will need time to review the request and when it is approved, L200 will be ready for commercial service.

Overall storage capacity in the West was below the five-year average in December 2022 and January 2023. Throughout December 2022 and January 2023, both PG&E and SoCal Gas continued to utilize their storage facilities to maintain system reliability. Puget Sound Energy's Jackson Prairie underground storage facility has no identified constraints at this time and was performing as designed.

### 3 CAISO'S ENERGY MARKET

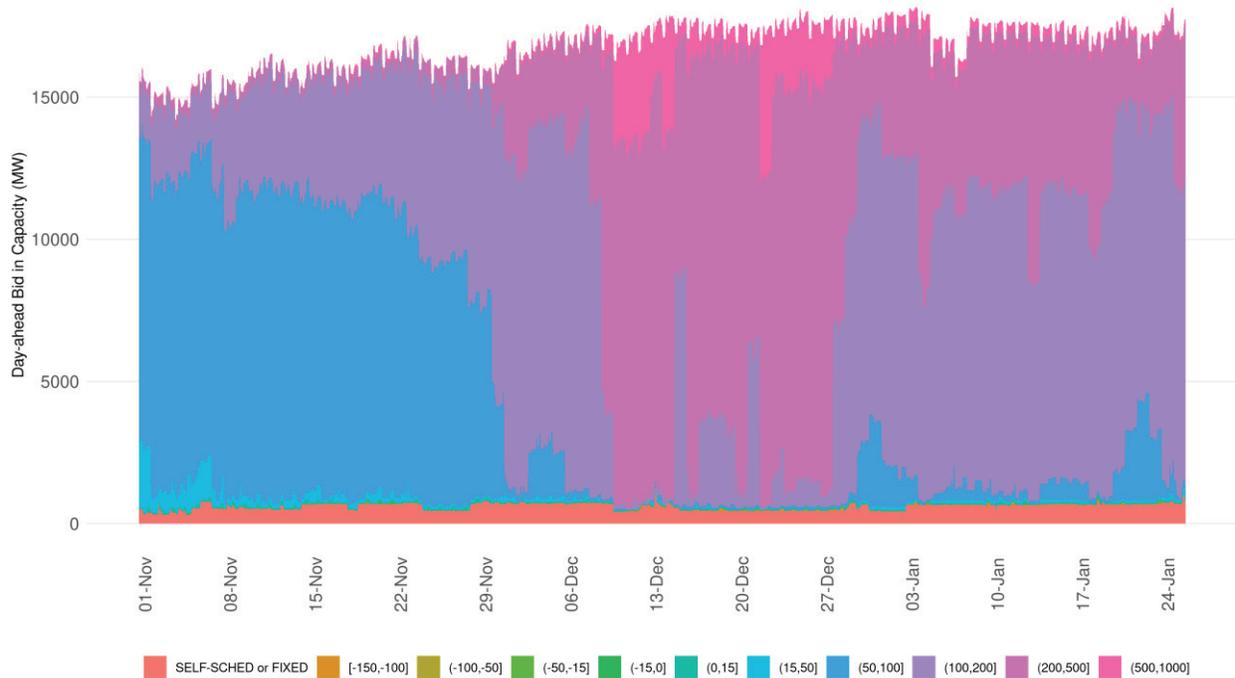
During the recent period of gas price volatility, there has not been any impact to the reliable operation of the electric system. CAISO has continued to coordinate with gas companies and has been tracking the gas system conditions. The main impact on the CAISO market has been on electric prices and wholesale costs.

#### Bid-in cost of CAISO's resources

The CAISO's electric market meets demand with supply from a variety of resource types, including gas, hydroelectric, wind, solar, and storage, as well as imports scheduled through the different intertie points. Gas generation represents a fair share of all supply in the CAISO system. For instance, in the summer of 2022 during the high-load days, gas provided close to 50 percent of the supply. The electric market clears supply to meet demand based on minimizing the bid-in cost. Resources can bid-in their costs to reflect the gas prices accordingly. Like other resources, gas-based generation has an array of market tools to reflect fuel costs into bid-in components including start-up costs, cost for operating at minimum levels, costs for transitions between stages (for multi-stage generating resources) and variable costs to be dispatched within the operational range. Correspondingly, CAISO's market incorporates gas prices in various mechanisms like the calculation of default energy bids and commitment cost bid caps. Gas price changes will be reflected accordingly in bid-in cost changes, which are consequently used to schedule supply.

Figure 10 shows the bid-in price of gas resources by price range. Each color represents a price range while the y-axis measures the corresponding bid-in supply capacity. The price ranges are organized from the lowest, which is a price-taker bid (willing to clear any price), followed by negative prices and then incrementally showing the ranges to cover up to the bid cap of \$1,000/MWh.

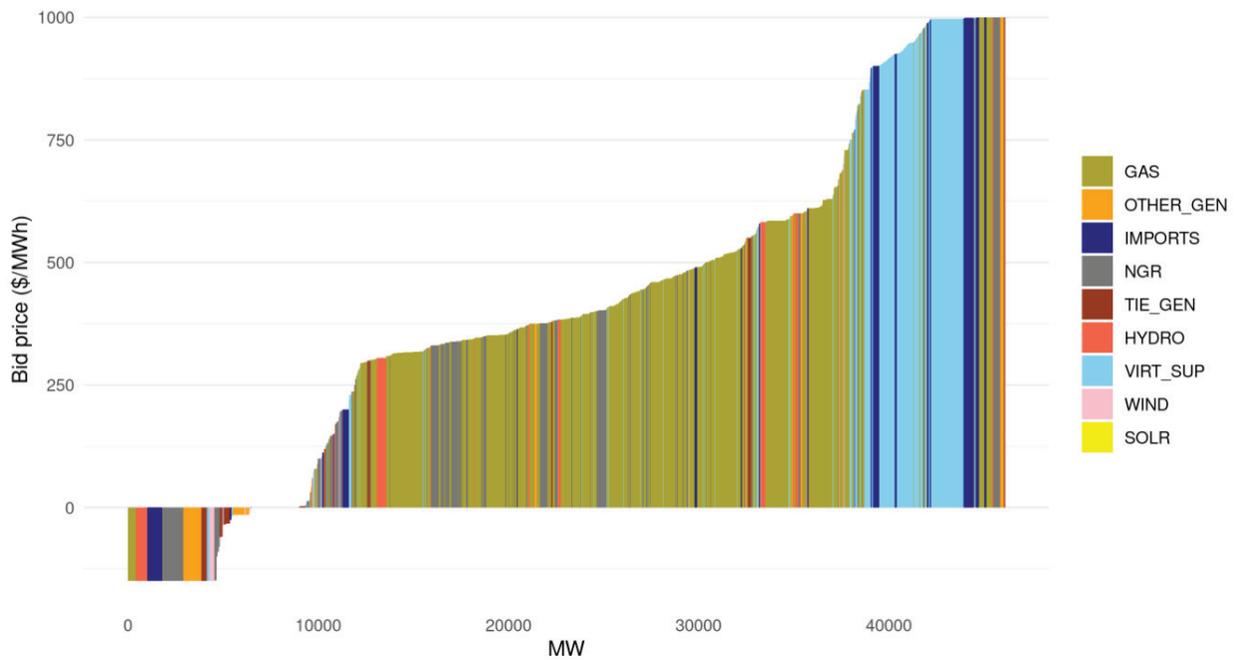
Figure 10. Day-ahead bid-in capacity from gas resources in CAISO market



At the beginning of November, when gas prices were about \$8/MMBtu, the majority of bid-in supply was in the range of \$50/MWh to \$100/MWh (depicted in blue). As November progressed and gas prices started to increase, the bid-in supply became more expensive; this can be seen with the area in purple increasing while the area in blue is decreasing. By November 29, when gas prices passed the \$10/MMBtu level and increased steeply, almost all bid-in supply from gas resources was in the range of \$200/MWh to \$500/MWh, and some supply showed bid-in prices between \$500/MWh and \$1,000/MWh as depicted by the red area. By the end of December and through January, when gas prices subsided to about \$16/MMBtu, a significant share of bid-in supply shifted down to prices between \$100/MWh and \$200/MWh.

