# Market Performance Report
# January 2020

March 26, 2020

ISO Market Quality and Renewable Integration

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## Executive Summary[1]

The market performance for January 2020 is summarized below.

CAISO area performance,

- With winter conditions, peak loads for ISO area stayed below 30,000 MW this month.
- Across the integrated forward market (IFM), fifteen-minute market (FMM) and real-time market (RTD), SDGE prices were elevated in a few days due to transmission congestion.
- Congestion rents for interties skidded to $1.27 million from $3.99 million in December. Majority of the congestion rents accrued on Palo Verde (24 percent), NOB (25 percent) and Malin500 (46 percent) intertie.
- In the congestion revenue rights (CRR) market, the balancing account for January had a surplus of approximately $3.24 million, which was allocated to measured demand.
- The monthly average ancillary service cost to load increased to $0.51/MWh from 0.46/MWh in December. There was one scarcity event this month.
- The cleared virtual supply was well above cleared demand throughout January. The profits from convergence bidding rose to $3.07 million from $1.97 million in December.
- The bid cost recovery inched down to $6.45 million from $7.08 million in December.
- The real-time energy offset cost dropped to -$1.21 million from $2.96 million in December. The real-time congestion cost skidded to $3.08 million from $10.01 million in December.
- The volume of exceptional dispatch increased to 278,038 MWh from 153,817 MWh in December. The top reasons to the monthly volume were unit testing and planned transmission outage. The monthly average of total exceptional dispatch volume as a percentage of load percentage was 1.61 percent, increasing from 0.85 percent in December.

[1] This report contains the highlights of the reporting period. For a more detailed explanation of the technical characteristics of the metrics included in this report please download the Market Performance Metric Catalog, which is available on the CAISO web site at **http://www.caiso.com/market/Pages/ReportsBulletins/Default.aspx**.

Energy Imbalance market (EIM) performance,

- In the FMM and RTD, the ELAP prices for AZPS were elevated on January 16 due to high demand, increased net export, and reduced supply.
- The monthly average prices in FMM for EIM entities (AZPS, BANCSMUD, BCHA, IPCO, NEVP, PACE, PACW, PGE and PSEI) were $23.49, $28.31, $23.56, $25.27, $25.93, $21.93, $23.56, 23.14, and $23.22 respectively.
- The monthly average prices in RTD for EIM entities (AZPS, BANCSMUD, BCHA, IPCO, NEVP, PACE, PACW, PGE and PSEI) were $23.23, $27.21, $22.67, $23.20, $25.07, $20.94, $23.73, $22.77, and $22.74 respectively.
- Bid cost recovery, real-time imbalance energy offset, and real-rime congestion offset costs for EIM entities (AZPS, BANCSMUD, BCHA, IPCO, NEVP, PACE, PACW, PGE and PSEI) were $0.58 million, -$4.84 million and -$0.82 million respectively.

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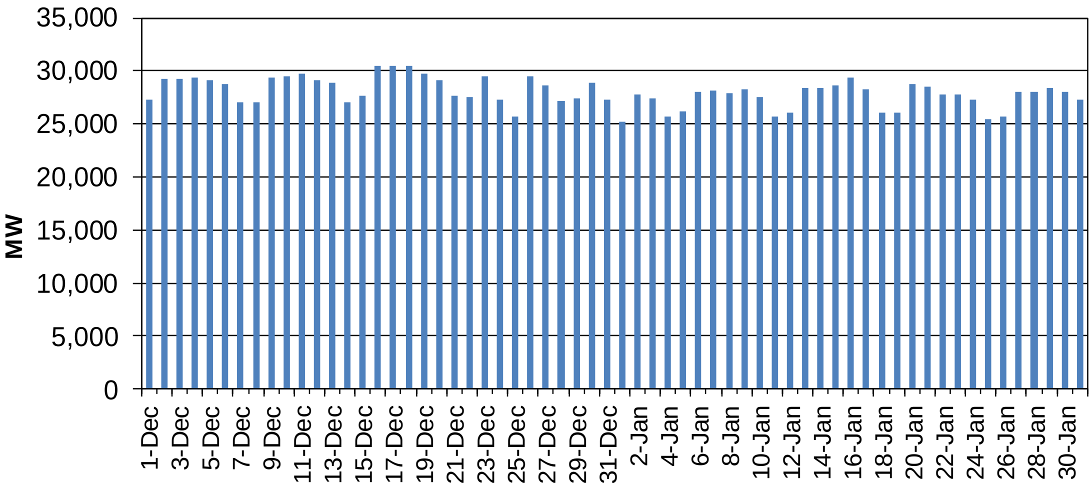
# Market Characteristics

## Loads

Peak loads for ISO area stayed below 30,000 MW this month.

**Figure 1: System Peak Load**



## Resource Adequacy Available Incentive Mechanism

Resource Adequacy Availability Incentive Mechanism (RAAIM) was activated on November 1, 2016 to track the performance of Resource Adequacy (RA) Resources. RAAIM is used to determine the availability of resources providing local and/or system Resource Adequacy Capacity and Flexible RA Capacity each month and then assess the resultant Availability Incentive Payments and Non-Availability Charges through the CAISO's settlements process. Table 1 below shows the monthly average actual availability, total non-availability charge, and total availability incentive payment. Starting from May 2018, the ISO reports the system RA average actual availability and flexible RA average actual availability separately.

**Table 1: Resource Adequacy Availability and Payment**

| | Total Non-availability Charge | Total Availability Incentive Payment | Flexible Average Actual Availability | System Average Actual Availability |
|---|---|---|---|---|
| **Jan19** | $1,381,334 | -$1,381,334 | 98.25% | 96.69% |
| **Feb19** | $1,858,922 | -$1,837,042 | 95.73% | 97.27% |
| **Mar19** | $1,454,246 | -$1,472,376 | 96.64% | 97.19% |
| **Apr19** | $3,792,889 | -$2,039,727 | 93.83% | 93.72% |
| **May19** | $2,826,675 | -$2,854,841 | 93.31% | 97.33% |
| **Jun19** | $3,331,178 | -$2,083,184 | 92.66% | 96.62% |
| **Jul19** | $1,648,195 | -$2,042,559 | 97.03% | 97.01% |
| **Aug19** | $2,231,077 | -$2,745,149 | 97.45% | 95.93% |
| **Sep19** | $3,162,035 | -$2,988,545 | 96.77% | 94.98% |
| **Oct19** | $1,094,547 | -$2,247,052 | 97.51% | 97.52% |
| **Nov19** | $1,818,975 | -$2,127,382 | 96.60% | 95.59% |
| **Dec19** | $3,324,385 | -$2,419,275 | 94.16% | 95.28% |
| **Jan20** | $1,527,998 | -$1,527,998 | 96.99% | 97.17% |

# Direct Market Performance Metrics

## Energy

### Day-Ahead Prices

Figure 2 shows daily prices of four default load aggregate points (DLAPs). Table 2 below lists the binding constraints along with the associated DLAP locations and the dates when the binding constraints resulted in relatively high or low DLAP prices.

**Figure 2: Day-Ahead Simple Average LAP Prices (All Hours)**

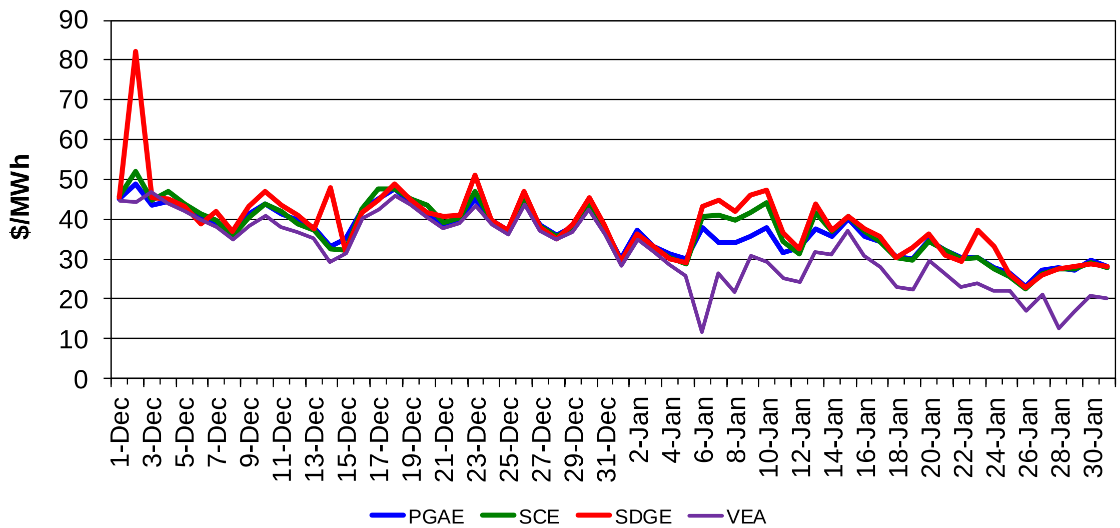



**Table 2: Day-Ahead Transmission Constraints**

| DLAP | Date | Transmission Constraint |
|---|---|---|
| SCE, SDGE | January 6-11 | SERRANO-SERRANO 500 kV XFMR |

### Real-Time Prices

FMM daily prices of the four DLAPs are shown in Figure 3. Table 3 lists the binding constraints along with the associated DLAP locations and the dates when the binding constraints resulted in relatively high or low DLAP prices.

**Figure 3: FMM Simple Average LAP Prices (All Hours)**

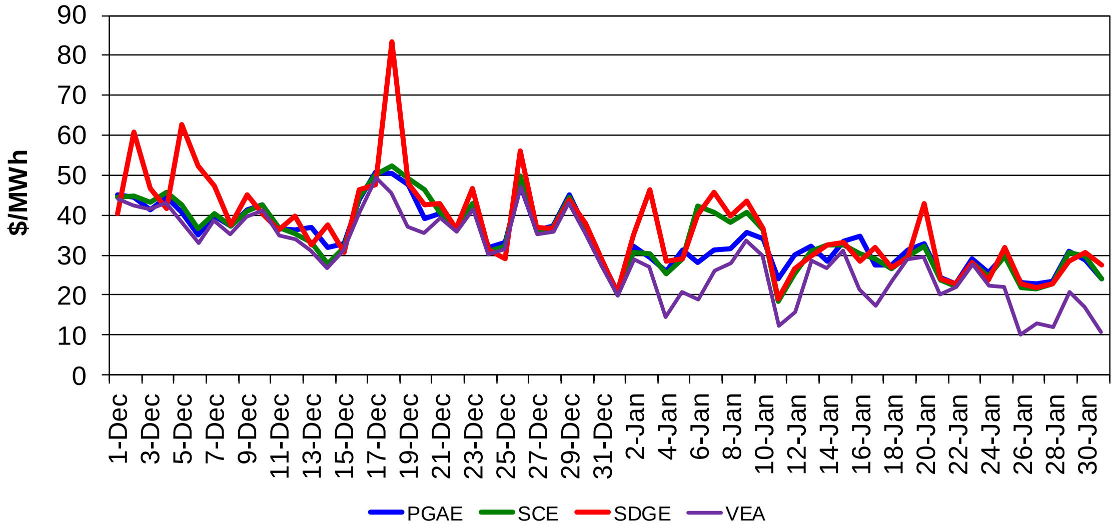
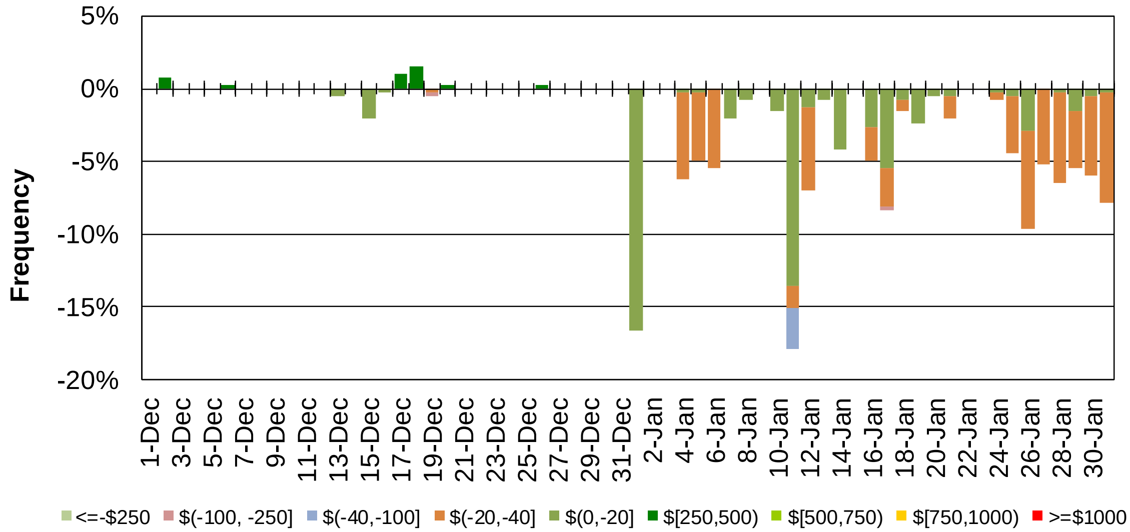



**Table 3: FMM Transmission Constraints**

| DLAP | Date | Transmission Constraint |
|---|---|---|
| SDGE | January 3 | 7820_TL 230S_OVERLOAD_NG |
| SCE, SDGE | January 6-9 | SERRANO-SERRANO 500 kV XFMR |
| SDGE | January 20 | OMS 8092823-MG-BK81_NG |

Figure 4 below shows the daily frequency of positive price spikes and negative prices by price range for the default LAPs in the FMM. The cumulative frequency of prices above $250/MWh decreased to 0 percent in January from 0.13 percent in December. The cumulative frequency of negative prices rose to 4.3 percent in January from 0.11 percent in December.

**Figure 4: Daily Frequency of FMM LAP Positive Price Spikes and Negative Prices**




RTD daily prices of the four DLAPs are shown in Figure 5. Table 4 lists the binding constraints along with the associated DLAP locations and the dates when the binding constraints resulted in relatively high or low DLAP prices.

**Figure 5: RTD Simple Average LAP Prices (All Hours)**

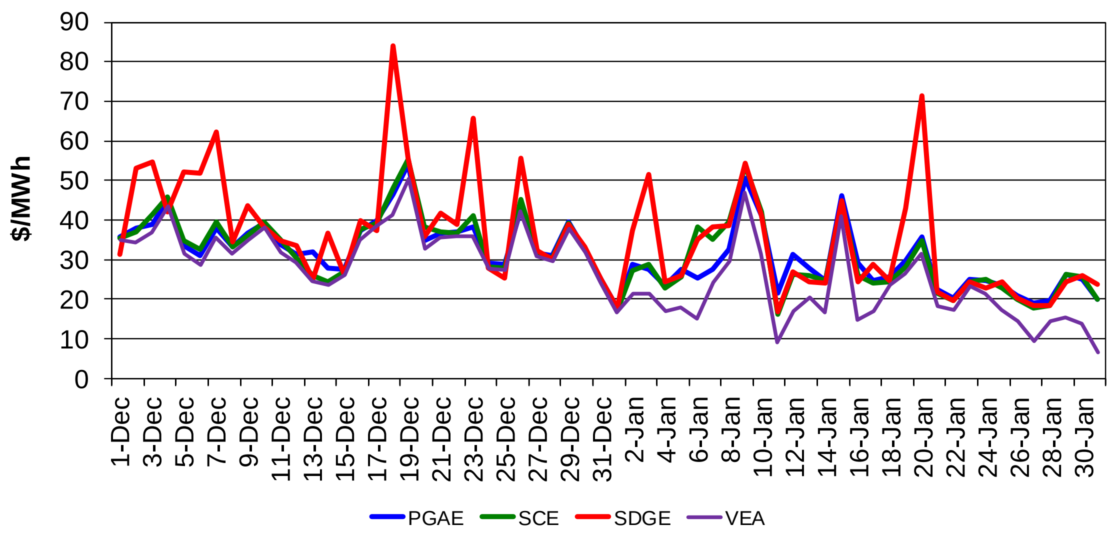
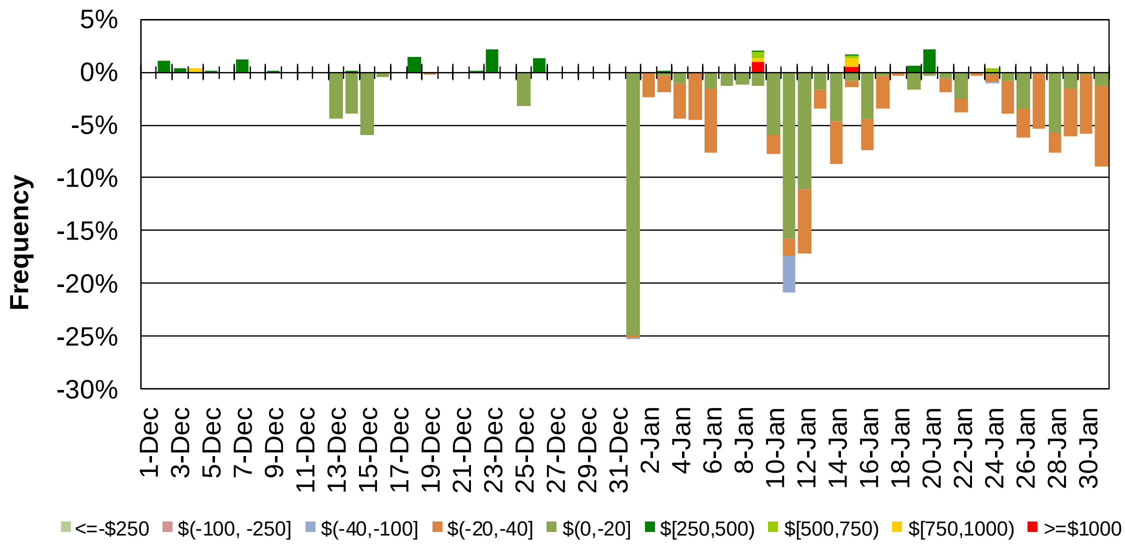



**Table 4: RTD Transmission Constraints**

| DLAP | Date | Transmission Constraint |
|---|---|---|
| SDGE | January 3 | SERRANO-SERRANO 500 kV XFMR |
| SDGE | January 20 | OMS 8092823-MG-BK81_NG |

Figure 6 below shows the daily frequency of positive price spikes and negative prices by price range for the default LAPs in RTD. The cumulative frequency of prices above $250/MWh declined to 0.23 percent in January from 0.28 percent in December. The cumulative frequency of negative prices increased to 5.58 percent in January from 0.59 percent in December.

