California Independent System Operator Corporation

California ISO

Demand response issues and performance 2024

Revised March 14, 2025

Department of Market Monitoring

1 Summary

This report provides analysis of how demand response resources participated and performed in the California ISO market on the most critical high load days in summer 2024.[1]

- **Demand response accounted for about 2.6 percent (or 1,400 MW) of total system resource adequacy capacity over the summer of 2024**, compared to about 3 to 4 percent of total system resource adequacy capacity in the previous four summers. This drop is mainly due to a change in CPUC rules removing the planning reserve margin and transmission adders totaling over 11 percent previously applied to demand response resource capacity used to meet resource adequacy requirements. This rule change addressed one of DMM's key prior recommendations for improving how demand response is used to meet resource adequacy requirements.

- **Utility demand response** — which includes reliability demand response resources (RDRR) and proxy demand resources (PDR) — accounts for about 76 percent of demand response used to meet resource adequacy requirements. About 85 percent of this demand response capacity was bid into the real-time market during the most critical hours of summer 2024. When dispatched, utility demand response reported curtailing about 81 percent of scheduled load reductions.

- **Non-utility (or third party) demand response** — which accounts for about 18 percent of demand response used as resource adequacy capacity requirements — reported load reductions averaging about 54 percent of scheduled load reductions, when measured by capping reductions for each resource at the resource's scheduled level. During some hours, individual non-utility resources reported reductions well in excess of scheduled levels. This caused the aggregate load reductions from non-utility demand response resources to meet or exceed the aggregate level scheduled during some hours.

- **Non-CPUC jurisdictional load serving entities** (such as municipal utilities) utilize an average of about 75 MW of demand response — or about 6 percent of demand response used to meet total ISO system resource adequacy requirements. Since this capacity is not bid or scheduled into the ISO market, DMM cannot assess the availability or performance of this demand response capacity.

The Department of Market Monitoring (DMM) has provided similar analysis of the performance of demand response resources during summers 2020 through 2023.[2] This report also follows up on prior recommendations made by DMM for improving the availability and performance of demand response resources used to meet resource adequacy requirements.

[1] This report focuses on the availability, schedules, and performance of demand response resources counted towards resource adequacy requirements on 20 days in summer 2024, when the ISO issued a Restricted Maintenance Operations (RMO) notice or an Energy Emergency Alert (EEA).[1] In this report, we refer to this sample of 20 days as *high load days*. Analysis in the report focuses on the peak net load hours (18 to 22) on these high load days.

[2] Prior reports are available on DMM's website under the section on **Special Reports and Presentations** at: https://www.caiso.com/market-operations/market-monitoring/reports-and-presentations

1.1 Key findings

Key findings in this report include the following:

- **Overall, about 85 percent of resource adequacy requirements met by demand response capacity was available through bids into the ISO market during peak net load hours on days when the ISO issued system warnings or restricted maintenance operations.** This is similar to last year (with 85 percent), but an improvement from the previous two years when only about two thirds of resource adequacy demand response was available. This increase in availability is due in large part to removing the planning reserve margin and transmission adders totaling about 11 percent previously applied to demand response resource capacity used to meet resource adequacy requirements, as discussed later in this report.

- **On high demand days in the summer, about 70 percent of total demand response capacity dispatched in real-time reported performing as scheduled.**[3] Utility demand response reported curtailing about 81 percent of scheduled load reductions, while reported performance of supply plan demand response operated by non-utility third parties averaged 54 percent of scheduled load reductions.

- **Reliability demand response resources (RDRR) operated by utilities reported the highest performance of all demand response resources**. These resources were scheduled in the real-time market during a limited number of hours on only four days in the summer of 2024, but reported curtailing about 83 percent of scheduled load reductions.

- **The availability of bids for utility proxy demand resources was very low, but these resources reported performing well when dispatched.** Only 44 percent of resource adequacy capacity provided by these resources were bid into the market on high load days in summer 2024. However, these resources reported load reductions averaging about 91 percent of scheduled load reductions.

- **The availability of bids for demand response operated by non-utility third party providers was high, but these resources did not perform as well when dispatched.** Bids for non-utility (or supply plan) demand response resources were very close to resource adequacy values, but the aggregate reported performance of these resources averaged only 54 percent of their scheduled load curtailments, as measured by capping individual resource performance at each resources' schedule.[4] These results suggest that resource adequacy values of proxy demand response resources may overstate the ability of these programs to curtail load during peak net load hours on high load days.