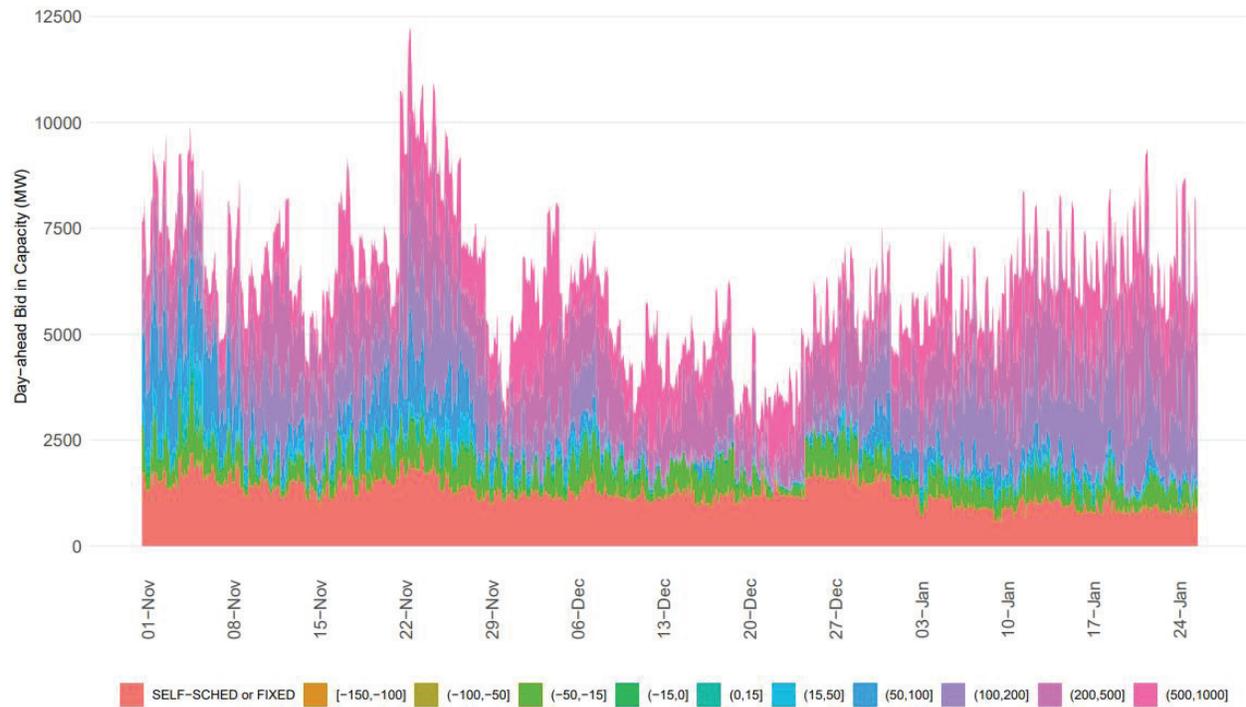
Figure 11 shows a more granular view of the bid composition. Using one peak hour for the day with the highest has prices, this figure shows all the energy bids submitted for the DAM market. The area in green shows the bid stack component from gas resources and how these resources are in the high-price range.

Figure 11. Submitted energy bids by resource type for DAM December 22, 2022 hour-ending 19



Import supply may seem to be impacted by the overall dynamic observed in December. This might be driven by factors in the West such as colder weather and potentially less hydro for supporting imports. Figure 12 shows the bid-in supply capacity from imports into the CAISO system organized by price range. These are the volume of imports bid-in in the market and do not reflect the actual awards of imports. The dynamics of import awards are discussed in subsequent sections.

Figure 12. Day-ahead bid-in capacity from Import resources in CAISO market

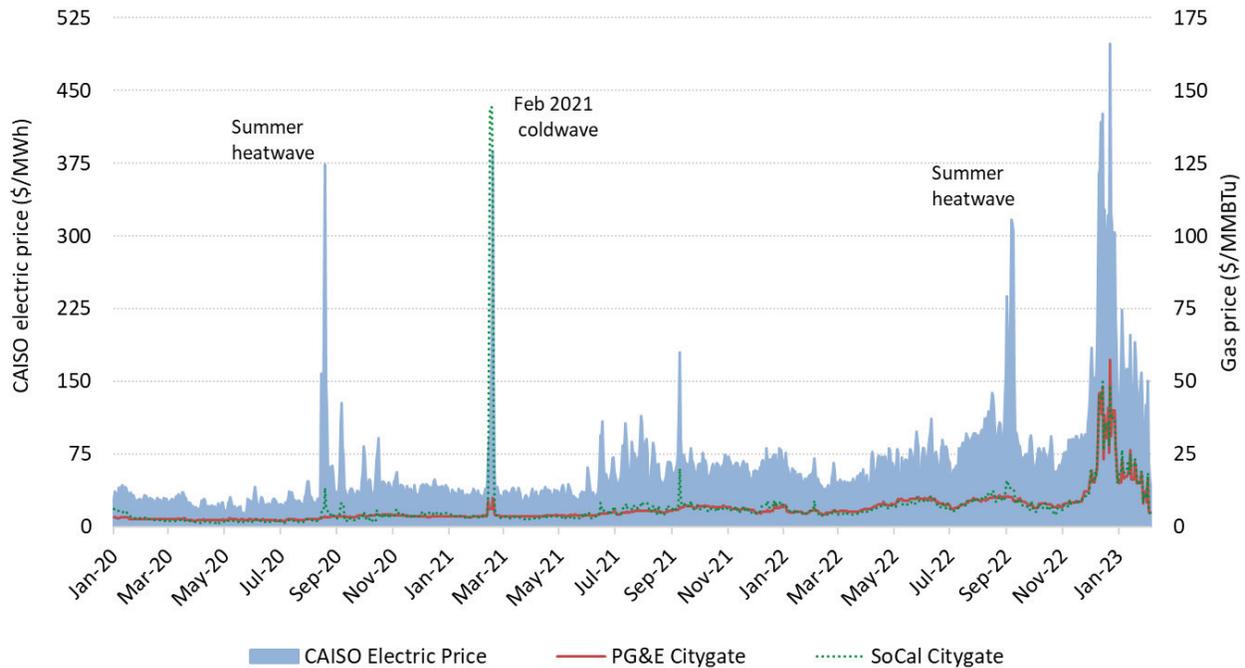


The reduction of imports started in later November from over 10,000 MW and reached minimum levels in mid-December at about 3,000 MW. With this reduction, the relative share of imports at higher prices (over \$100/MWh) was significantly larger.