**Figure 6: Daily Frequency of RTD LAP Positive Price Spikes and Negative Price**



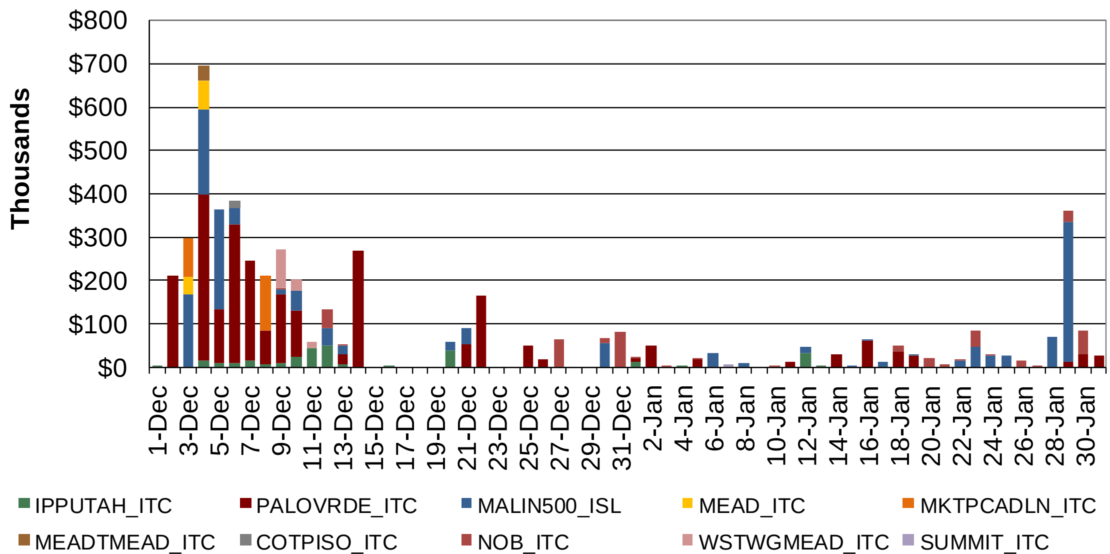
# Congestion

## Congestion Rents on Interties

Figure 7 below illustrates the daily integrated forward market congestion rents by interties. The cumulative total congestion rent for interties in January skidded to $1.27 million from $3.99 million in December. Majority of the congestion rents in January accrued on Palo Verde (24 percent) intertie, NOB (25 percent) and Malin500 (46 percent) intertie.

The congestion rent on Malin500 declined to $0.58 million in January from $0.86 million in December. The congestion rent on Palo Verde dropped to $0.30 million in January from $2.19 million in December. The congestion rent on NOB increased to $0.32 million in January from $0.21 million in December.

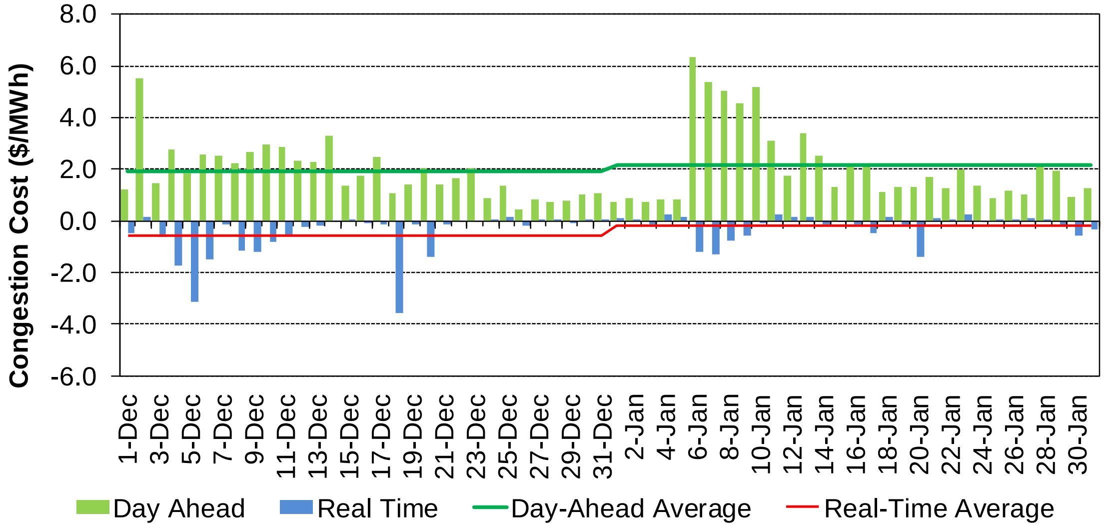
**Figure 7: IFM Congestion Rents by Interties (Import)**



### Average Congestion Cost per Load Served

This metric quantifies the average congestion cost for serving one megawatt of load in the ISO system. Figure 8 shows the daily and monthly averages for the day-ahead and real-time markets respectively.

**Figure 8: Average Congestion Cost per Megawatt of Served Load**




The average congestion cost per MWh of load served in the integrated forward market inched up to $2.15/MWh in January from $1.91/MWh in December. The average congestion cost per load served in the real-time market increased to -$0.19/MWh in January from -$0.57/MWh in December.

## Congestion Revenue Rights

Congestion revenue rights auction efficiency 1B became in effect on January 1, 2019. It includes key changes related to the congestion revenue rights settlements process:

- Targeted reduction of congestion revenue rights payouts on a constraint by constraint basis.
- Distribute congestion revenues to the extent that CAISO collected the requisite revenue on the constraint over the month. That is, implement a pro-rata funding for CRRs.
- Allow surpluses on one constraint in one hour to offset deficits on the same constraint in another hour over the course of the month.
- Only distribute surpluses to congestion revenue rights if the surplus is collected on a constraint that the congestion revenue right accrued a deficit, and only up to the full target payment value of the congestion revenue right.
- Distribute remaining surplus revenue at the end of the month, which are associated with constraints that collect more surplus over the month than deficits, to measured demand.

Figure 9 illustrates the CRR notional value in the corresponding month for the various transmission elements that experienced congestion during the month. CRR notional value is calculated as the product of CRR implied flow and constraint shadow price in each hour per constraint and CRR.

**Figure 9: Daily CRR Notional Value by Transmission Element**

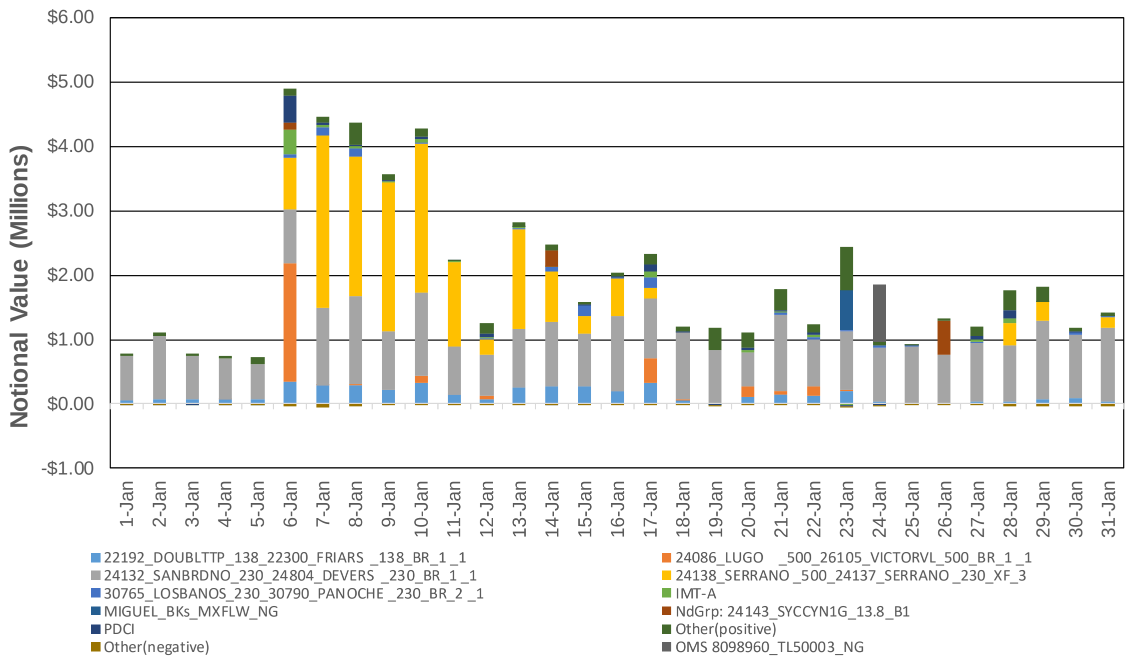
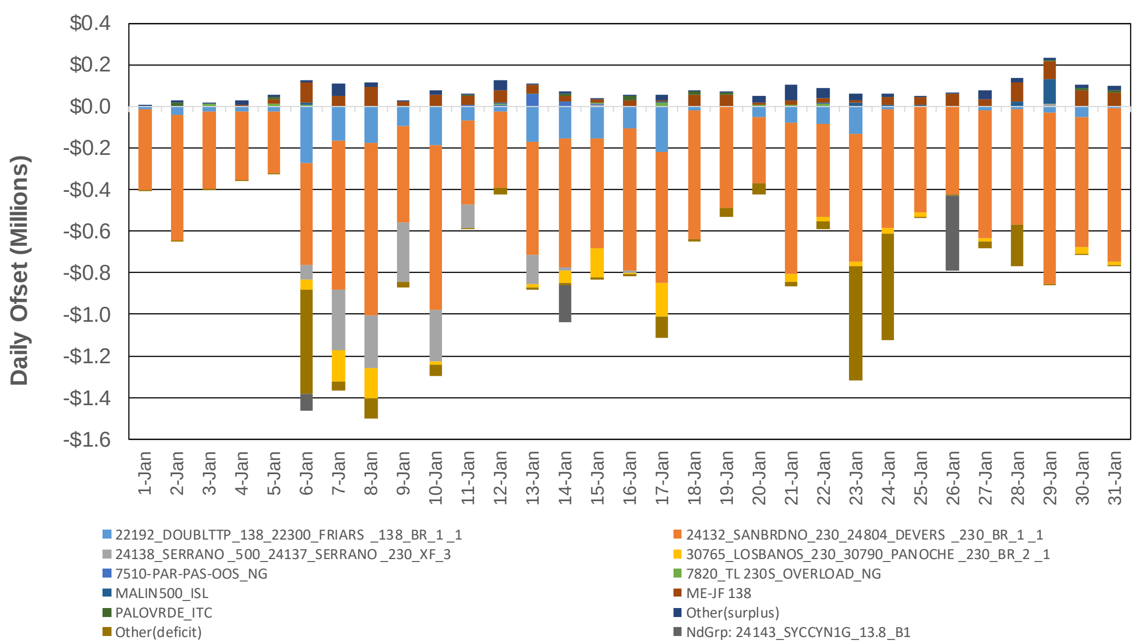



Figure 10 illustrates the daily CRR offset value in the corresponding month for the transmission elements that experienced congestion during the month.

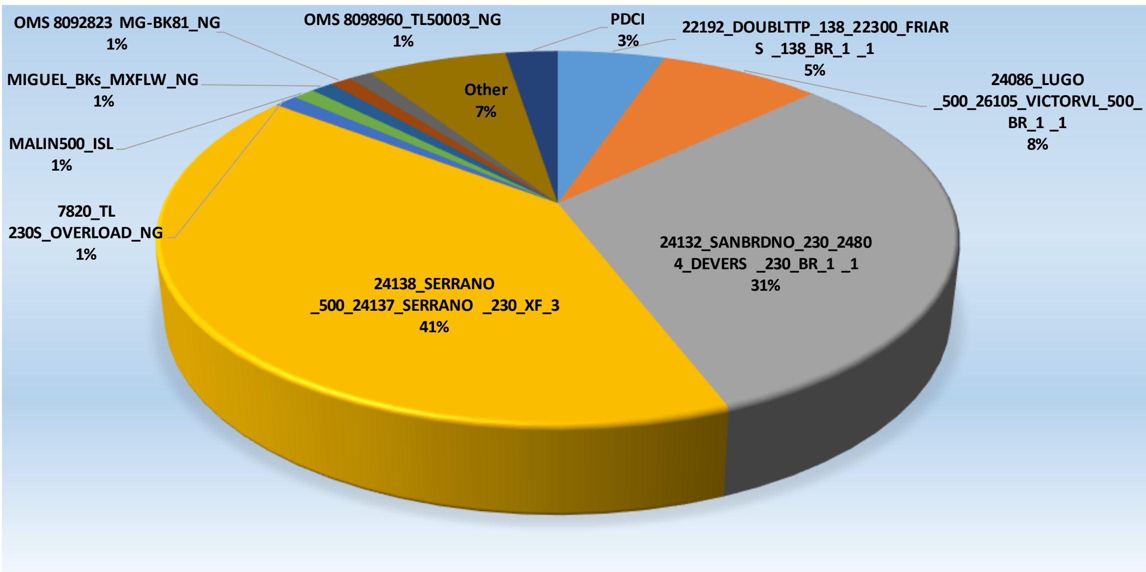
**Figure 10: Daily CRR Offset Value by Transmission Element**



CRR offset value is the difference between the revenue collected from the day-ahead congestion and CRR notional value. It is also calculated in each hour per constraint and CRR. A positive CRR offset value represents surplus and a negative CRR offset value represents shortfall.

The shares of the CRR payment on various congested transmission elements for the reporting period are shown in Figure 11 and the monthly summary for CRR revenue adequacy is provided in Table 5.

**Figure 11: CRR Payment by Transmission Element**




Net monthly balancing surplus in January was $0.32 million. The auction revenues credited to the balancing account for January was $2.92 million. As a result, the balancing account for January had a surplus of approximately $3.24 million, which was allocated to measured demand.

**Table 5: CRR Revenue Adequacy Statistics**

| Row | Description | Formula | Amount |
|---|---|---|---|
| 1 | CRR Notional Value | | $60,232,907 |
| 2 | CRR Deficit | | -$24,746,061 |
| 3 | CRR Settlement Rule | | -$7,015 |
| 4 | CRR Adjusted Payment | | $35,479,831 |
| 5 | CRR Surplus | | $2,197,486 |
| 6 | Monthly Auction Revenue | | $957,002 |
| 7 | Annual Auction Revenue | | $1,963,011 |
| 8 | CRR Daily Balancing Account | | $1,043,310 |
| 9 | Net Monthly Balancing Surplus | row 5 + row 8 - (row 6 + row 7) | $320,783 |
| 10 | Allocation to Measured Demand | row 6 + row 7 + row9 | $3,240,796 |

# Ancillary Services

## IFM (Day-Ahead) Average Price

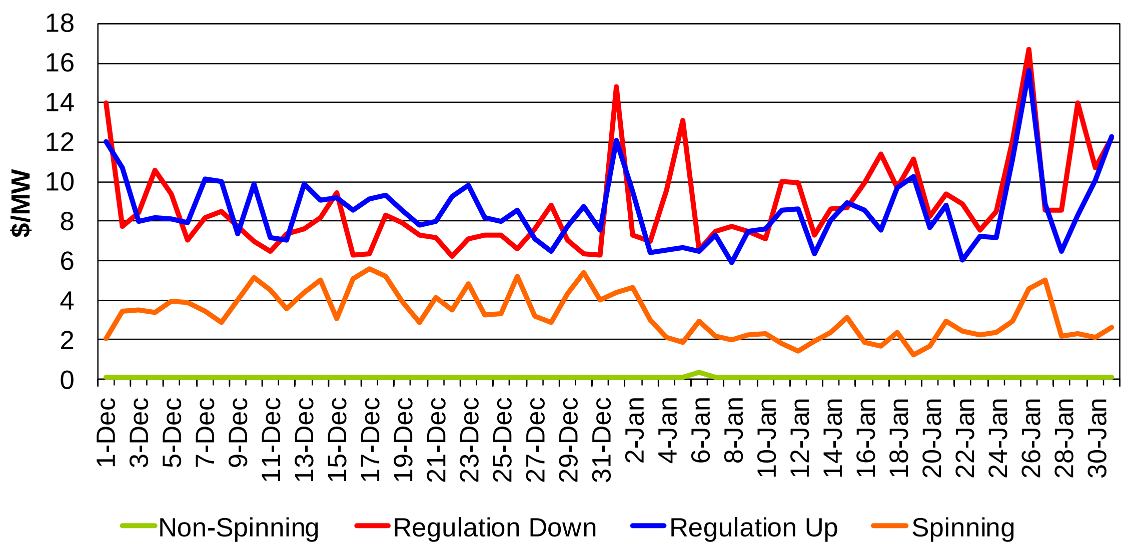
Table 6 shows the monthly IFM average ancillary service procurements and the monthly average prices. In January the monthly average procurement increased for regulation up, spinning and non-spinning reserves.

**Table 6: IFM (Day-Ahead) Monthly Average Ancillary Service Procurement**

| | Average Procured | | | | Average Price | | | |
|---|---|---|---|---|---|---|---|---|
| | Reg Up | Reg Dn | Spinning | Non-Spinning | Reg Up | Reg Dn | Spinning | Non-Spinning |
| **Jan-20** | 372 | 517 | 756 | 756 | $8.45 | $9.68 | $2.54 | $0.11 |
| **Dec-19** | 366 | 523 | 745 | 745 | $8.63 | $7.79 | $3.96 | $0.11 |
| **Percent Change** | 1.67% | -1.11% | 1.47% | 1.49% | -2.08% | 24.29% | -35.70% | -1.47% |

The monthly average prices decreased for regulation up, spinning and non-spinning reserves in January. Figure 12 shows the daily IFM average ancillary service prices. The average prices for regulation up and regulation down were relatively high on January 1 and January 25-26 due to high opportunity cost.

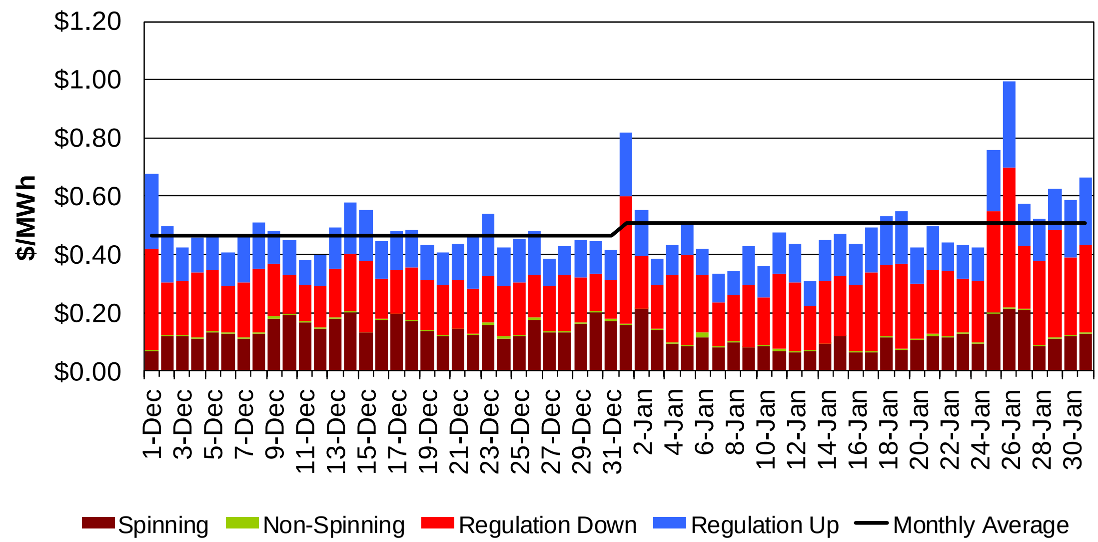
**Figure 12: IFM (Day-Ahead) Ancillary Service Average Price**



## Ancillary Service Cost to Load

The monthly average cost to load increased to $0.51/MWh in January from 0.46/MWh in December. The average cost was high on January 1 and January 25-26 driven by high regulation up and regulation down prices in day-ahead market.

**Figure 13: System (Day-Ahead and Real-Time) Average Cost to Load**




## Scarcity Events

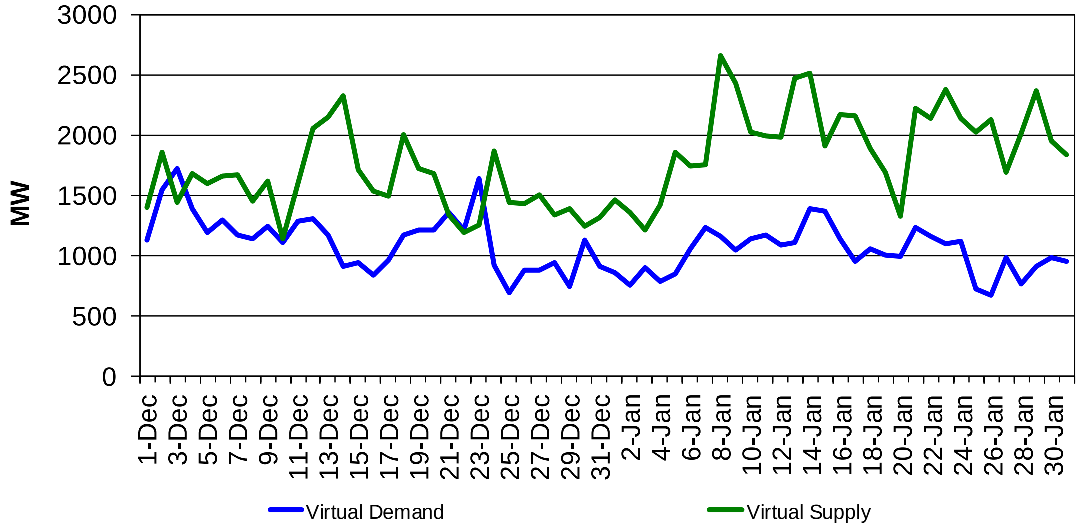
The ancillary services scarcity pricing mechanism is triggered when the ISO is not able to procure the target quantity of one or more ancillary services in the IFM and real-time market runs. The scarcity event in January is shown in the table below.

| Date | Hour Ending | Interval | Ancillary Service | Region | Shortfall (MW) | Percentage of Requirement |
|---|---|---|---|---|---|---|
| Jan. 22 | 11 | 1 | Regulation Down | SP26_EXP | 1.95 | 1.86 % |

## Convergence Bidding

Figure 14 below shows the daily average volume of cleared virtual bids in IFM for virtual supply and virtual demand. The cleared virtual supply was well above cleared demand throughout January.

**Figure 14: Cleared Virtual Bids**




Convergence bidding tends to cause the day-ahead market and real-time market prices to move closer together, or “converge”. Figure 15 shows the energy prices (namely the energy component of the LMP) in IFM, hour ahead scheduling process (HASP), FMM, and RTD.

**Figure 15: IFM, HASP, FMM, and RTD Prices**

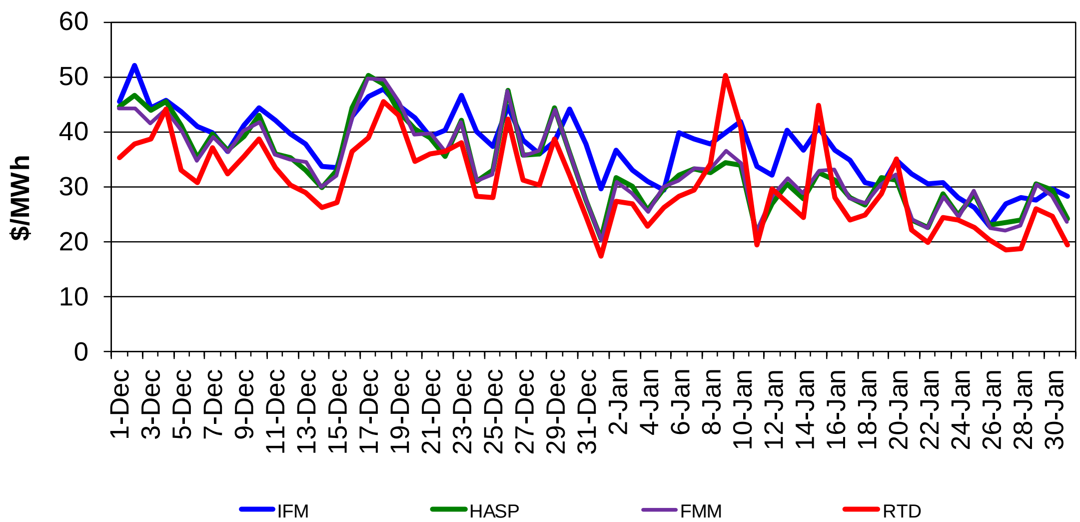
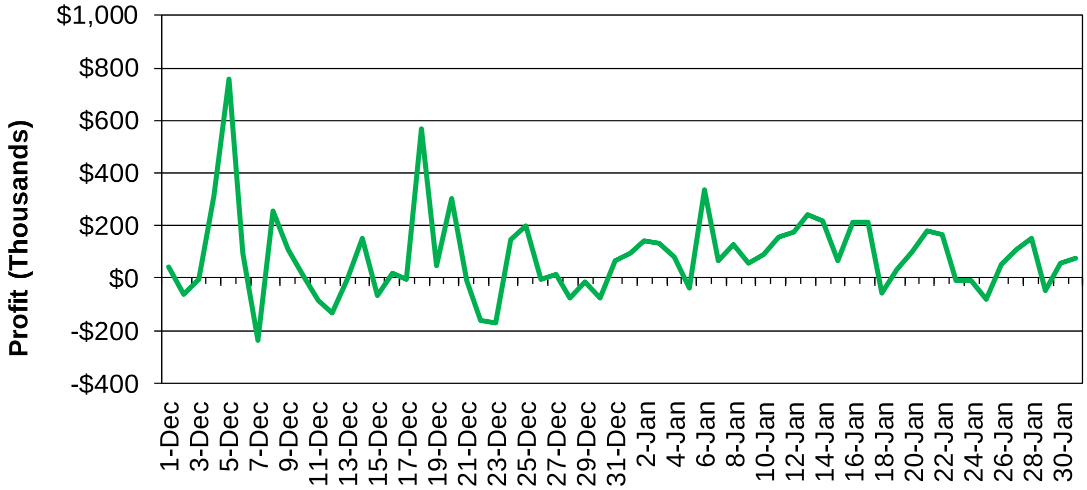


Figure 16 shows the profits that convergence bidders receive from convergence bidding. The total profits from convergence bidding in January rose to $3.07 million from $1.97 million in December.

**Figure 16: Convergence Bidding Profits**




## Renewable Generation Curtailment

Figure 17 below shows the monthly wind and solar VERs (variable energy resource) curtailment due to system wide condition or local congestion in RTD. Figure 18 shows the monthly wind and solar VERs (variable energy resource) curtailment by resource type in RTD. Economic curtailment is defined as the resource's dispatch upper limit minus its RTD schedule when the resource has an economic bid. Dispatch upper limit is the maximum level the resource can be dispatched to when various factors are take into account such as forecast, maximum economic bid, generation outage, and ramping capacity. Self-schedule curtailment is defined as the resource's self-schedule minus its RTD schedule when RTD schedule is lower than self-schedule. When a VER resource is exceptionally dispatched, then exceptional dispatch curtailment is defined as the dispatch upper limit minus the exceptional dispatch value.

As Figure 17 and Figure 18 below show, the renewable curtailment increased in January. The majority of the curtailment was economic and local.

**Figure 17: Renewable Curtailment by Reason**

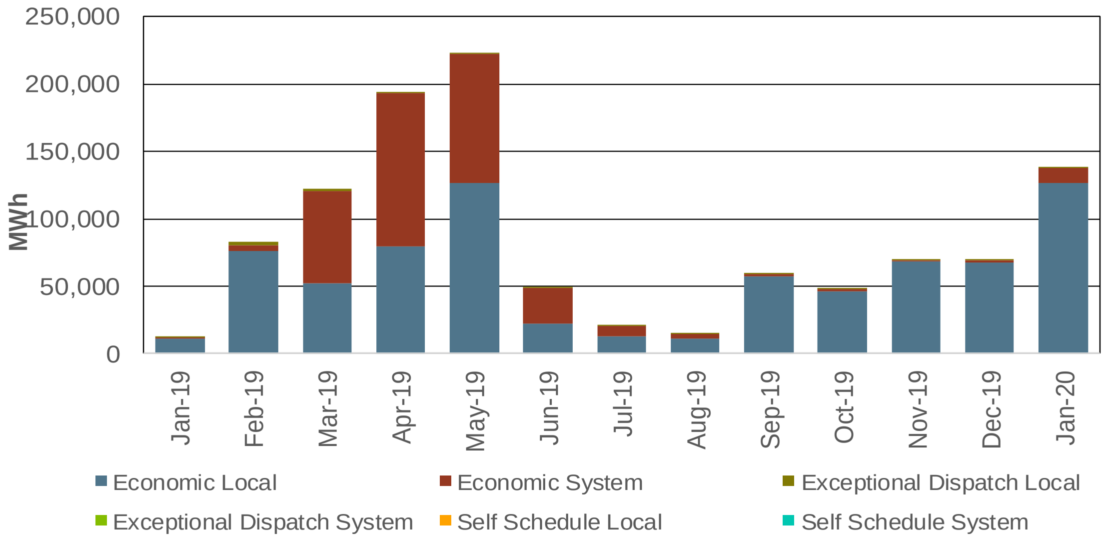
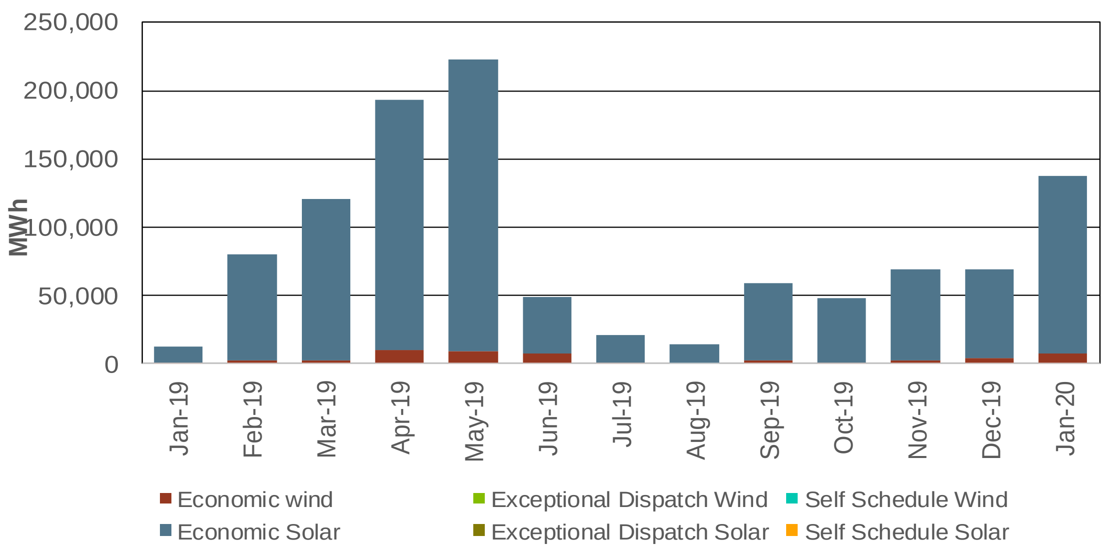



**Figure 18: Renewable Curtailment by Resource Type**




## Flexible Ramping Product

On November 1, 2016 the ISO implemented two market products in the 15-minute and 5-minute markets: Flexible Ramping Up and Flexible Ramping Down uncertainty awards. These products provide additional upward and downward flexible ramping capability to account for uncertainty due to demand and renewable forecasting errors. In addition, the existing flexible ramping sufficiency test was extended to ensure feasible ramping capacity for real-time interchange schedules.

### Flexible Ramping Product Payment

Figure 19 shows the flexible ramping up and down uncertainty payments. Flexible ramping up uncertainty payment fell to $8,441 in January from $96,929 in December. Flexible ramping down uncertainty payment increased to $13,321 in January from $207 in December.