### Electric prices

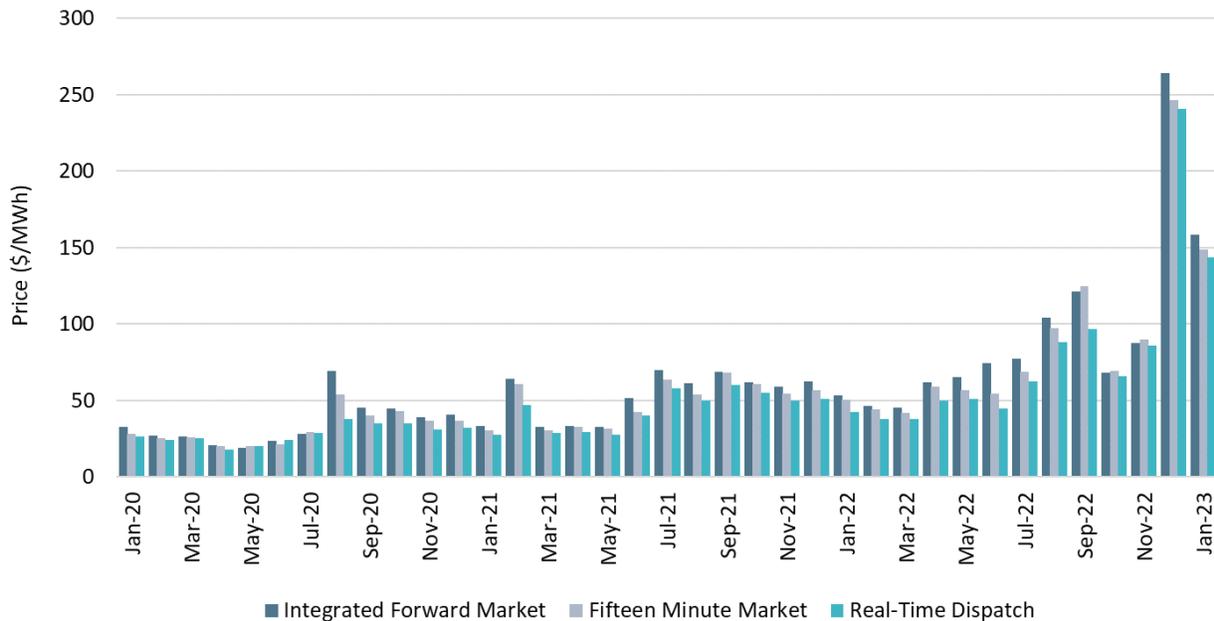
As part of the market-clearing process, the market determines optimal schedules and prices for resources. The cost minimization process used in the market-clearing uses locational marginal pricing. Overall, any resource type, including gas resources, can set the prices in the system. Given the relatively significant share of gas generation in the CAISO system, it is common that gas resources can be the marginal resources, thus their bid-in costs will define the system energy price. As a result, higher gas prices reflected in higher bid-in prices for gas resources will generally be reflected in, and set the value of, electric prices in the CAISO markets. Figure 13 shows the trend of the two main gas hubs in California, SoCal Citygate and PG&E Citygate, in comparison to the average day-ahead price in the CAISO’s electric market. Electric prices track gas prices relatively closely. As gas prices have steadily increased across December and January, so do the electric prices. This correlation is more marked during the sustained gas price increases of December when electric prices remained equally high.

Figure 13: Day-ahead average electric price compared to California hubs gas prices



Historically, there have been other gas price spikes that resulted in higher electric prices, including the spike observed in February 2021 during the cold snap that impacted the broader United States. Conversely, there are other instances in which higher electric prices were not directly driven by higher gas prices, such as the higher electric prices observed in the summers of 2021 and 2022 which were driven mainly by tight supply conditions. Figure 14 shows the trend of average electric prices across the different CAISO markets. Electric prices in December 2022 were at their highest levels in recent years. This is not because the CAISO’s prices have experienced spikes for a limited amount of hours; instead, it is because these prices have been sustained for many consecutive days across all hours, reflecting the underlying, more expensive, fuel costs. Relative to average electric prices from December 2021, prices in December 2022 saw a fivefold increase.

Figure 14: Average prices in CAISO markets

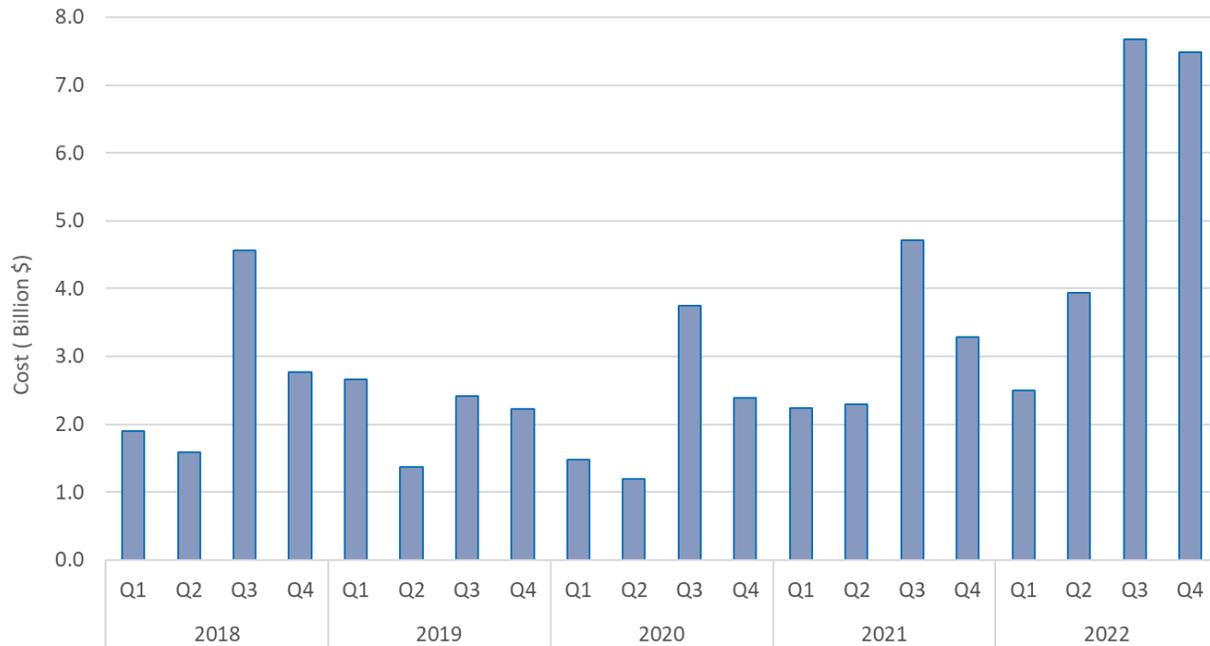


### Wholesale costs

The CAISO’s electric prices are financially binding and used in the settlements for supply and demand. Supply is paid the corresponding locational marginal prices while demand is charged based on the locational marginal price of the aggregated demand locations (DLAPs). Therefore, higher electric prices driven by higher gas prices will directly impact the settlements of energy cleared in the market. The CAISO has consistently reported the overall wholesale costs and its various components through market updates and reports. The wholesale costs include the settlements of energy, ancillary services and other miscellaneous costs such as the Grid Management Charge (GMC), across all markets. Over 90 percent of the wholesale costs settled is from the day-ahead market while the real-time market cost is incremental. Figure 15 shows the wholesale costs by financial quarter from the CAISO’s electric market. The highest level at about \$7.6 billion in the third quarter in 2022 reflects the summer conditions where record-high demand levels were settled at relatively higher prices given the tight supply conditions. The cost of fourth quarter of 2022 came fairly close to the same level of the third quarter, at about \$7.4 billion, even though electric demand was lower. This is a twofold and threefold increase relative to the fourth quarters of 2021 and 2020, respectively<sup>2</sup>.

<sup>2</sup> The cost data is based on preliminary settlements calculations; CAISO’s settlements run at specific time frames. These costs will be updated once another settlement cycle is run. Although costs are updated and more accurate in subsequent settlements run, they typically do not change significantly from the preliminary estimates.

Figure 15: Quarterly wholesale costs in CAISO electric market



The cost for the fourth quarter of 2022 is largely driven by the steep increase observed in December 2022. Figure 16 shows the same wholesale costs organized by month for the last five years to provide a broader reference of historical cost levels. The cost observed in December 2022 is about four times higher than in previous years. In comparison to November 2022, the December 2022 costs saw a threefold increase. In general, costs have been trending higher throughout 2022.