**Figure 19: Flexible Ramping Up/down Uncertainty Payment**

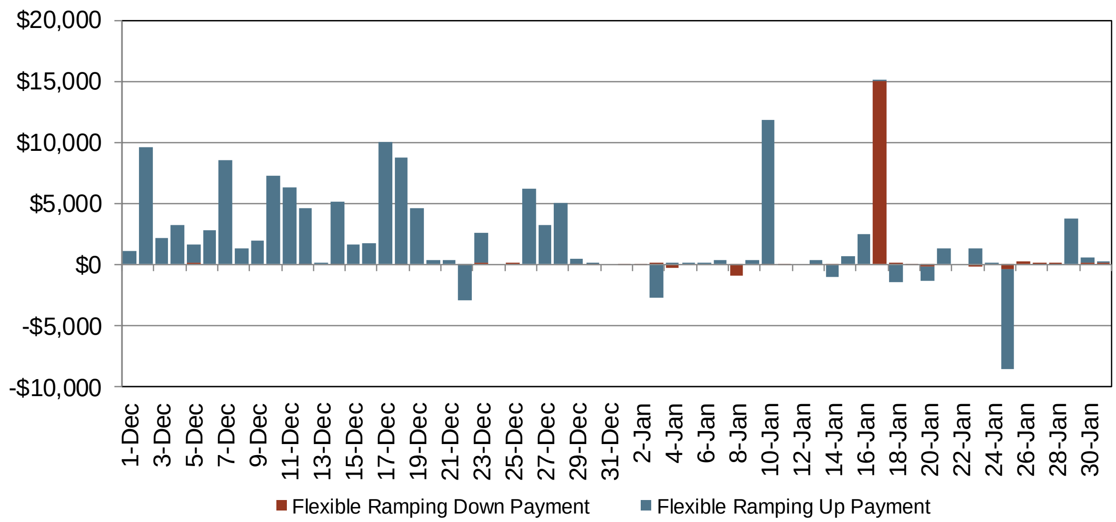
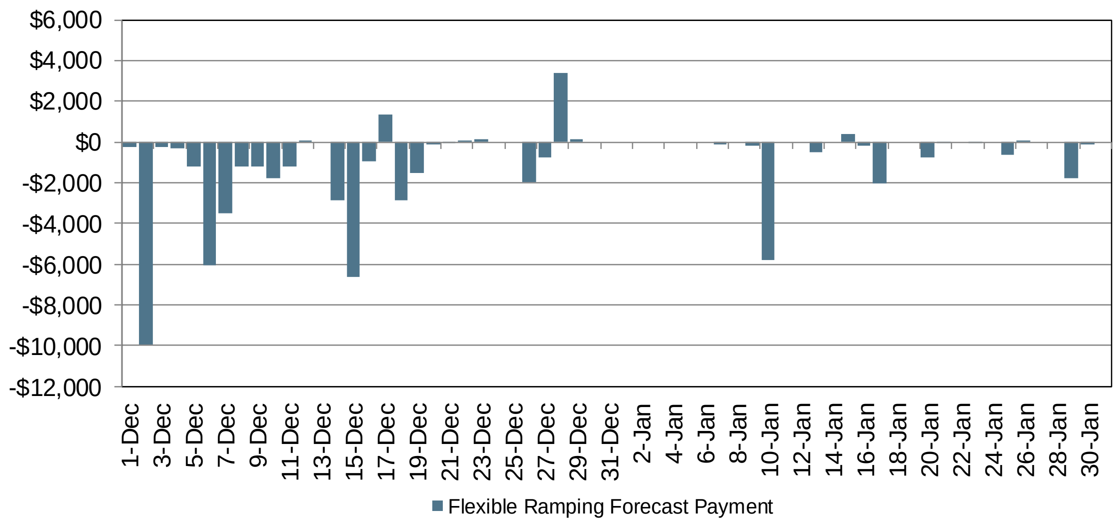



Figure 20 shows the flexible ramping forecast payment. Flexible ramping forecast payment increased to -$11,777 this month from -$39,326 in December.

**Figure 20: Flexible Ramping Forecast Payment**



# Indirect Market Performance Metrics

## Bid Cost Recovery

Figure 21 shows the daily uplift costs due to exceptional dispatch payments. The monthly uplift costs in January skidded to $1.70 million from $5.98 million in December.

**Figure 21: Exceptional Dispatch Uplift Costs**

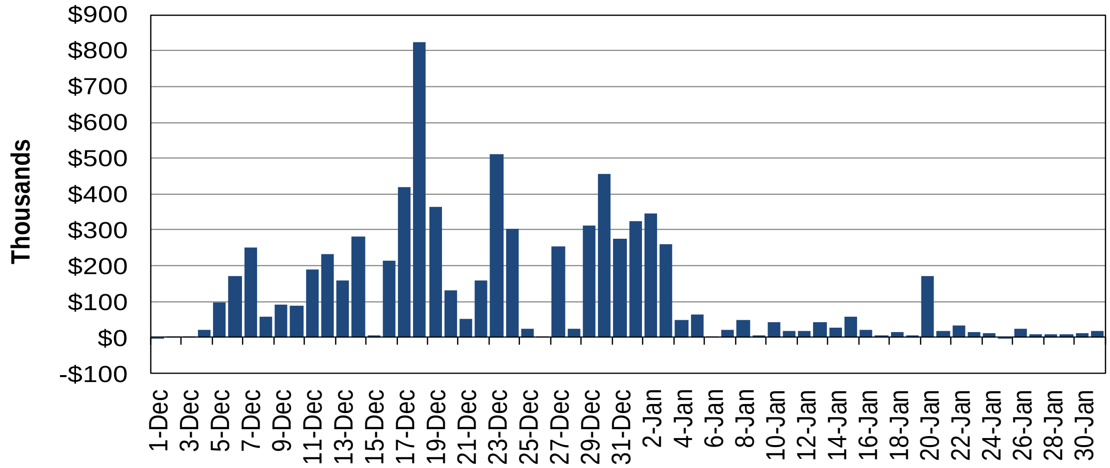



Figure 22 shows the allocation of bid cost recovery payment in the IFM, residual unit commitment (RUC) and RTM markets. The total bid cost recovery for January inched down to $6.45 million from $7.08 million in December. Out of the total monthly bid cost recovery payment for the three markets in January, the IFM market contributed 21 percent, RTM contributed 45 percent, and RUC contributed 34 percent of the total bid cost recovery payment.

**Figure 22: Bid Cost Recovery Allocation**

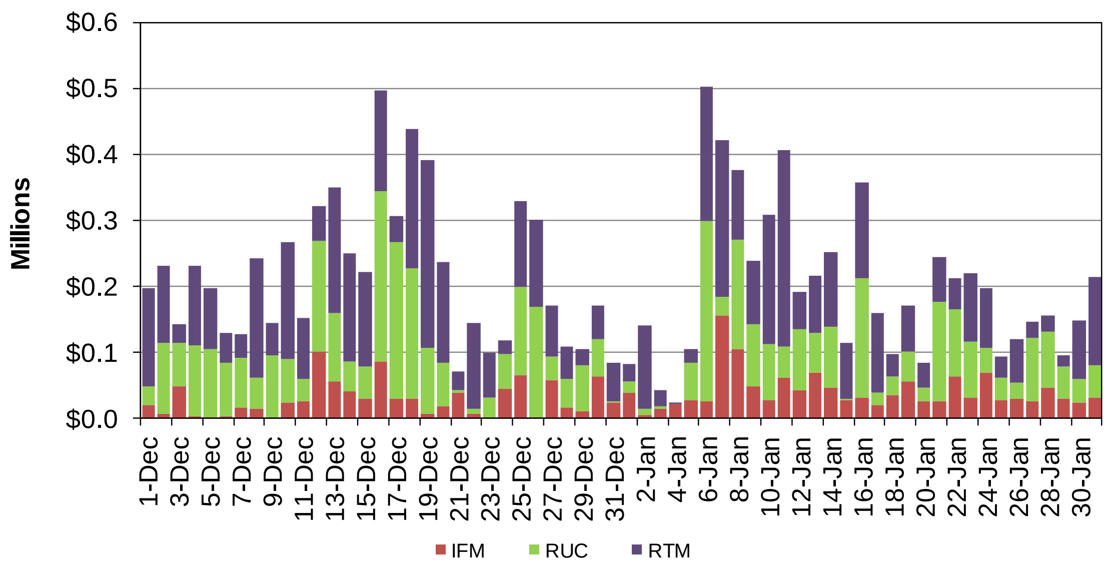


Figure 23 and Figure 24 show the daily and monthly BCR cost by local capacity requirement area (LCR) respectively.

**Figure 23: Bid Cost Recovery Allocation by LCR**

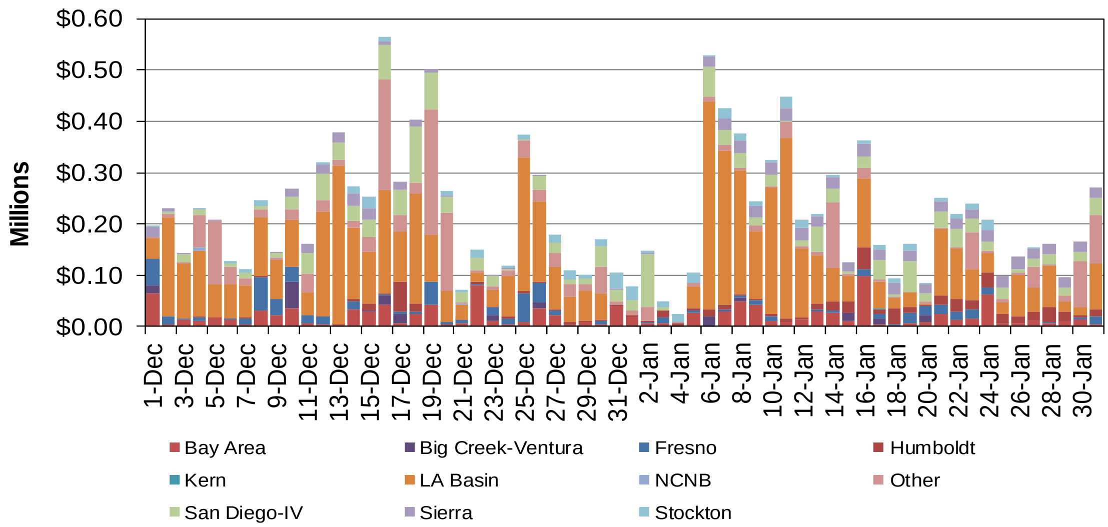



**Figure 24: Monthly Bid Cost Recovery Allocation by LCR**

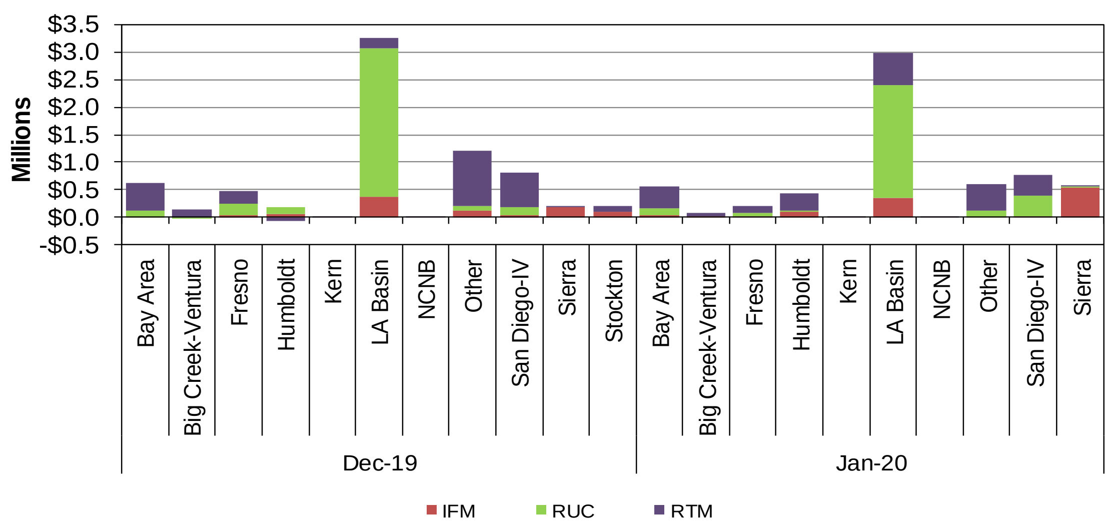


Figure 25 and Figure 26 show the daily and monthly BCR cost by utility distribution company (UDC) respectively.

**Figure 25: Bid Cost Recovery Allocation by UDC**

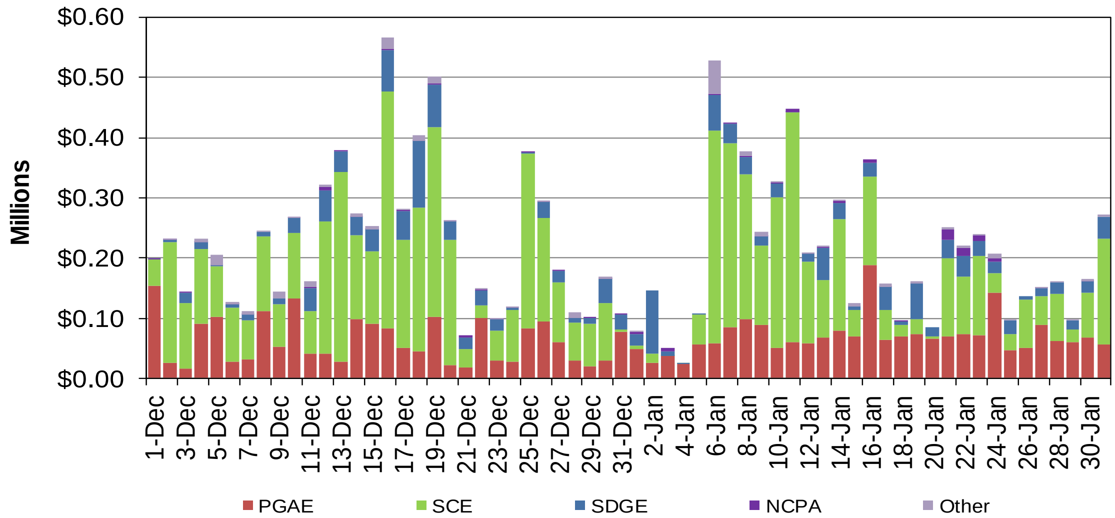



**Figure 26: Monthly Bid Cost Recovery Allocation by UDC**

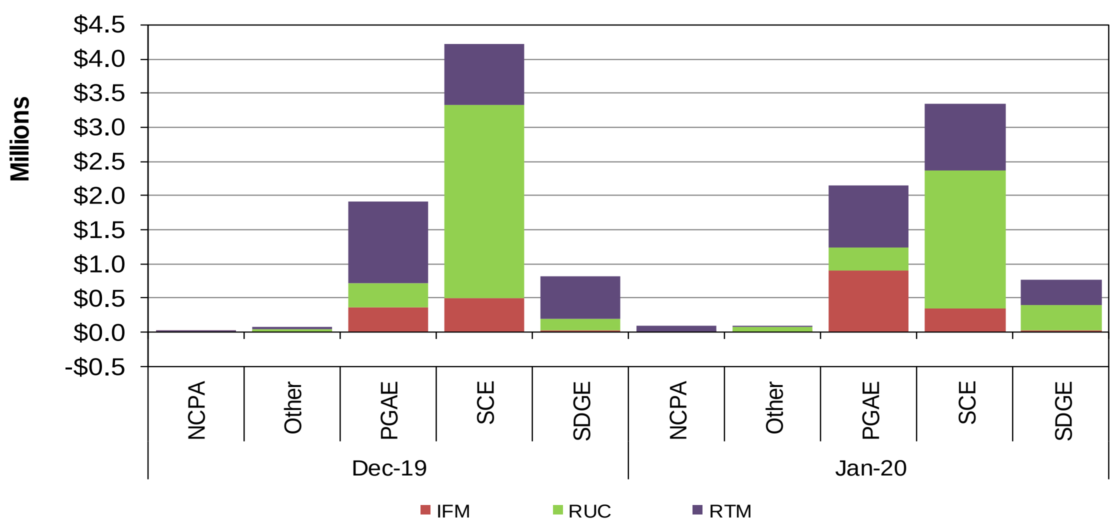


Figure 27 shows the cost related to BCR by cost type in RUC.

**Figure 27: Cost in RUC**

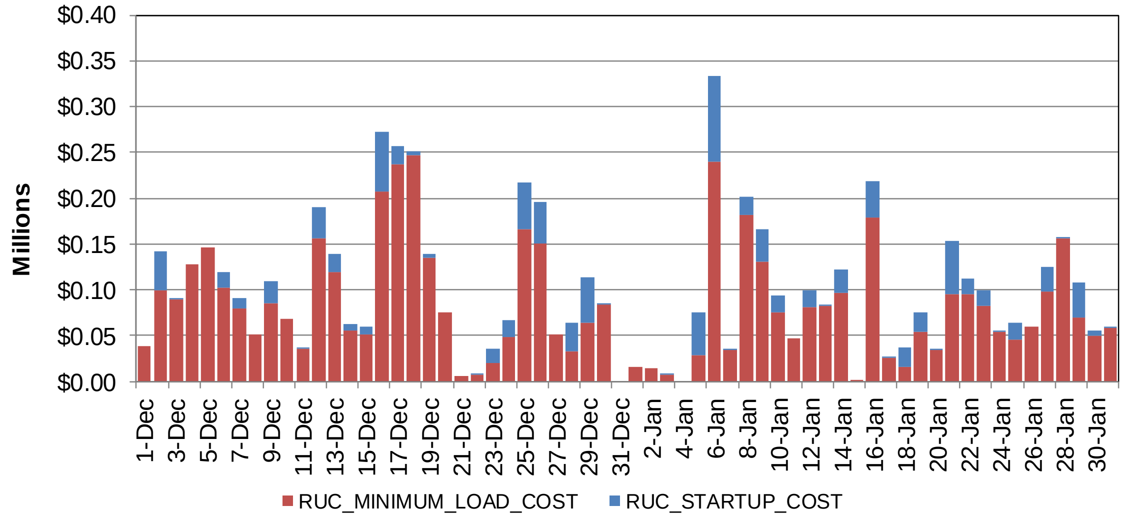



Figure 28 and Figure 29 show the daily and monthly cost related to BCR by type and LCR in RUC respectively.

**Figure 28: Cost in RUC by LCR**

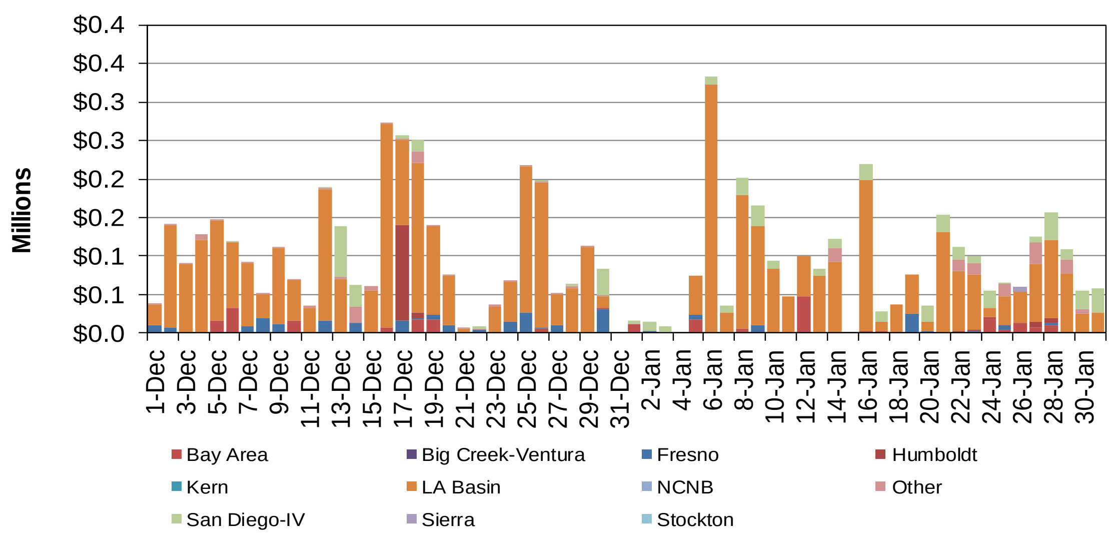


**Figure 29: Monthly Cost in RUC by LCR**

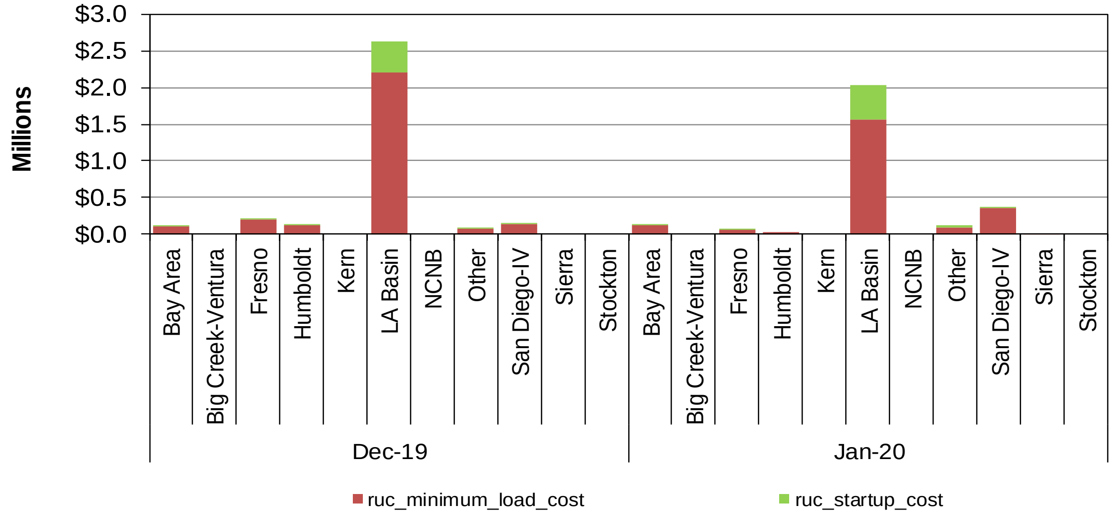



Figure 30 and Figure 31 show the daily and monthly cost related to BCR by type and UDC in RUC respectively.

**Figure 30: Cost in RUC by UDC**

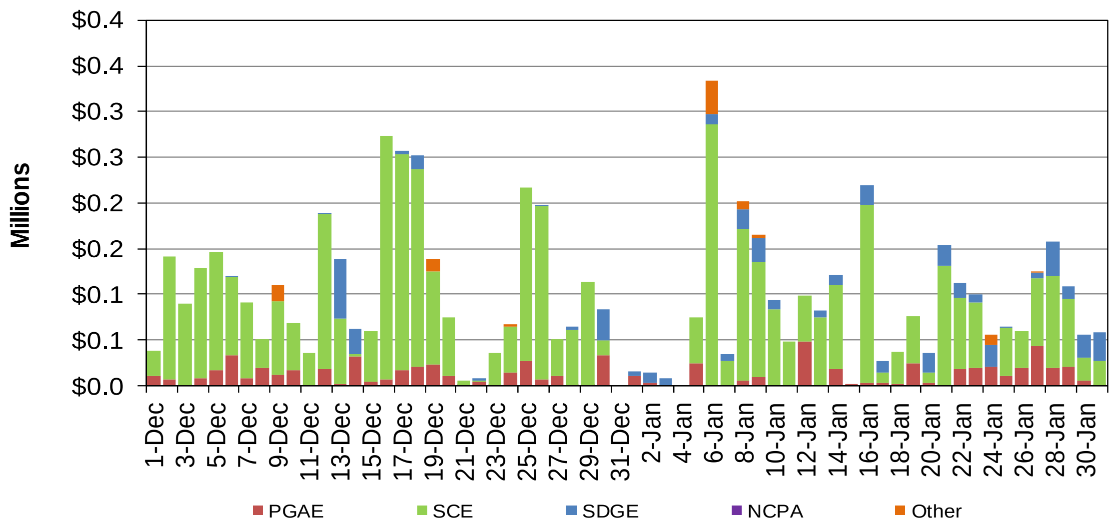


**Figure 31: Monthly Cost in RUC by UDC**

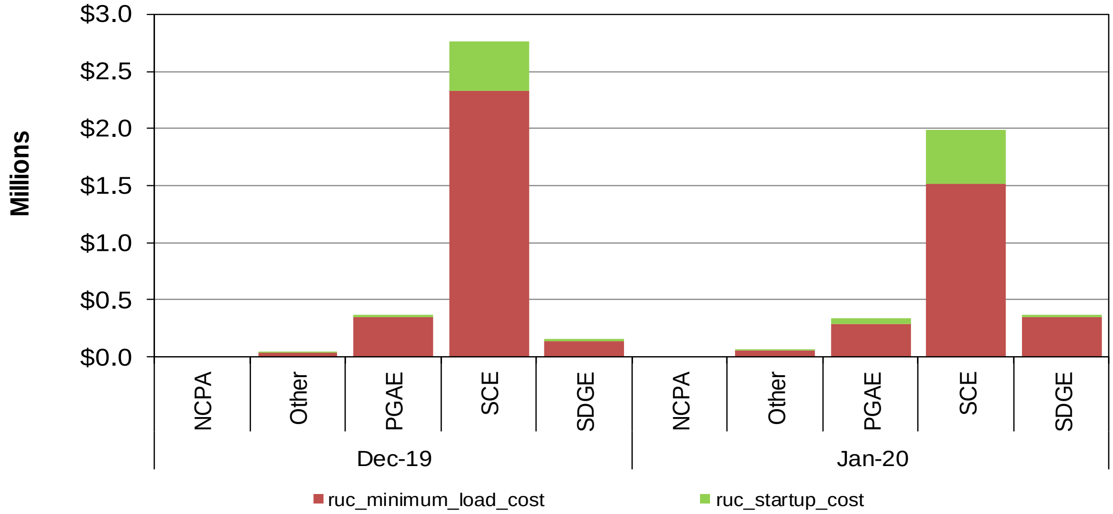



Figure 32 shows the cost related to BCR in real time by cost type. Minimum load cost contributed largely to the real time cost this month.

**Figure 32: Cost in Real Time**

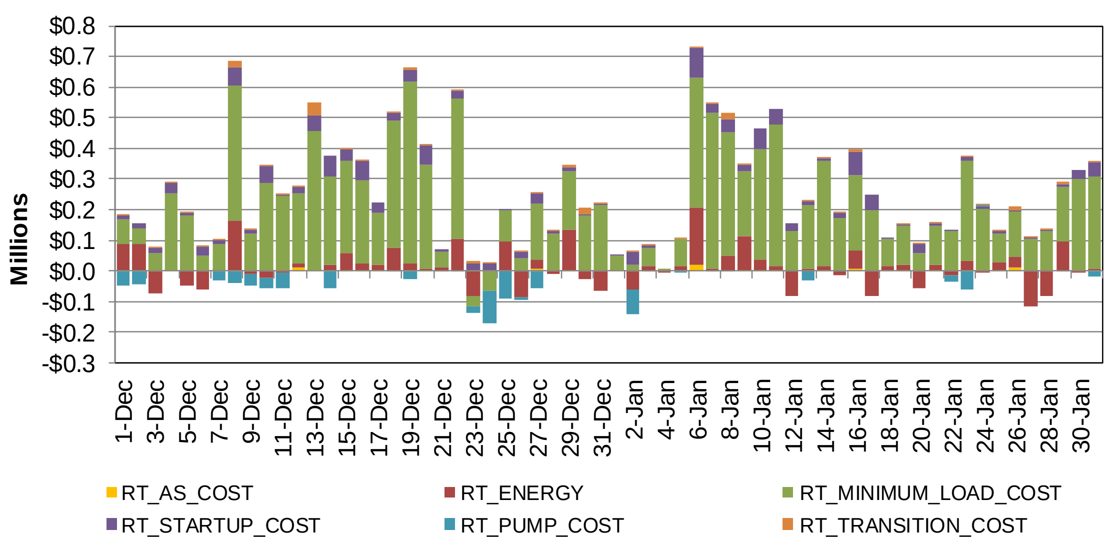


Figure 33 and Figure 34 show the daily and monthly cost related to BCR by type and LCR in real time respectively.

**Figure 33: Cost in Real Time by LCR**

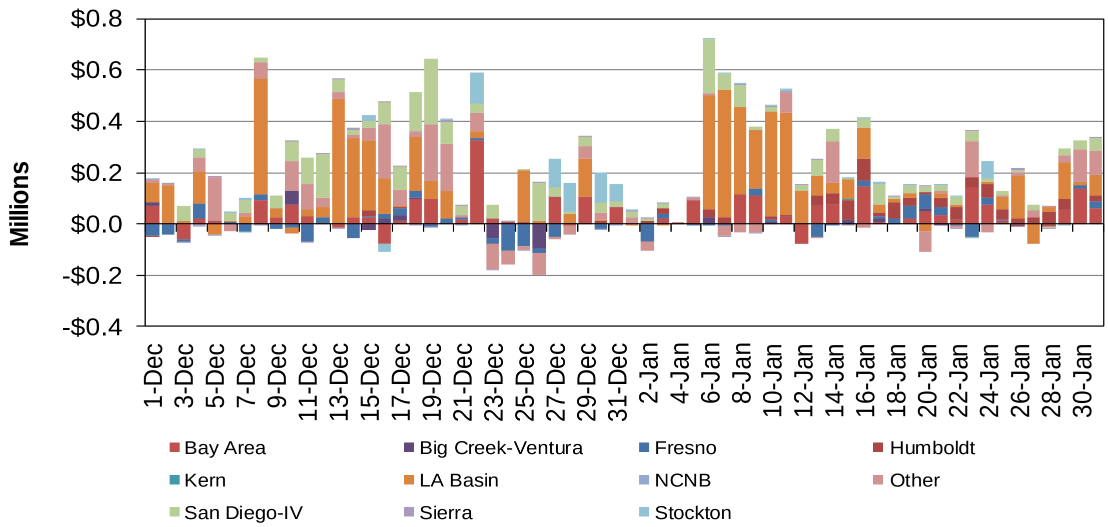



**Figure 34: Monthly Cost in Real Time by LCR**

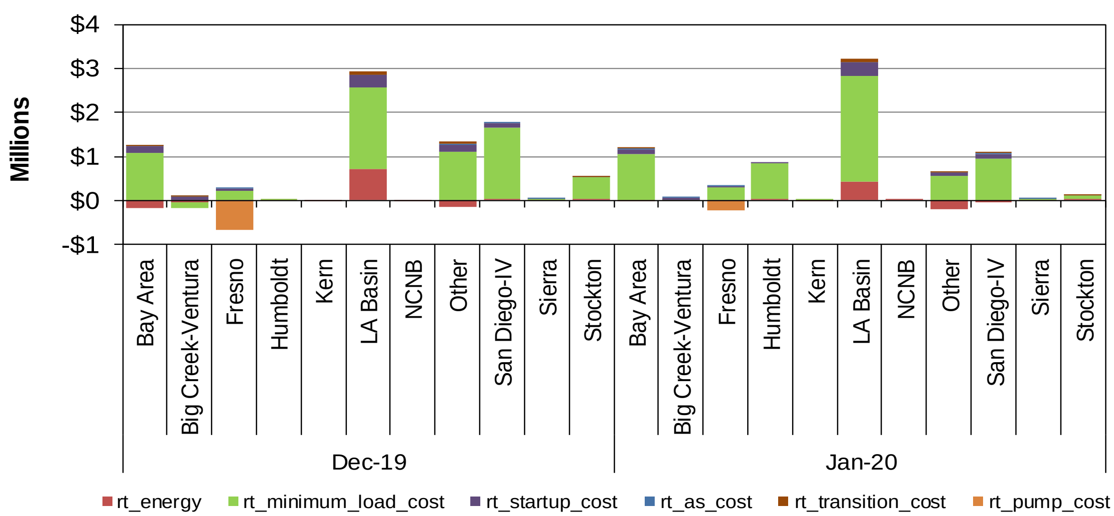


Figure 35 and Figure 36 show the daily and monthly cost related to BCR by type and UDC in Real Time respectively.

**Figure 35: Cost in Real Time by UDC**

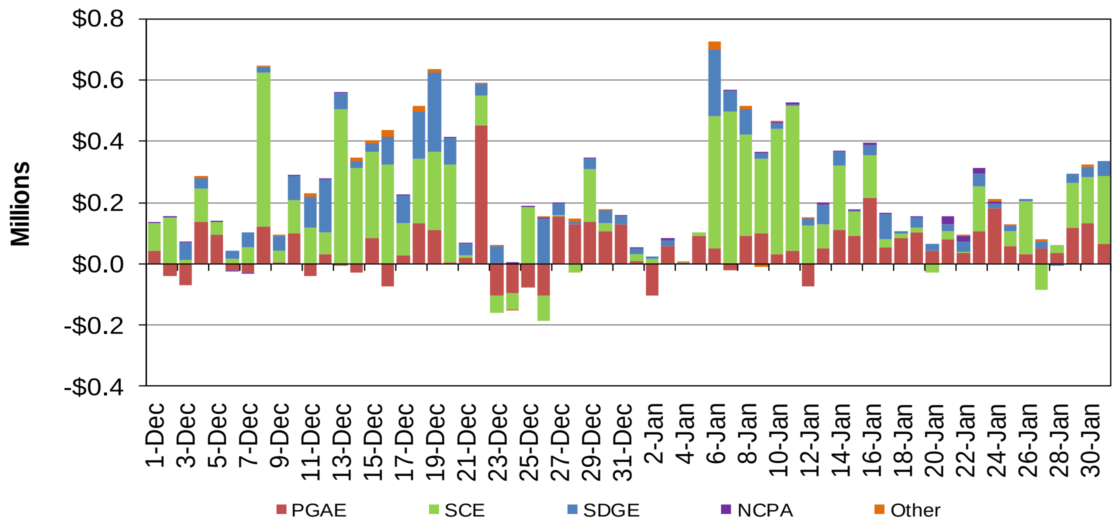



**Figure 36: Monthly Cost in Real Time by UDC**

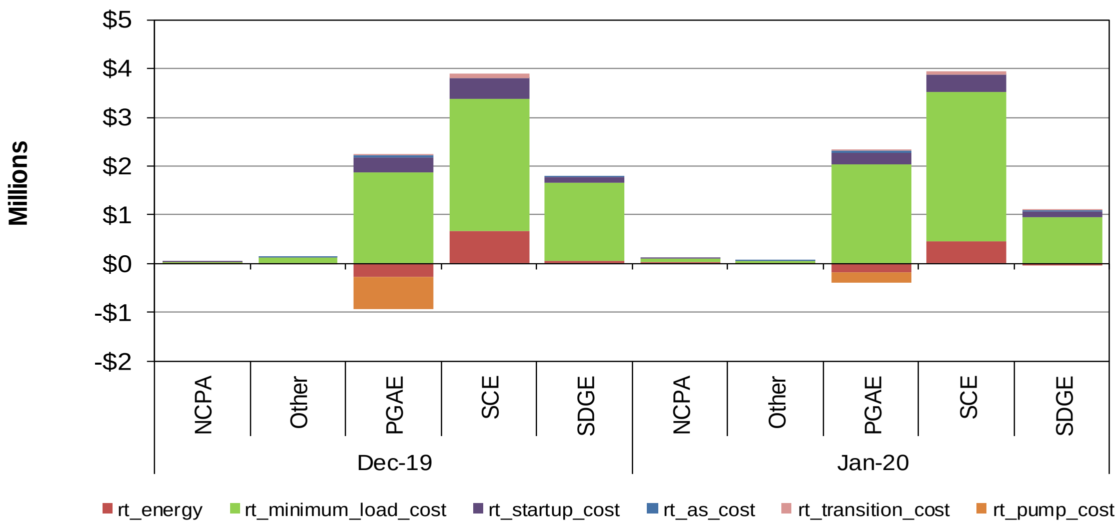


Figure 37 shows the cost related to BCR in IFM by cost type.