Figure 16: Monthly wholesale costs in CAISO electric market

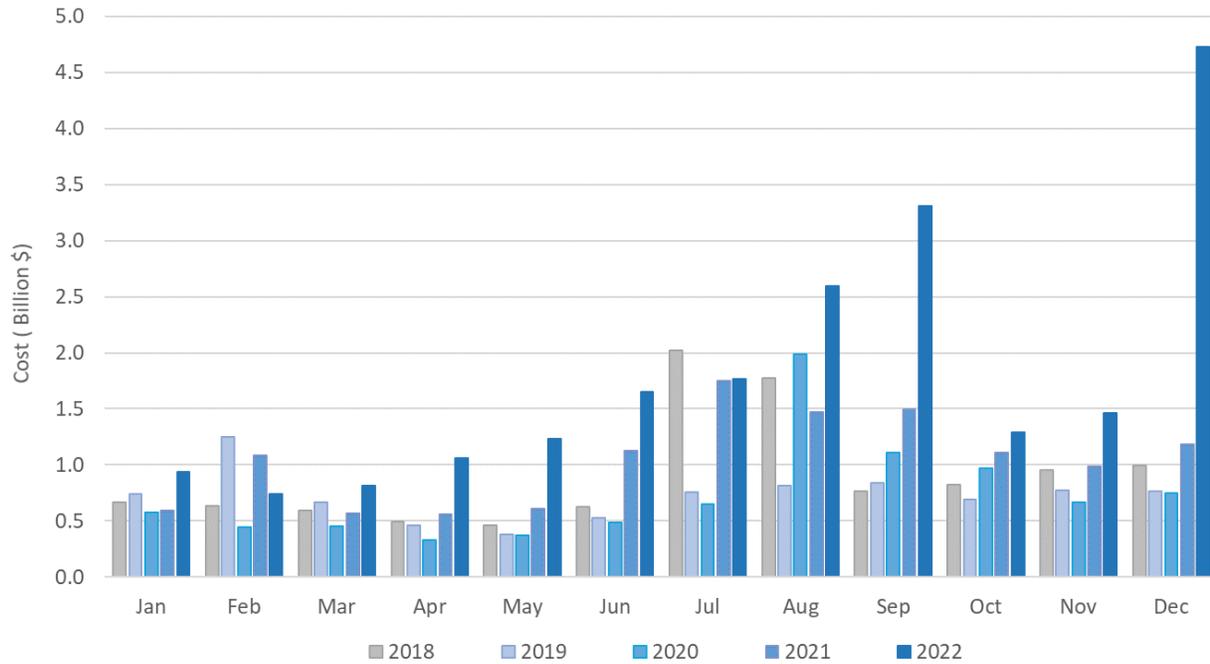
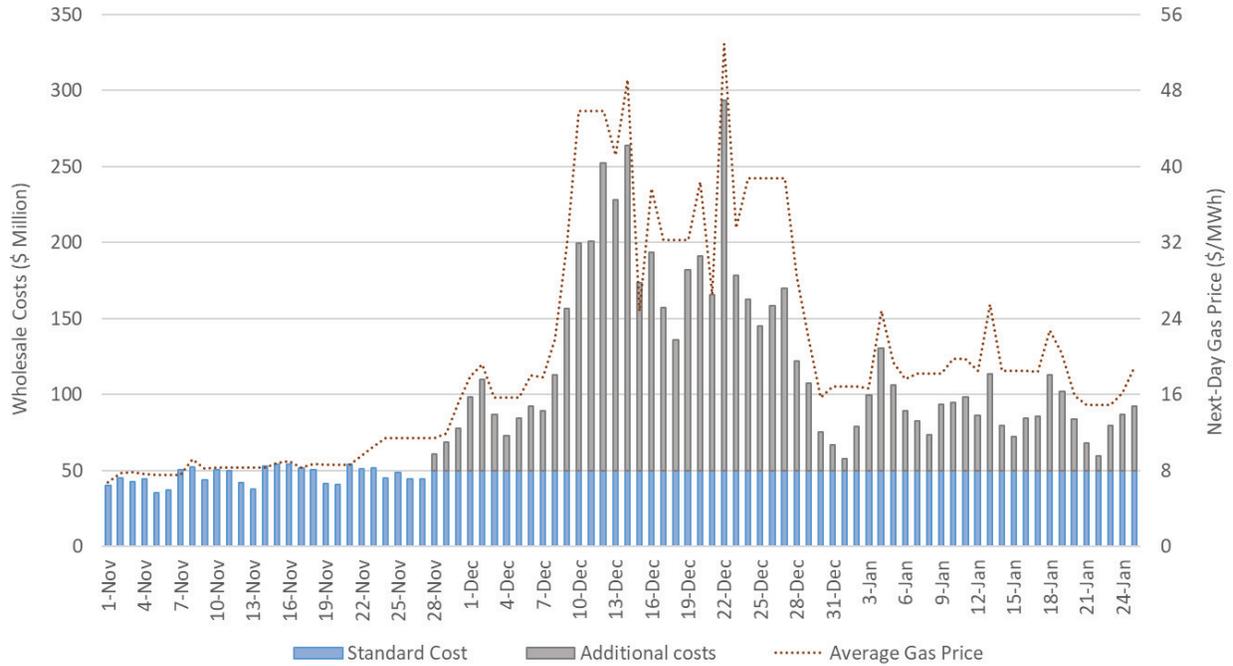


Figure 17 shows the daily wholesale costs from November 2022 through the end of January 2023. The dotted red line is the daily day-ahead gas price while the bars represent the wholesale costs. The bars in blue are a rough projection of the costs for December and January taking the average cost observed in early November, of about \$50 million per day, as a reference. Thus, the bars in grey are a rough approximation of the additional cost observed by the sustained gas price increases in December and January. This is a very crude approximation of the additional costs due to the atypical gas price increases. The additional cost is about \$3 billion in December and about \$0.9 billion for the first 25 days of January.

Figure 17: Wholesale costs for CAISO's electric market



The wholesale costs are largely allocated to demand. CAISO does not have information on hedging mechanisms that load serving entities may have in place to mitigate exposure to wholesale electricity costs, but expects extensive use of such instruments and expects that load serving entities are insulated from a significant portion of total wholesale costs. Energy hedging can mitigate load-serving entity exposure to the variability of wholesale costs induced by increasing fuel costs and subsequent impacts to retail customer costs.

### Gas use from electric generation

Based on the bid-in cost and the overall supply availability, the CAISO's market-clearing process determines the optimal schedule of generation, including gas generation, to meet the forecasted demand. Although the fuel cost, as reflected in the bid-in price of resources, is a main driver to determine what generation is scheduled, the amount of supply from gas generation also depends on the relative availability and costs of other supplies. Figure 18 shows the gas burn projected from gas resources dispatched in the day-ahead market, organized by the three main gas regions in the CAISO system: PG&E (Pacific Gas & Electric), SoCal Gas, and Kern River. The red dashed line shows the daily average load in MW.

Figure 18: Day-ahead gas burn from gas resources in CAISO market

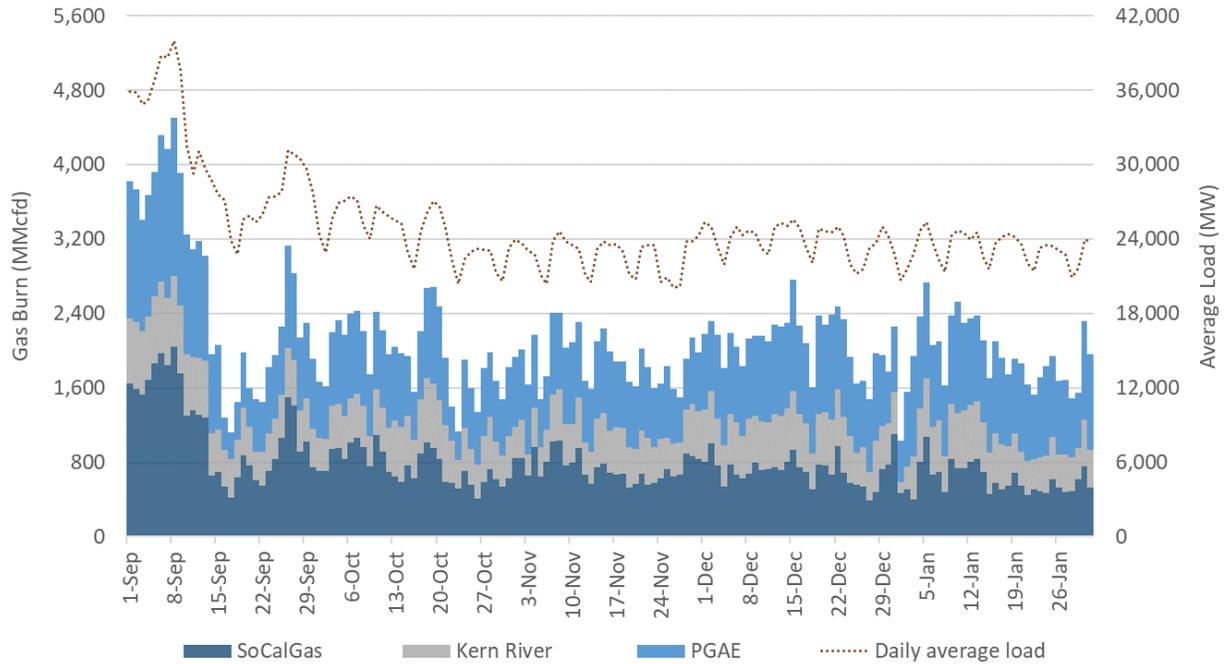


Figure 19 shows a comparison of daily gas use for the period of November through January between 2021 and 2023. Overall, CAISO gas generation used more gas in December 2022 compared to December 2021. This higher use depended on the overall supply availability, electric demand, and fuel costs reflected in CAISO market bids. First, the electric demand in 2022 was elevated compared to electric demand in 2021; indeed, the demand in December 2022 was slightly higher than that of December 2021, and was also slightly higher than that of November 2022. Second, since prices across the West were high, there was not a marked price separation from gas generation from outside the CAISO that could incentivize cheaper generation to flow into California. Indeed, with less import volumes coming into California in December, there was a need for more generation from internal resources to offset that import reduction.