**Figure 37: Cost in IFM**

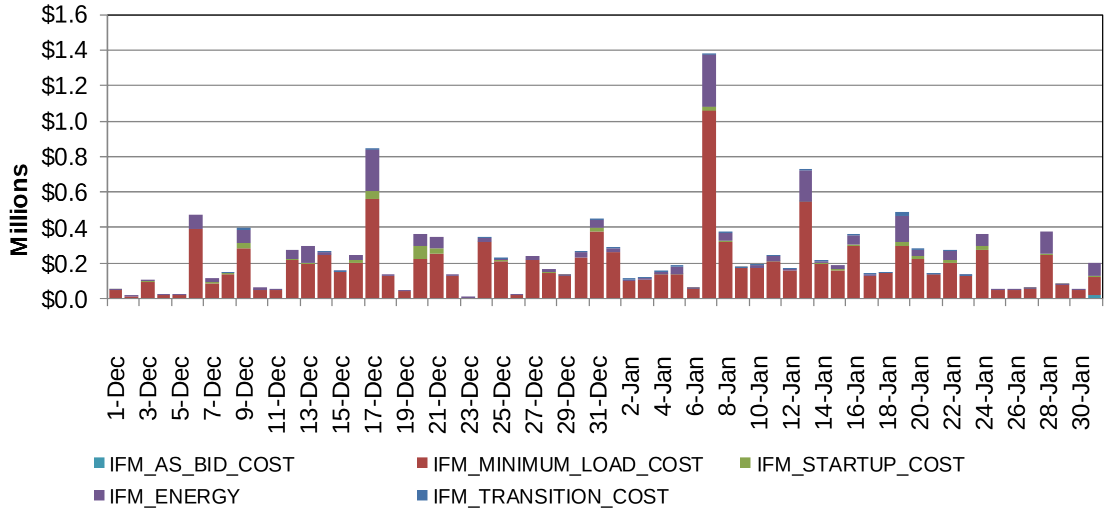



Figure 38 and Figure 39 show the daily and monthly cost related to BCR by type and location in IFM respectively.

**Figure 38: Cost in IFM by LCR**

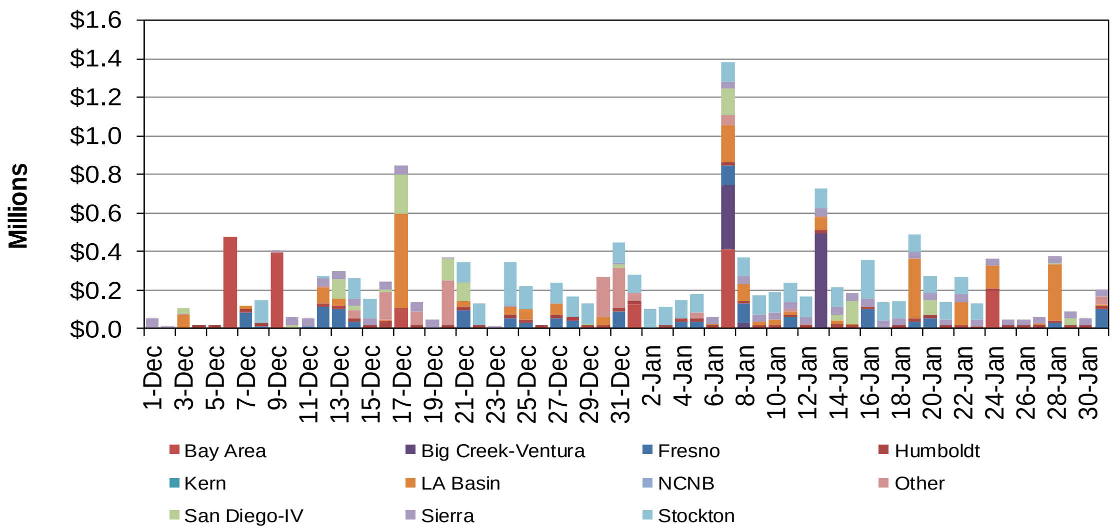


**Figure 39: Monthly Cost in IFM by LCR**

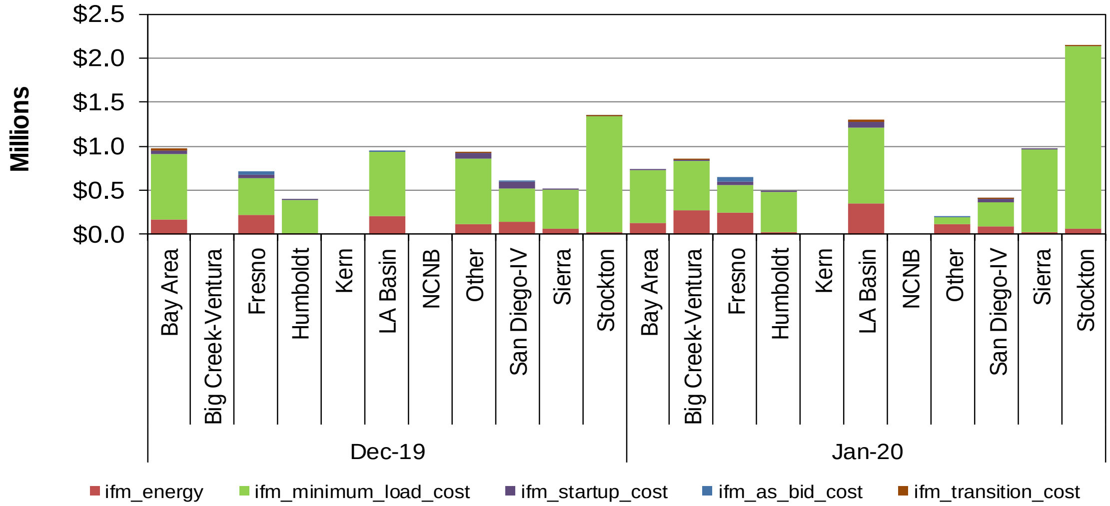



Figure 40 and Figure 41 show the daily and monthly cost related to BCR by type and UDC in IFM respectively.

**Figure 40: Cost in IFM by UDC**

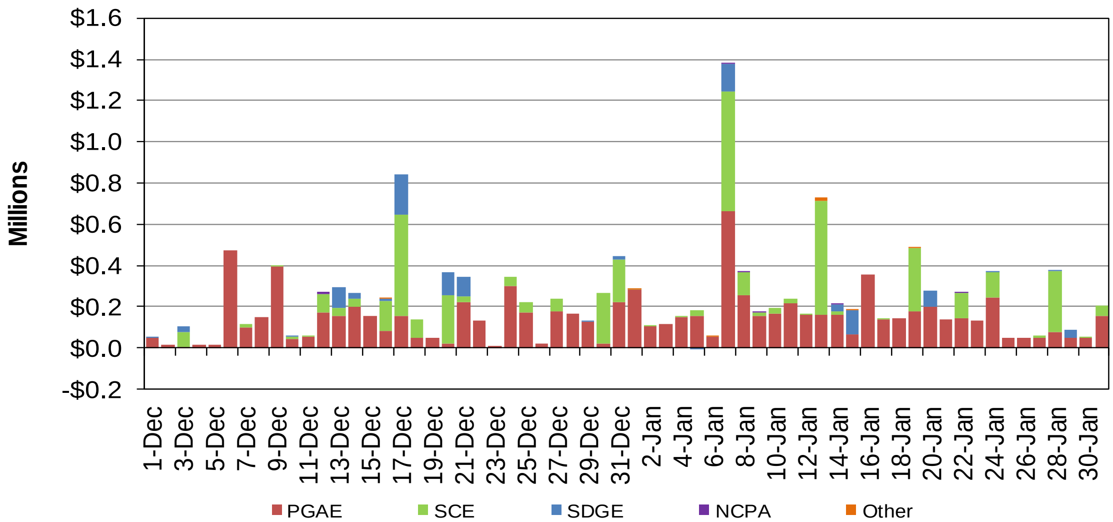
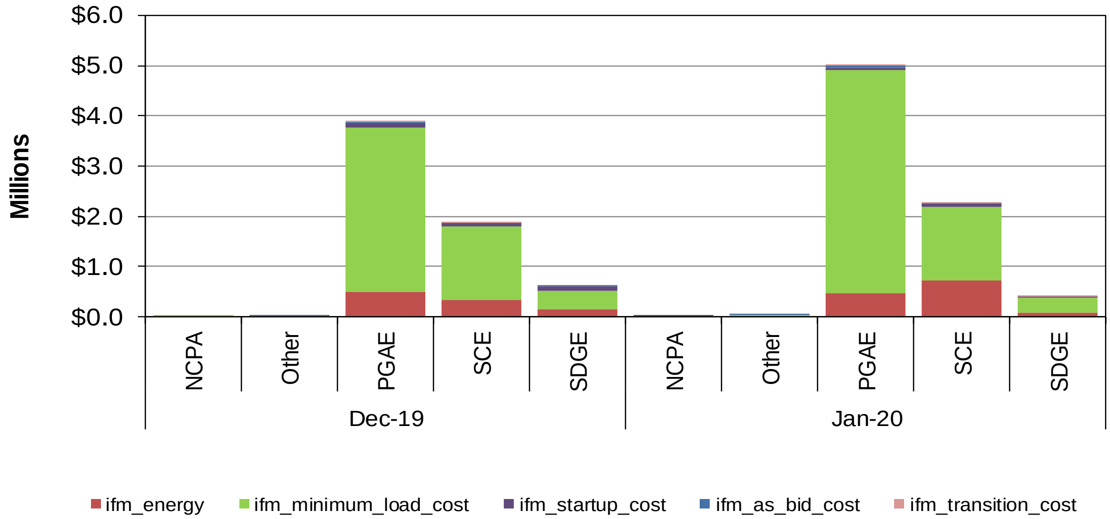


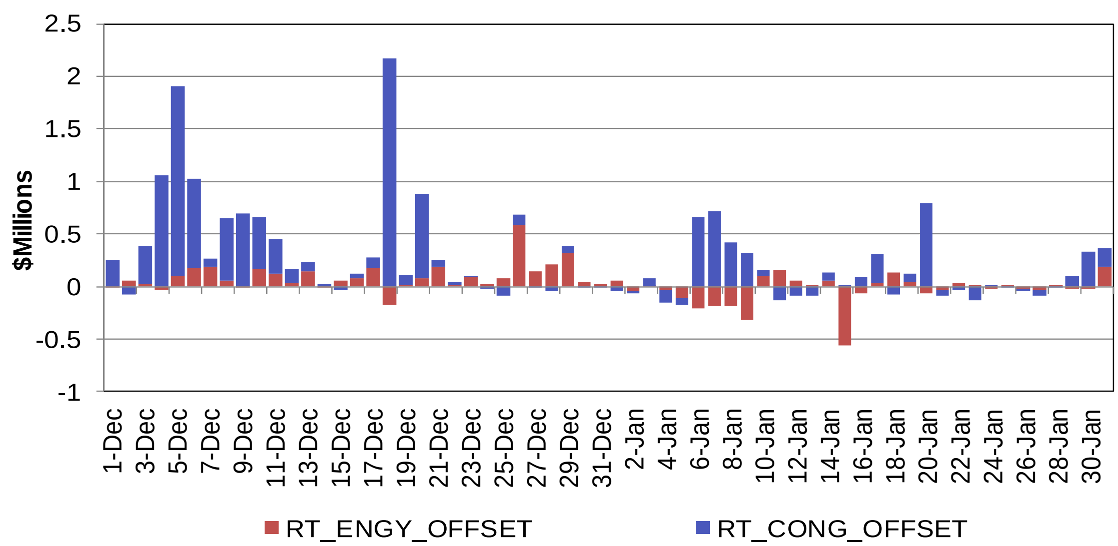
**Figure 41: Monthly Cost in IFM by UDC**




## Real-time Imbalance Offset Costs

Figure 42 shows the daily real-time energy and congestion imbalance offset costs. Real-time energy offset cost dropped to -$1.21 million in January from $2.96 million in December. Real-time congestion offset cost in January skidded to $3.08 million from $10.01 million in December.

**Figure 42: Real-Time Energy and Congestion Imbalance Offset**



## Market Software Metrics

Market performance can be confounded by software issues, which vary in severity levels with the failure of a market run being the most severe.

## Market Disruption

A market disruption is an action or event that causes a failure of an ISO market, related to system operation issues or system emergencies.[2] Pursuant to section 7.7.15 of the ISO tariff, the ISO can take one or more of a number of specified actions to prevent a market disruption, or to minimize the extent of a market disruption.

Table 7 lists the number of market disruptions and the number of times that the ISO removed bids (including self-schedules) in any of the following markets in this month. The ISO markets include IFM, RUC, FMM and RTD processes

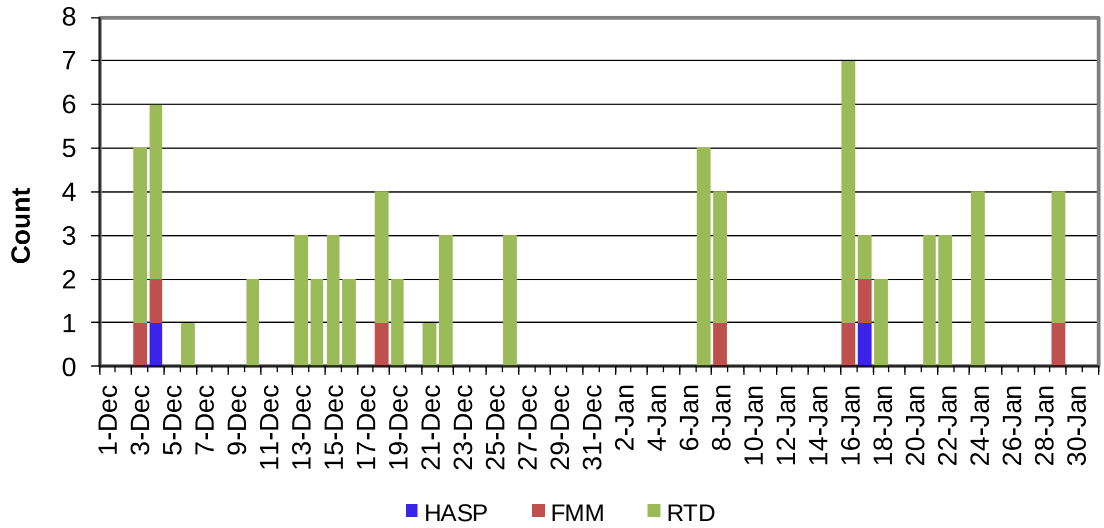
**Table 7: Summary of Market Disruption**

| Type of CAISO Market | Market Disruption or Reportable | Removal of Bids (including Self-Schedules) |
|---|---|---|
| **Day-Ahead** | | |
| IFM | 0 | 0 |
| RUC | 0 | 0 |
| **Real-Time** | | |
| FMM Interval 1 | 2 | 0 |
| FMM Interval 2 | 1 | 0 |
| FMM Interval 3 | 1 | 0 |
| FMM Interval 4 | 1 | 0 |
| Real-Time Dispatch | 30 | 0 |

Figure 43 shows the frequency of IFM, HASP (FMM interval 2), FMM (intervals 1, 3 and 4), and RTD failures. There were a total of 35 market disruptions this month. On January 16, there were one FMM and six RTD disruptions due to application problem.

[2] These system operation issues or system emergencies are referred to in Sections 7.6 and 7.7, respectively, of the ISO tariff.

**Figure 43: Frequency of Market Disruption**



# Manual Market Adjustment

## Exceptional Dispatch

Figure 44 shows the daily volume of exceptional dispatches, broken out by market type: real-time incremental dispatch and real-time decremental dispatch. The real-time exceptional dispatches are among one of the following types: a unit commitment at physical minimum; an incremental dispatch above the day-ahead schedule and a decremental dispatch below the day-ahead schedule.

The total volume of exceptional dispatch in January rose to 278,038 MWh from 153,817 MWh in December.