## Gas Conditions Report

Figure 19: Comparison of gas use for December 2022 vs. 2021

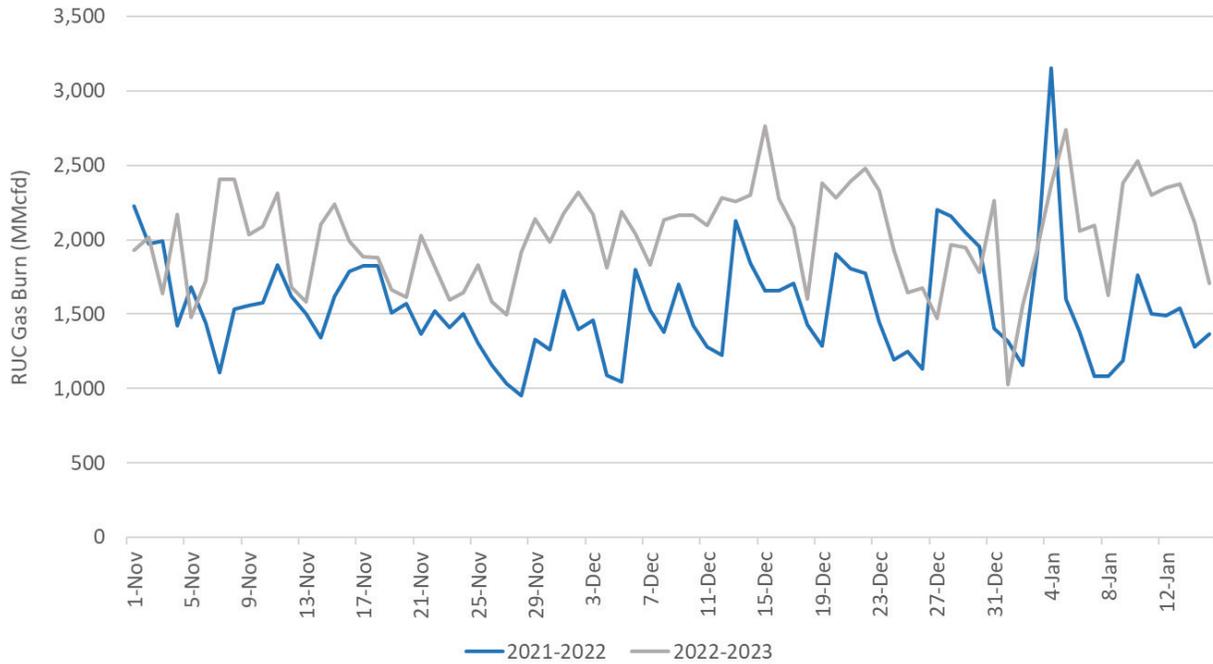
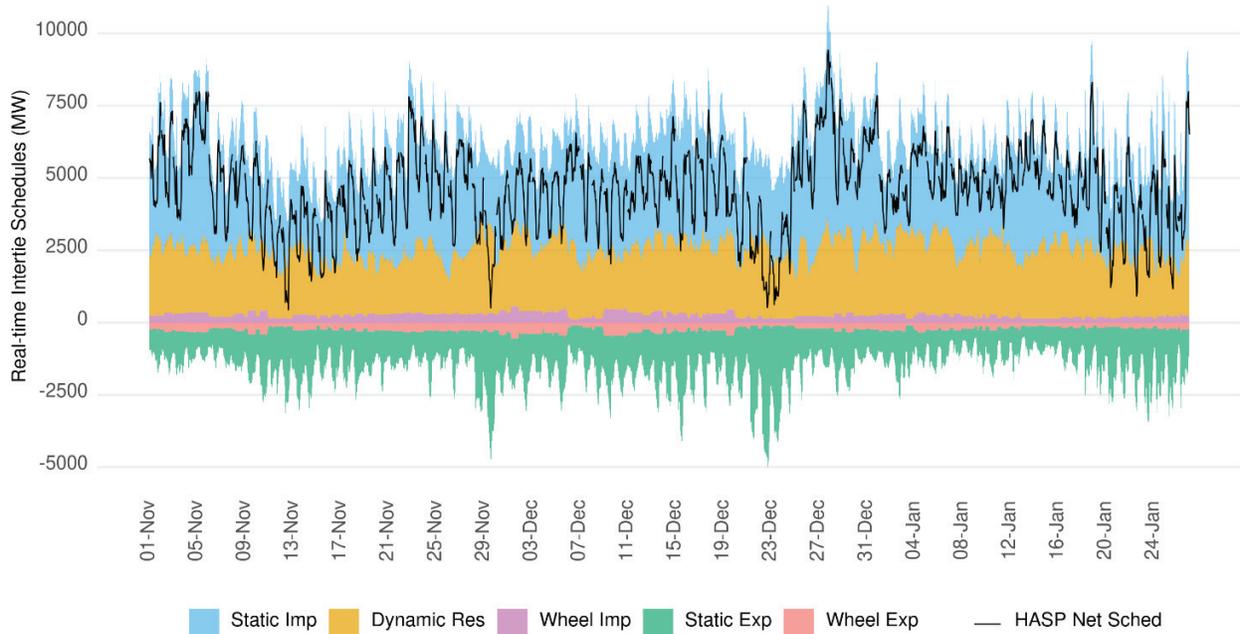


Figure 20 shows the trend of intertie schedules from the CAISO’s market organized by the type of transactions, namely import, exports, dynamic resources and existing transmission rights, and wheels through. In addition to the low volume of imports coming into the CAISO system in December 2022, the net schedule interchange was lower during the latter half of December when a higher volume of exports cleared.

Figure 20: Intertie transactions scheduled by transaction type

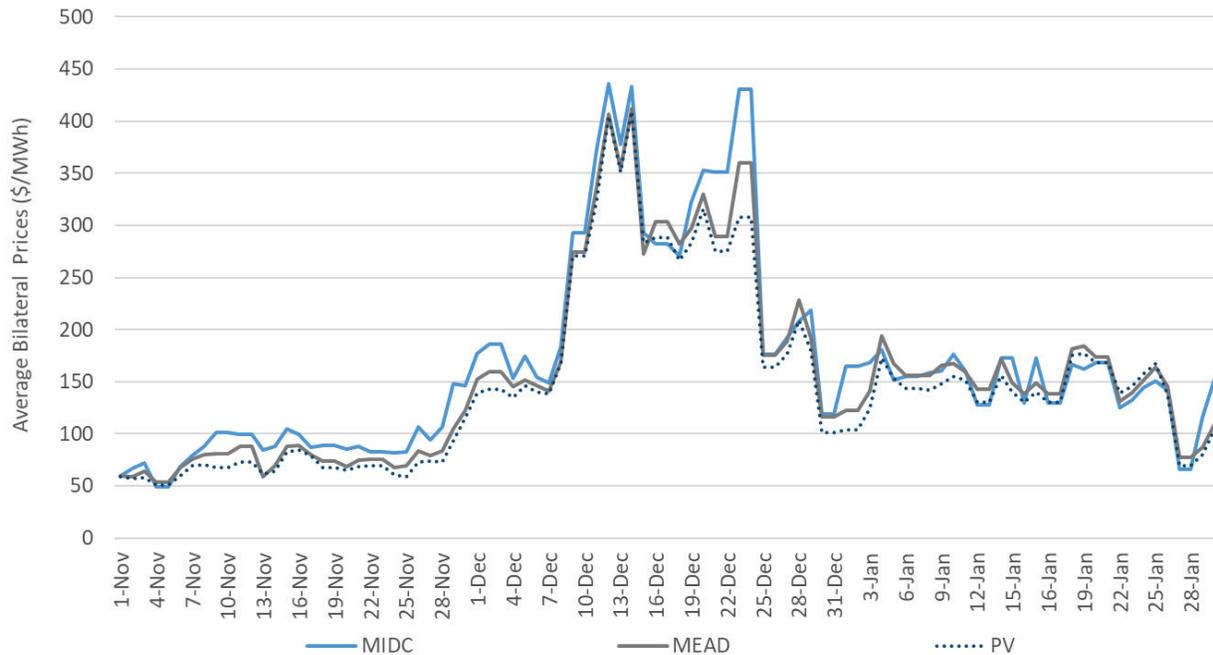


The volume of interties scheduled in the real-time are based on the intertie bids submitted into the real-time market, which can change from what was originally observed in the day-ahead timeframe. The bid-in capacity for imports and exports in the real-time market are shown in the Appendix.

### Bilateral market prices

Outside of the CAISO market, power trades bilaterally at different geographical hubs spread across the West. The bilateral power market can provide a useful indication of how prices are trending across the West for the near-term, *i.e.* physical next-day power, and the long-term, *i.e.* financial future power. Both next-day and future power prices are used in various CAISO market calculations. In general, bilateral power prices trade in multi-hour blocks for on-peak and off-peak hours. Figure 21 shows the trend of next-day bilateral electric prices across some of the main hubs in the West: Mid-Columbia (MIDC), Mead, and Palo Verde (PV). In general, prices were elevated at all hubs during December as compared to surrounding months.

Figure 21. Next-day bilateral electric prices for main hubs in the West



During the periods of gas price volatility, the energy bid cap did not increase above \$1,000/MWh. In general, the energy bid cap can be raised above \$1,000/MWh and up to \$2,000/MWh if either condition is met:

1. The Maximum Import Bid Price exceeds \$1,000/MWh, or
2. A scheduling coordinator submits a cost-verified energy bid above \$1,000/MWh.

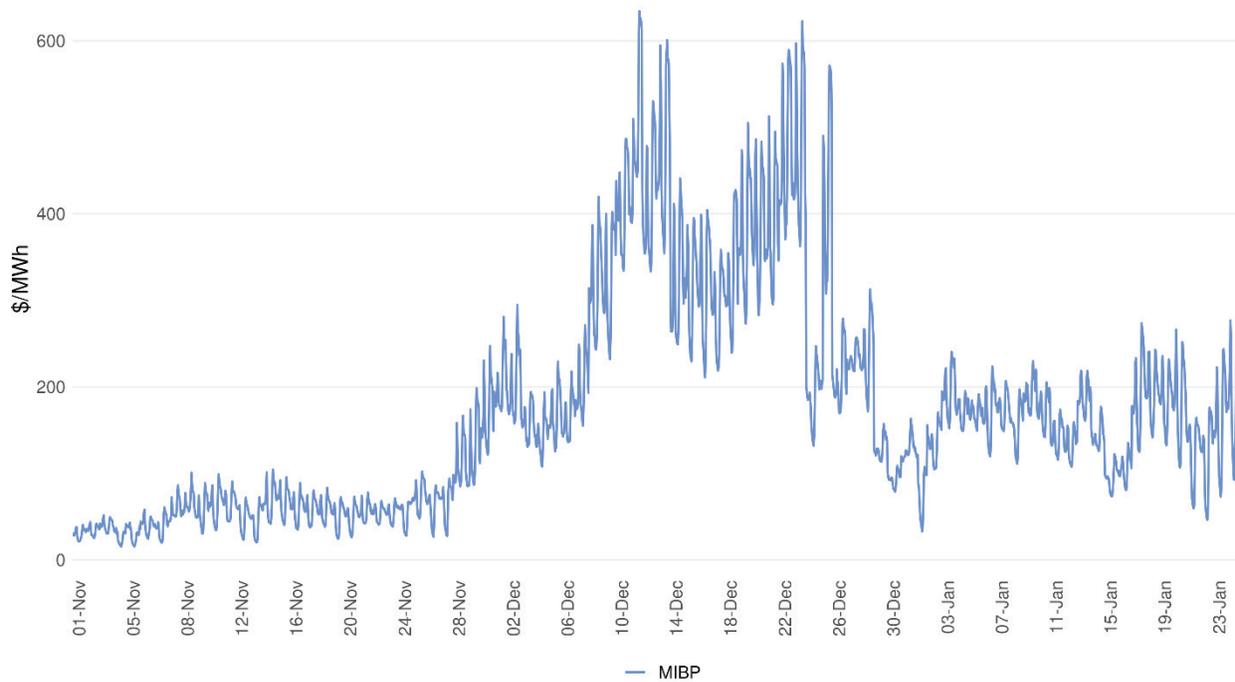
The Maximum Import Bid Price (MIBP) is a CAISO-calculated component that is intended to approximate the prevailing bilateral energy prices outside the CAISO’s BAA on an hourly basis.<sup>3</sup> Because the MIBP did not exceed \$1,000/MWh during this time period, certain resources including imports, reliability demand response resources in real time, non-participating load, exports, and virtual bids were not able to bid above \$1,000/MWh and up to \$2,000/MWh. Resource-specific resources may bid above \$1,000/MWh and up to \$2,000/MWh if they have the ability to justify they have costs above \$1,000/MWh, *i.e.* cost-verify their bids.<sup>4</sup>

Figure 22 and Figure 23 show the MIBP values leading up to, and following, the period of gas volatility in December 2022. As the MIBP is an hourly value and is shaped using hourly CAISO day-ahead SMEC prices, intra-day variation is expected.

<sup>3</sup> Details on the MIBP calculation can be found in the BPM for Market Instruments Attachment P.2. The MIBP is calculated separately for DAM and RTM.

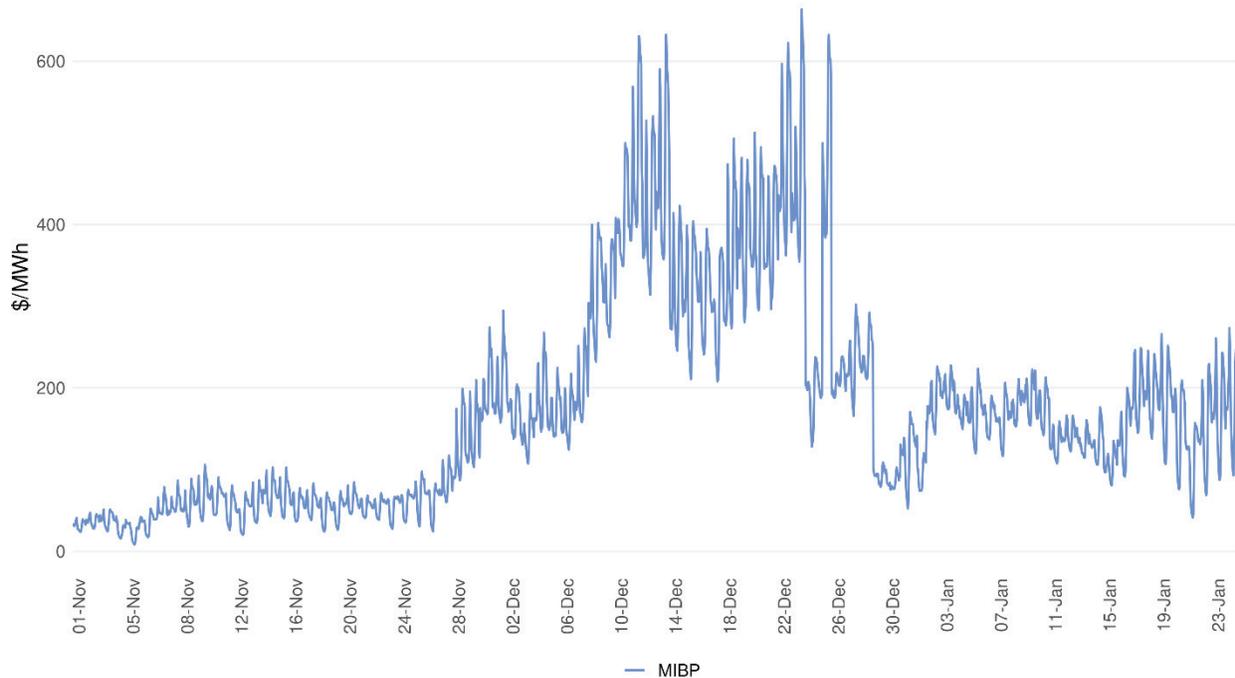
<sup>4</sup> Details on the process to cost-verify bids can be found in the BPM for Market Instruments Attachments O and P