**Figure 44: Total Exceptional Dispatch Volume (MWh) by Market Type**

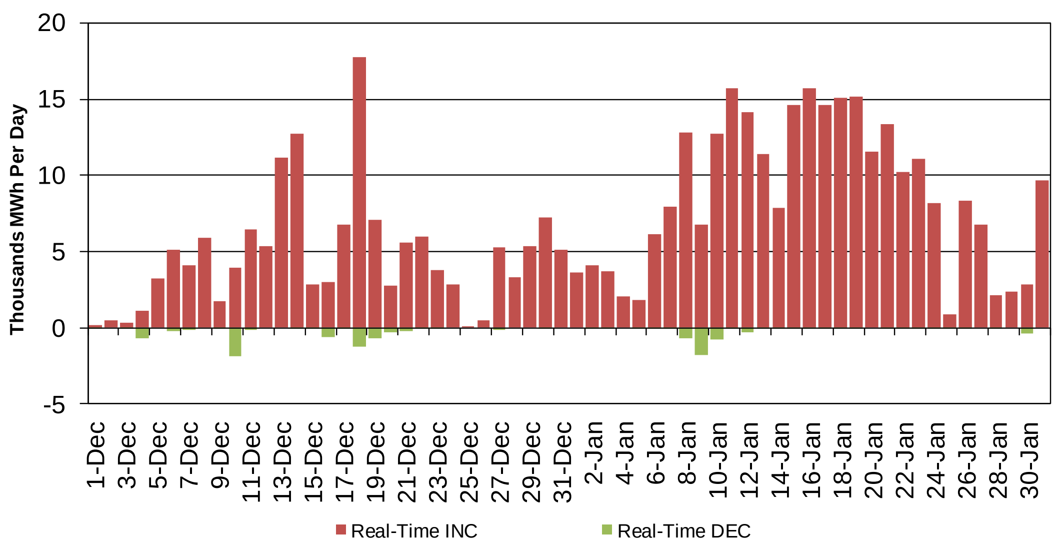



Figure 45 shows the volume of the exceptional dispatch broken out by reason.[3] The majority of the exceptional dispatch volumes in January were driven by unit testing (75 percent) and planned transmission outage (17 percent).

[3] For details regarding the reasons for exceptional dispatch please read the white paper at this link: **http://www.caiso.com/1c89/1c89d76950e00.html**.

**Figure 45: Total Exceptional Dispatch Volume (MWh) by Reason**

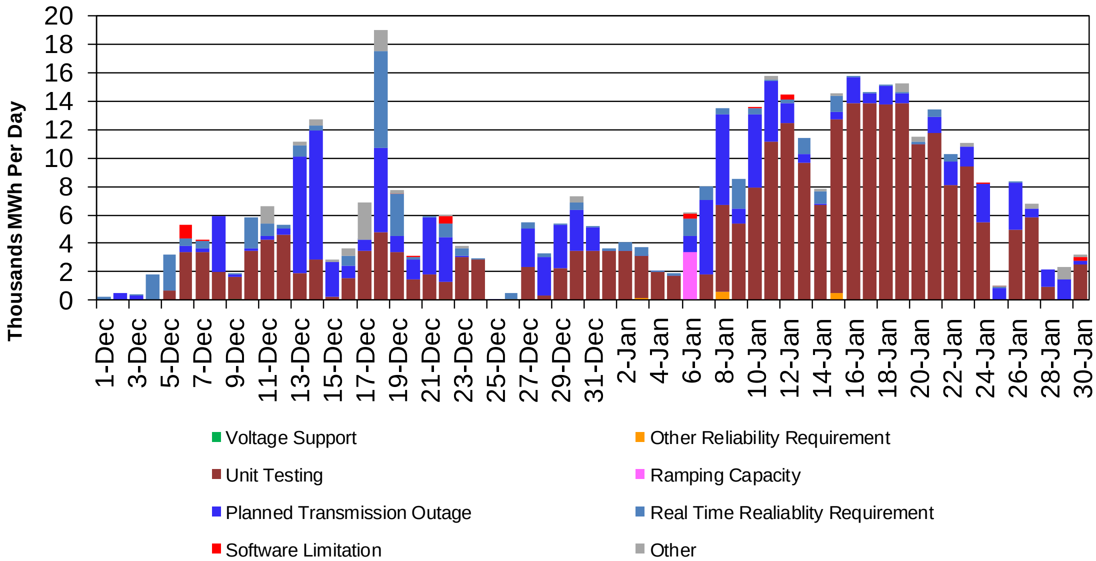
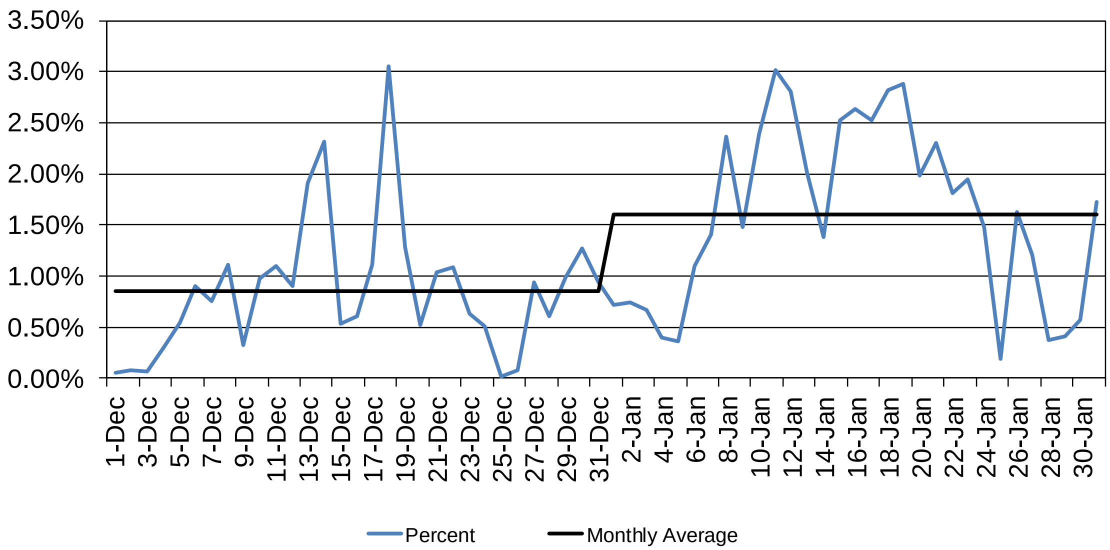



Figure 46 shows the total exceptional dispatch volume as a percent of load, along with the monthly average. The monthly average percentage was 1.61 percent in January, increasing from 0.85 percent in December.

**Figure 46: Total Exceptional Dispatch as Percent of Load**



## Energy Imbalance Market

On November 1, 2014, the California Independent System Operator Corporation (ISO) and Portland-based PacifiCorp fully activated the Energy Imbalance Market (EIM). This real-time market is the first of its kind in the West. EIM covers six western states: California, Oregon, Washington, Utah, Idaho and Wyoming.

On December 1, 2015, NV Energy, the Nevada-based utility successfully began participating in the western Energy Imbalance Market (EIM). On October 1, 2016, Phoenix-based Arizona Public Service (AZPS) and Puget Sound Energy (PSEI) of Washington State successfully began full participation in the western Energy Imbalance Market.

On October 1, 2017, Portland General Electric Company (PGE) became the fifth western utility to successfully begin full participation in the western Energy Imbalance Market (EIM). PGE joins Arizona Public Service, Puget Sound Energy, NV Energy, PacifiCorp and the ISO, together serving over 38 million consumers in eight states: California, Arizona, Oregon, Washington, Utah, Idaho, Wyoming and Nevada.

On April 4, 2018, Boise-based Idaho Power and Powerex of Vancouver, British Columbia successfully entered the western Energy Imbalance Market (EIM) today, allowing the ISO's real-time power market to serve energy imbalances occurring within about 55 percent of the electric load in the Western Interconnection. The eight western EIM participants serve more than 42 million consumers in the power grid stretching from the border with Canada south to Arizona, and eastward to Wyoming.

On April 3, 2019, Sacramento Municipal Utility District (SMUD), part of the Balancing Authority of Northern California (BANC), successfully began full participation in the Western EIM, becoming the first publicly owned agency to be an EIM entity in the Western EIM.

Figure 47 shows daily simple average ELAP prices for PacifiCorp east (PACE), PacifiCorp West (PACW), NV Energy (NEVP), Arizona Public Service (AZPS), Puget Sound Energy (PSEI), Portland General Electric Company (PGE), Idaho Power (IPCO), Powerex (BCHA), and Sacramento Municipal Utility District (BANCSMUD), for all hours in FMM. January 16 saw high price for AZPS due to high demand, increased net export, and reduced supply.

**Figure 47: EIM Simple Average LAP Prices (All Hours) in FMM**

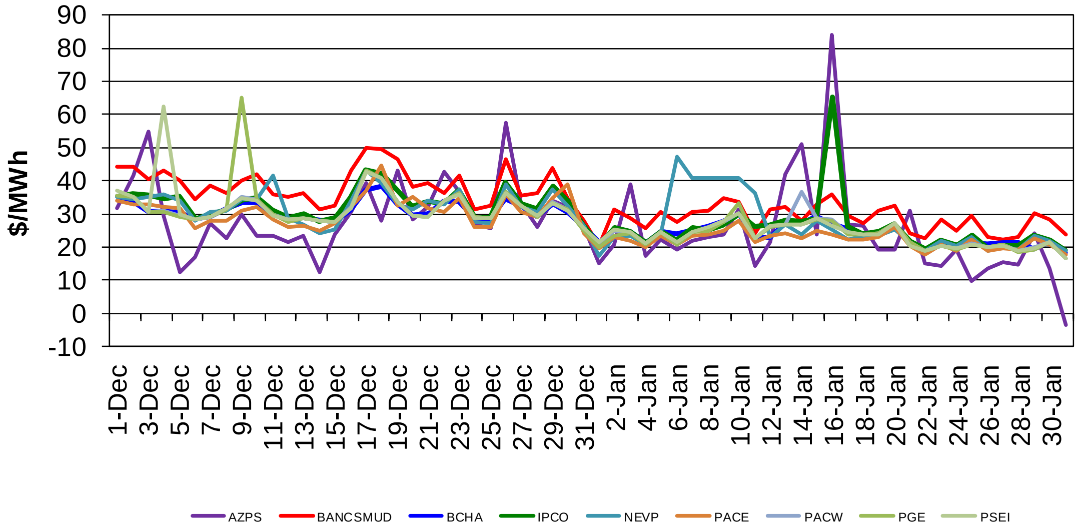



Figure 48 shows daily simple average ELAP prices for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD for all hours in RTD. January saw relatively quiet average ELAP prices. The price for AZPS spiked on January 16 due to high demand, increased net export, and reduced supply. January 21 also saw high price for AZPS driven by generation outage, upward load forecast adjustment, and reduced net import.

**Figure 48: EIM Simple Average LAP Prices (All Hours) in RTD**

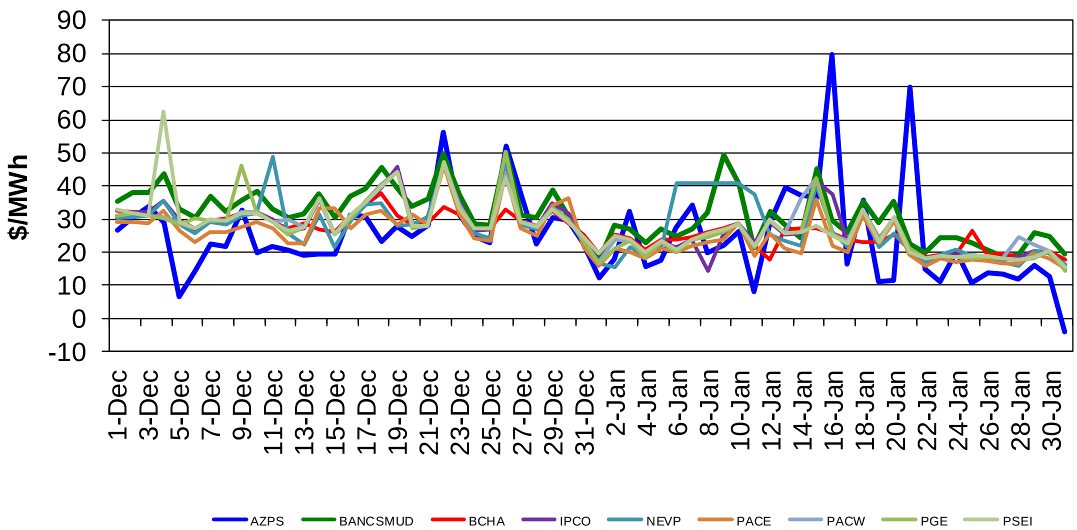



Figure 49 shows the daily price frequency for prices above $250/MWh and negative prices in FMM for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD. The cumulative frequency of prices above $250/MWh edged down to 0.08 percent in January from 0.11 percent in December. The cumulative frequency of negative prices increased to 0.96 percent in January from 0.59 percent in December.

**Figure 49: Daily Frequency of EIM LAP Positive Price Spikes and Negative Prices in FMM**

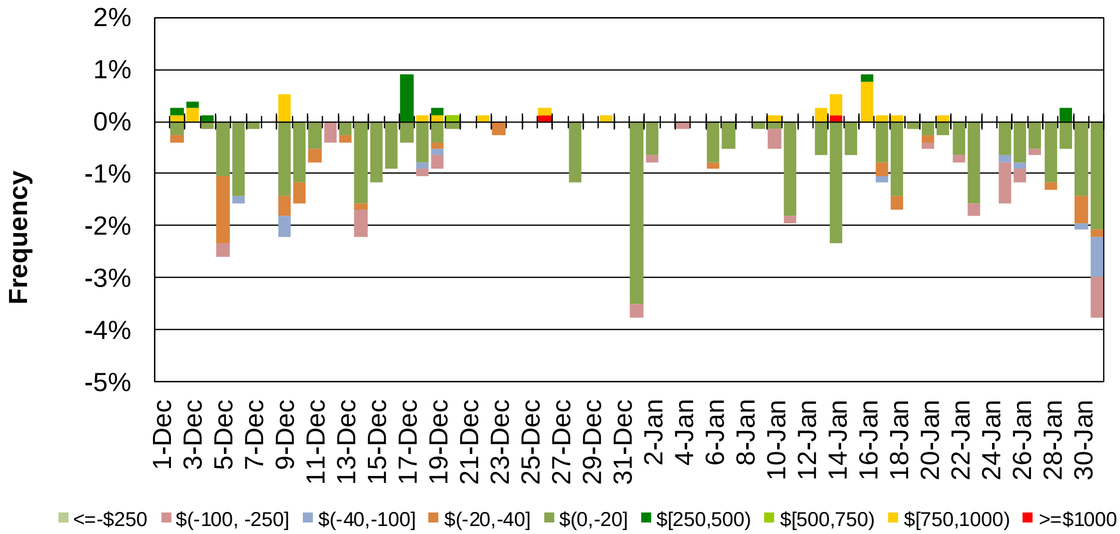



Figure 50 shows the daily price frequency for prices above $250/MWh and negative prices in RTD for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD. The cumulative frequency of prices above $250/MWh increased to 0.15 percent in January from 0.07 from in December. The cumulative frequency of negative prices rose to 1.94 percent in January from 0.79 percent in December.

**Figure 50: Daily Frequency of EIM LAP Positive Price Spikes and Negative Prices in RTD**

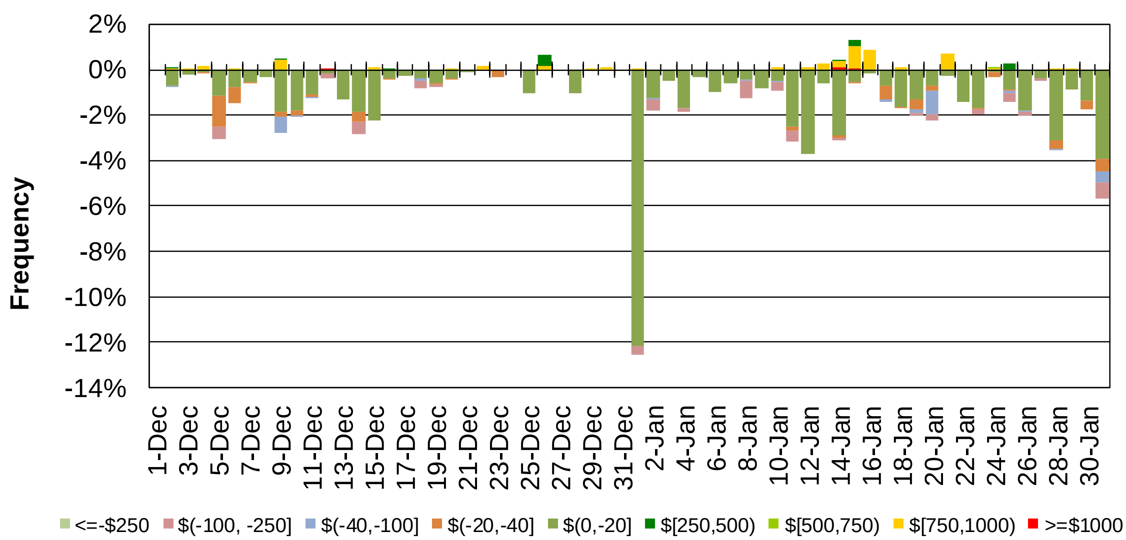


Figure 51 shows daily real-time imbalance energy offset cost (RTIEO) for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD respectively. Total RTIEO slid to -$4.84 million in January from -$2.70 million in December.

**Figure 51: EIM Real-Time Imbalance Energy Offset by Area**

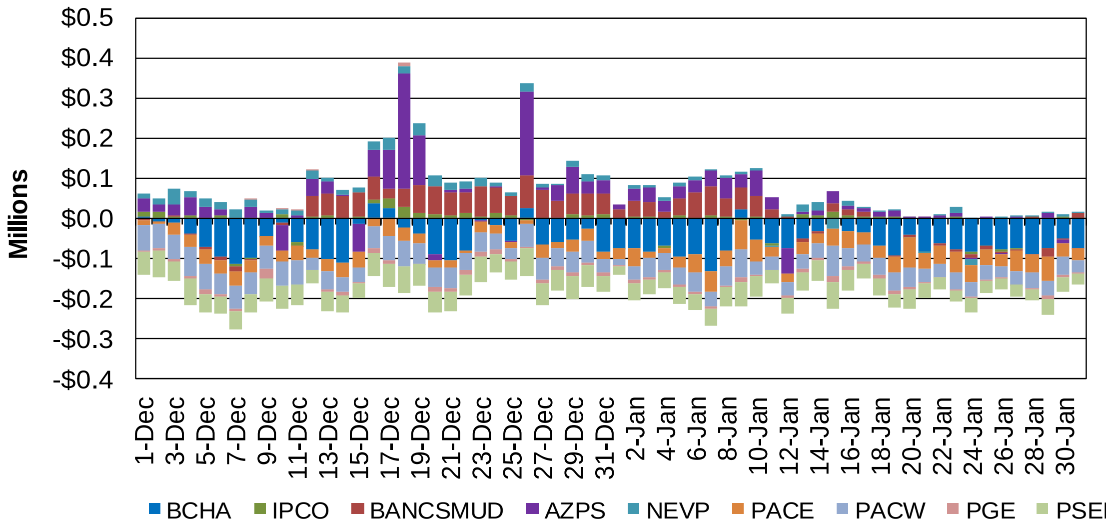



Figure 52 shows daily real-time congestion offset cost (RTCO) for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD respectively. Total RTCO fell to -$0.82 million in January from -$0.13 million in December.

**Figure 52: EIM Real-Time Congestion Imbalance Offset by Area**

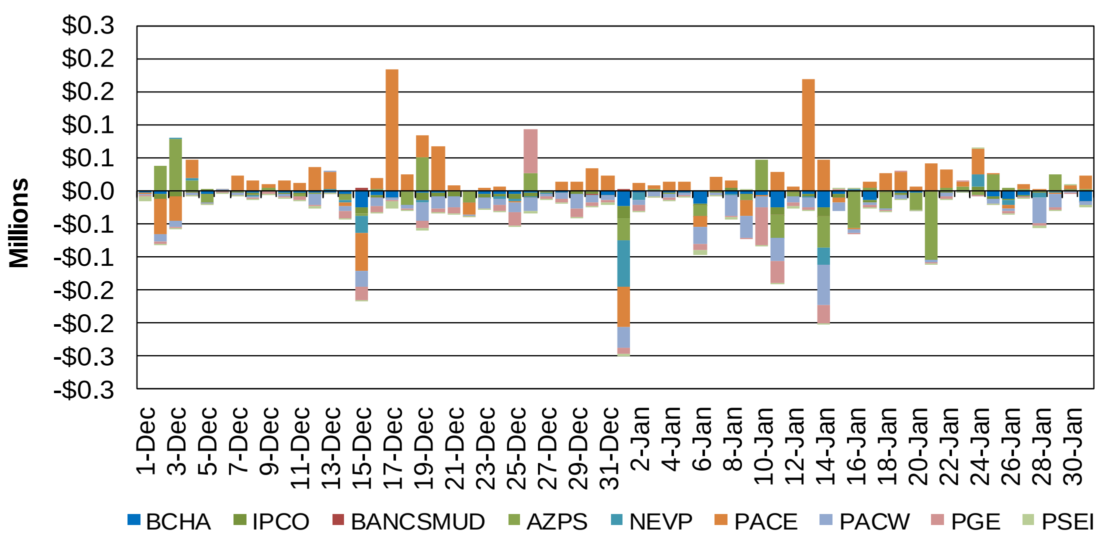


Figure 53 shows daily bid cost recovery for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD respectively. Total BCR inched down to $0.58 million in January from $0.82 million in December.

**Figure 53: EIM Bid Cost Recovery by Area**

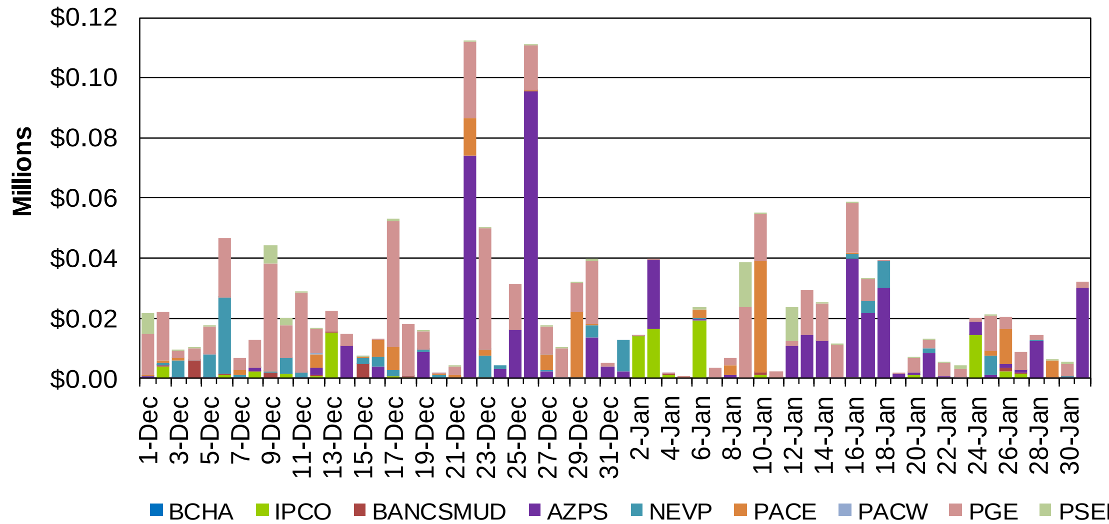



Figure 54 shows the flexible ramping up uncertainty payment for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD respectively. Total flexible ramping up uncertainty payment in January dropped to -$5,009 from $76,653 in December.

**Figure 54: Flexible Ramping Up Uncertainty Payment**

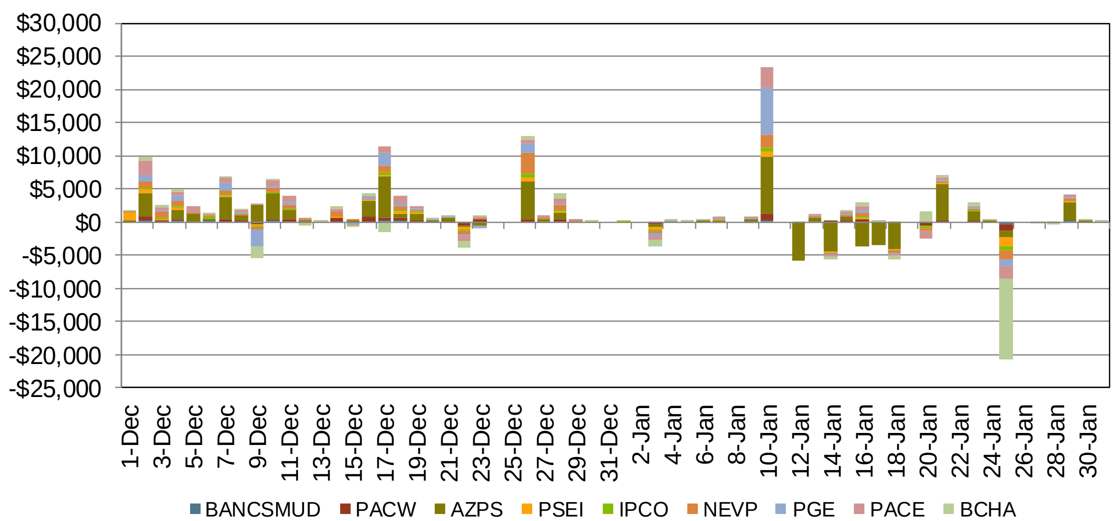


Figure 55 shows the flexible ramping down uncertainty payment for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD respectively. Total flexible ramping down uncertainty payment in January declined to -$13,172 from -$2,899 in December.

**Figure 55: Flexible Ramping Down Uncertainty Payment**

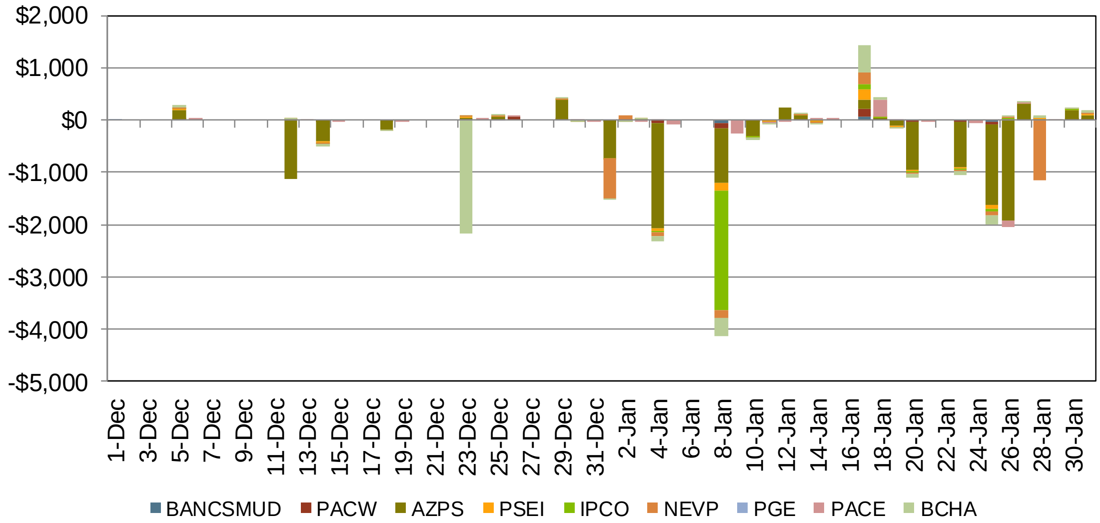
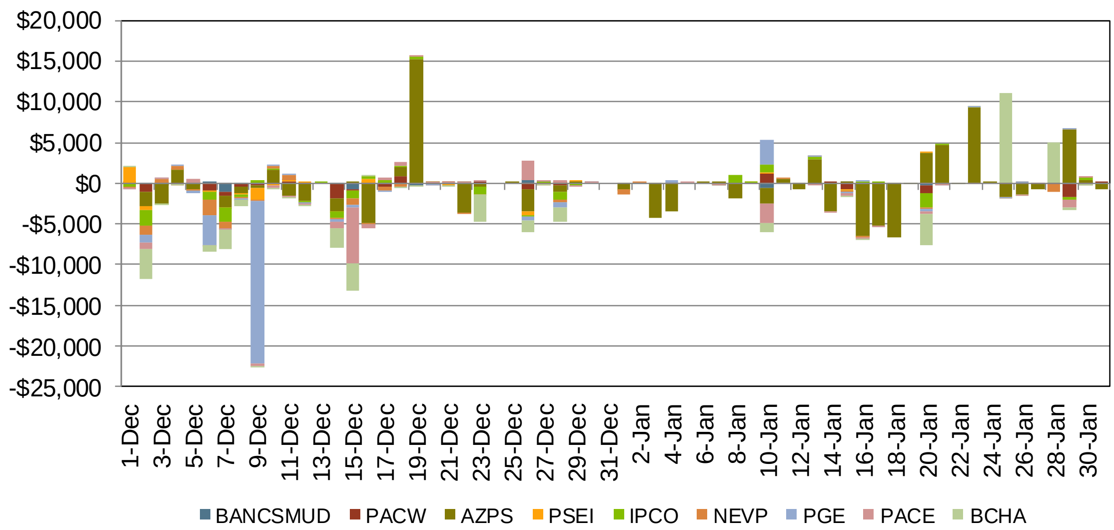



Figure 56 shows the flexible ramping forecast payment for PACE, PACW, NEVP, AZPS, PSEI, PGE, IPCO, BCHA, and BANCSMUD respectively. Total forecast payment in January increased to -$5,819 from -$78,839 in December.

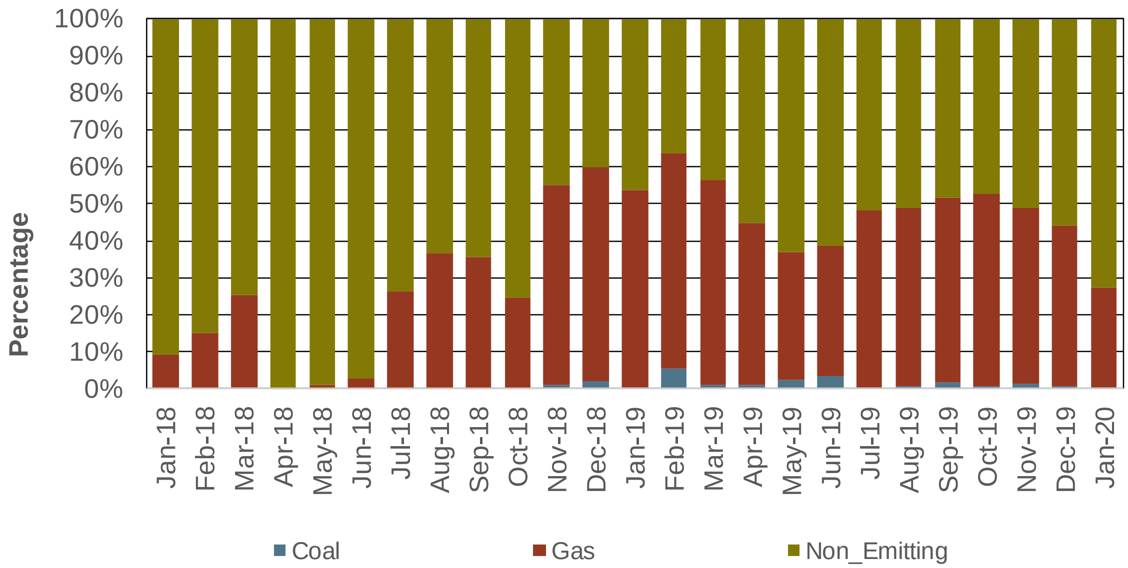
**Figure 56: Flexible Ramping Forecast Payment**



The ISO's Energy Imbalance Market Business Practice Manual[4] describes the methodology for determining whether an EIM participating resource is dispatched to support transfers to serve California load. The methodology ensures that the dispatch considers the combined energy and associated marginal greenhouse gas (GHG) compliance cost based on submitted bids[5].

The EIM dispatches to support transfers into the ISO were documented in Figure 57 and Table 8 below.

**Figure 57: Percentage of EIM Transfer into ISO by Fuel Type**




[4] See the Energy Imbalance Market Business Practice Manual for a description of the methodology for making this determination, which begins on page 42 -- http://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Energy Imbalance Market.

[5] A submitted bid may reflect that a resource is not available to support EIM transfers to California.

## Table 8: EIM Transfer into ISO by Fuel Type

| Month | Coal (%) | Gas (%) | Non-Emitting (%) | Total |
|---|---|---|---|---|
| Jan-18 | 0.00% | 9.12% | 90.88% | 100% |
| Feb-18 | 0.00% | 15.20% | 84.80% | 100% |
| Mar-18 | 0.16% | 25.00% | 74.84% | 100% |
| Apr-18 | 0.00% | 0.14% | 99.86% | 100% |
| May-18 | 0.00% | 1.09% | 98.91% | 100% |
| Jun-18 | 0.00% | 2.89% | 97.11% | 100% |
| Jul-18 | 0.00% | 26.21% | 73.79% | 100% |
| Aug-18 | 0.00% | 36.54% | 63.46% | 100% |
| Sep-18 | 0.00% | 35.50% | 64.50% | 100% |
| Oct-18 | 0.00% | 24.51% | 75.49% | 100% |
| Nov-18 | 1.16% | 53.81% | 45.03% | 100% |
| Dec-18 | 2.00% | 57.77% | 40.23% | 100% |
| Jan-19 | 0.45% | 53.44% | 46.11% | 100% |
| Feb-19 | 5.60% | 58.13% | 36.28% | 100% |
| Mar-19 | 1.07% | 55.40% | 43.52% | 100% |
| Apr-19 | 1.13% | 43.63% | 55.25% | 100% |
| May-19 | 2.22% | 34.75% | 63.03% | 100% |
| Jun-19 | 3.45% | 35.16% | 61.39% | 100% |
| Jul-19 | 0.49% | 47.74% | 51.77% | 100% |
| Aug-19 | 0.56% | 48.55% | 50.89% | 100% |
| Sep-19 | 1.77% | 50.01% | 48.22% | 100% |
| Oct-19 | 0.68% | 52.10% | 47.22% | 100% |
| Nov-19 | 1.39% | 47.69% | 50.92% | 100% |
| Dec-19 | 0.54% | 43.68% | 55.78% | 100% |
| Jan-20 | 0.17% | 27.05% | 72.79% | 100% |