Figure 22. Maximum Import Bid Price values in DAM, Nov. 2022 through Jan. 2023



For both the day-ahead and real-time markets, the MIBP values follow a similar trend across each of the three months; values remain below \$200/MWh in November and begin to rise during the first part of December, spiking above \$600/MWh a few times during the month. Prices dropped down to around or below \$200/MWh in January. These fluctuations correspond to the movement of the next-day bilateral energy prices at Mid-C and PV hubs, upon which the MIBP is based.

Figure 23. Maximum Import Bid Price values in RTM, Nov. 2022 through Jan. 2023



Future power can trade at a monthly granularity, or strip, for upcoming months, and can trade for that strip during the month itself (e.g. December 2022 future power can trade for the entire month of December). Figure 24 below shows future on-peak bilateral power prices at four main hubs, Mid-Columbia (MIDC or Mid-C), Palo Verde (PV), NP15, and SP15 for the months of December 2022, January 2023, and February 2023. The figure shows on-peak future prices that started trading in November 2022 through the most recent trading date as of this report’s publication. December 2022 on-peak futures began to rise at the end of November, then spiked significantly starting on December 9. January 2023 and February 2023 on-peak futures also spiked at this time, albeit more modestly. January 2023 on-peak futures saw a greater spike during the last few months of December then dropped to lower levels throughout January. During this period, February 2023 on-peak futures remained modest in comparison. Mid-C generally traded at the highest prices across the four hubs, while PV traded at the lowest prices.

Figure 25 below shows a similar trend for off-peak future bilateral power prices at the same four hubs, with price spikes observed during the mid-December and late December timeframe. In comparison to the on-peak prices, the off-peak prices were generally lower in value.

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Figure 24. Future on-peak bilateral prices at four main hubs, Dec. 2022 through Feb. 2023

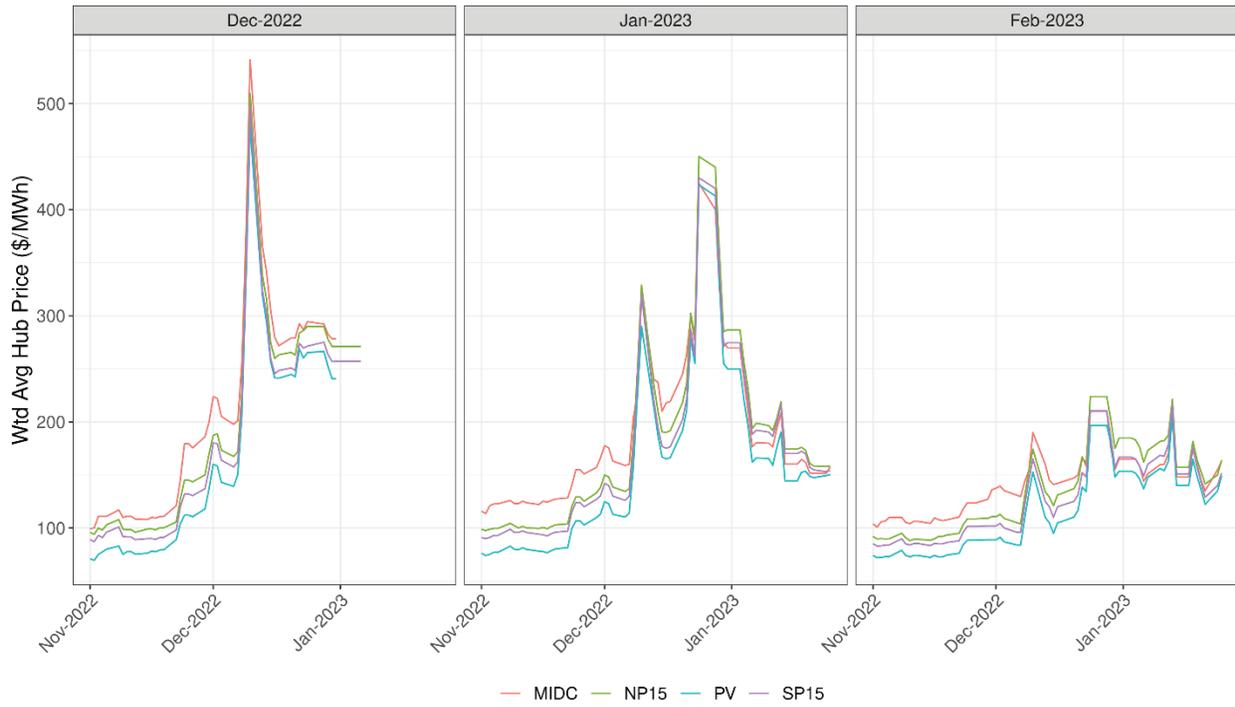
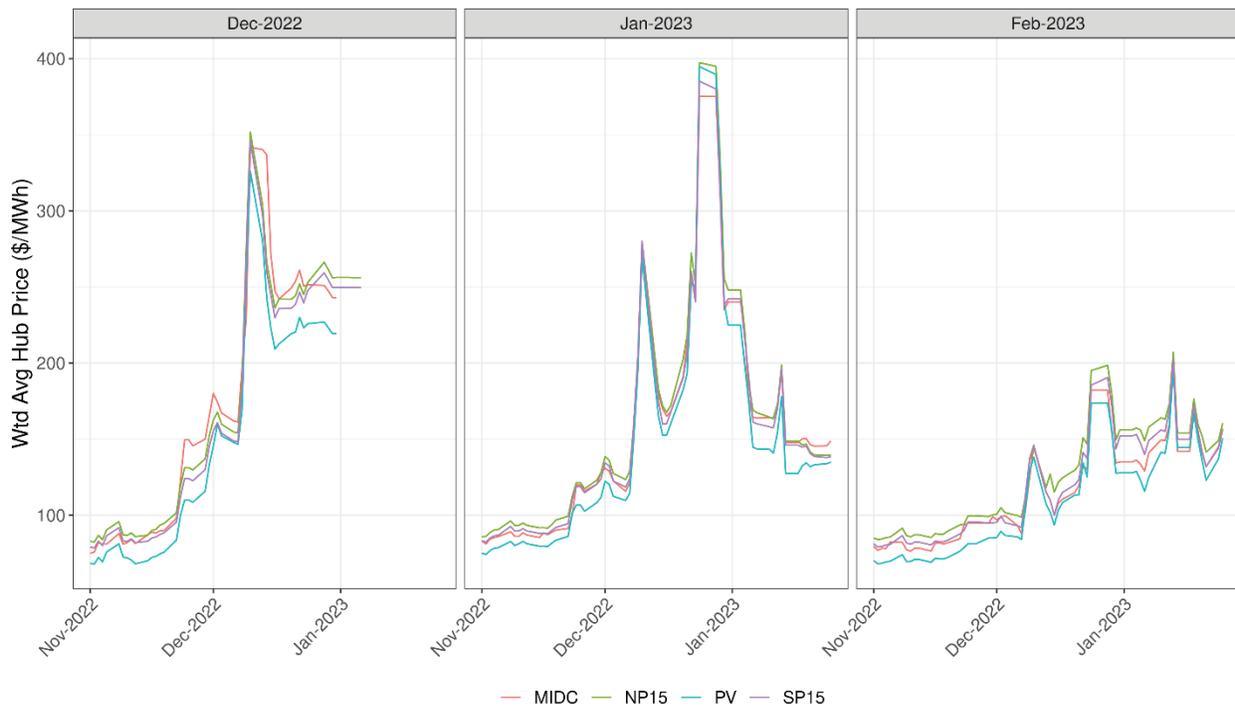


Figure 25. Future off-peak bilateral prices at four main hubs, Dec. 2022 through Feb. 2023



## 4 REFERENCE LEVEL CHANGE REQUESTS

A relatively new aspect of the CAISO markets related to gas prices is the ability for scheduling coordinators to submit reference level change requests (RLCRs). RLCRs effectively allow scheduling coordinators to reflect their resource-specific gas prices in their energy bids if the CAISO's standard processes would have limited their ability to do so. It does so as follows:

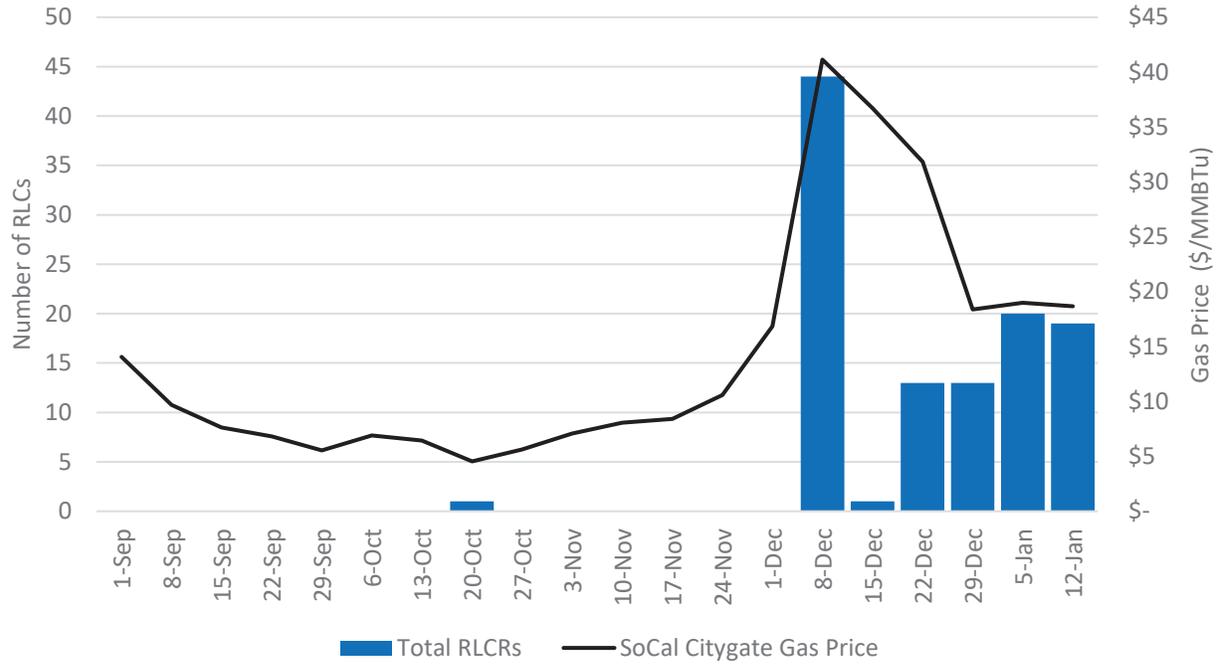
- In the CAISO markets, there is a price cap on how high a scheduling coordinator can submit their energy bid. For gas resources, the price cap is a function of the gas price in the region in which the resource is located<sup>5</sup>. The CAISO refers to this gas price as the fuel region gas price.
- Normally, the CAISO calculates the fuel region gas price based on vendor price indices received from external vendors. These vendor price indices are the weighted average prices of a large number of executed trades and reported by the gas purchaser to the vendors.
- Naturally, some specific gas resources will procure gas at a resource-specific gas price that is above the weighted average price. If this deviation is significant enough, the bid price caps calculated through the standard process will limit the resource's ability to reflect their costs in their bids, thus leading to inefficient market outcomes.
- To ameliorate these inefficient outcomes, the CAISO implemented the RLCR tool in 2020. This allows the scheduling coordinator to increase their bid price caps provided that they can support the change with documentation proving their higher resource-specific gas price. This documentation needs to be either submitted at the same time as the RLCR or maintained on file by the scheduling coordinator to be audited at the CAISO's discretion.
- This new, higher bid price cap allows the scheduling coordinator to reflect their resource-specific gas price in their energy bid.

In times of higher-than-normal gas prices, it would be natural to expect that the number of RLCRs would increase. Figure 26 shows this indeed appears to be the case for recent months. The bar chart shows the number of resources for which there was a RLCR submitted for a given 7-day period from September 1, 2022 through January 18, 2023. The line shows the weekly average SoCal Citygate fuel region gas price for a 7-day period for the same time period. The close correlation in the trends between the number of RLCRs and the SoCal Citygate price, particularly in the 7 days between December 8, 2022 and December 14, 2022, match CAISO's expectation. All but one of the 111 RLCRs were submitted since December 1, 2022.

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<sup>5</sup> This is only true for the bid components for minimum load cost and startup cost bids. For the incremental energy bids, these are subject to a \$1,000/MWh bid cap in most cases. However, the incremental energy bids are capped based on the fuel region gas price in cases where the resource is subject to local market power mitigation. For ease of reading, the CAISO will assume all components of the energy bid are subject to bid caps.

Figure 26: Number of RLCRs submitted compared to SoCal Citygate gas price



## 5 APPENDIX

Figure 27. Bid-in capacity for Imports in real-time

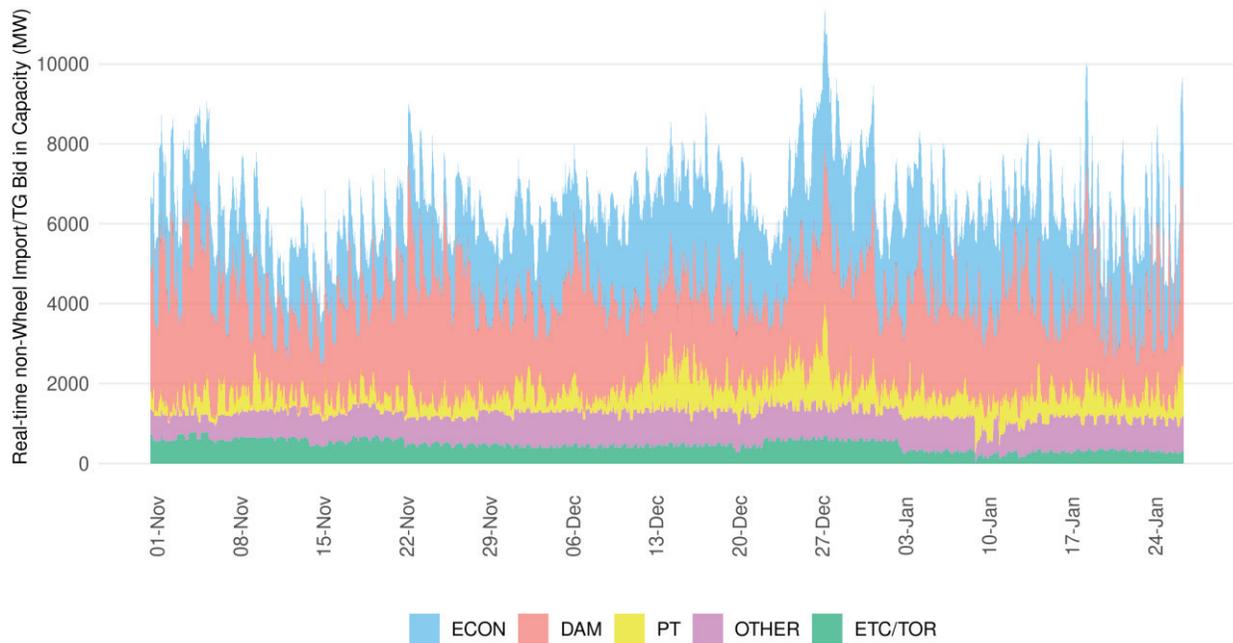


Figure 28. Bid-in capacity for Exports in real-time