- **In July 2023, the California Public Utilities Commission clarified that the ISO should be able to dispatch reliability demand response in the real-time upon the declaration of an Energy Emergency Alert (EEA) Watch.** Previously, reliability demand response could only be dispatched in the real-time if the ISO was under an EEA 2 or higher. On July 24, 2024, the ISO was in an EEA Watch but reliability demand response was not dispatched. All other instances of the market dispatching

[3] Performance of demand response dispatched in the ISO is based on data self-reported by demand response scheduling coordinators. These data include the aggregate metered loads of demand response resources, and a counterfactual baseline of estimated load that would have occurred if the demand response had not been dispatched.

[4] Without capping reported performance at the resource adequacy ratings of each individual resource, supply plan proxy demand response performed at 113 percent of their schedules. However, aggregate performance measured this way varied widely by day and hour, exceeding scheduled load reductions significantly during some hours and falling well short of scheduled reductions in other hours.

reliability demand response in summer 2024 were due to these resources being economically scheduled in the day-ahead market.

- **Resource adequacy payments, or the value of reduced resource adequacy requirements for load serving entities, are the primary revenue source for demand response resources.** Even when demand response resources are frequently dispatched, the energy market revenues from actually performing (or charges for failing to perform) have represented a relatively small portion of the overall compensation or value of these resources.[5] This current market framework does not provide a strong financial incentive for most demand response resources to perform when needed most under critical system conditions.

1.2 Policy changes and recommendations

In prior reports, DMM has highlighted some recommendations that the ISO and California Public Utilities Commission (CPUC) could consider to enhance the availability and performance of demand response resources.[6] Over the last few years, the CPUC has made a number of changes to the treatment of demand response resources that count towards resource adequacy requirements. In July 2023, the CPUC announced several significant changes and clarifications regarding treatment of reliability demand response, which took effect in 2024.[7]

- **Transmission loss gross-ups and the planning reserve margin adder totaling over 11 percent were removed from credited utility demand response resource adequacy values.[8]** DMM had previously recommended the CPUC reconsider the transmission and distribution loss factor gross-ups and the planning reserve margin (PRM) adder because evidence suggested the resource adequacy values of utility demand response was over-estimated. During high load days the past two summers, an average of only about 87 percent of demand response resource adequacy capacity was bid into the market. DMM noted this might be due in part to CPUC-jurisdictional demand response gross-ups and the PRM adder, which previously totaled over 11 percent.

- **Beginning in 2024, demand response resource adequacy capacity must be available during all days during which the ISO calls a Flex Alert, issues a Grid Warning, or the Governor's Office has issued an emergency notice**, in addition to the minimum of three days per week for at least four hours per day. The CPUC's Energy Division proposed this change following the 10-day heat wave in September 2022. DMM supported this proposal to incentivize resource adequacy demand response resources to bid in whatever capacity they have available during hours with tight system conditions.

- **Capacity awarded to demand response resources under the load impact protocol (LIP) process will be de-rated based on performance during test events.** Average performance results of each quarter will affect the capacity awarded through the LIPs for the respective sub-load aggregation

[5] *Demand response issues and performance 2022,* February 14, 2023, pp 23-25: https://www.caiso.com/Documents/Demand-Response-Issues-and-Performance-2022-Report-Feb14-2023.pdf

[6] *2022 Annual report on market issues and performance,* July 11, 2023, pp 21-22: https://www.caiso.com/documents/2022-annual-report-on-market-issues-and-performance-jul-11-2023.pdf

[7] CPUC Decision (D.) 23-06-029, July 5, 2023: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M513/K132/513132432.PDF

[8] The CPUC removed transmission adders of about 2.5 to 3 percent, plus a planning reserve margin (PRM) of 9 percent.

point. DMM supported this proposal to incorporate the test results in capacity awards because it may incentivize resources to provide accurate capacity estimates and to perform better when dispatched, which could lead to improved reliability.

- **Proxy demand response resources can bid no higher than $949/MWh** to ensure proxy demand resources are dispatched before reliability demand response resources. DMM supported this proposal and agrees the proxy demand resources should be used prior to emergency reliability demand response.

In 2024, the ISO completed some limited penalty enhancements for demand response that include explicit deadlines and well-defined penalty structures regarding the submission of demand response monitoring data. DMM supported these enhancements, as it will improve the ability to monitor since it increases incentives to submit demand response monitoring data. The changes are in effect as of January 6, 2025.

The ISO, CPUC, and California Energy Commission (CEC) also continue to work on addressing some additional issues pertaining to demand response, including enhancing resource adequacy counting methodologies to account for the variable nature of some demand response resources. DMM continues to recommend that the ISO consider other potential changes to enhance the reliability of demand response capacity. These include:

- **Re-examine demand response counting methodologies.** Demand response appeared to be over-counted in terms of these resources' contribution towards meeting resource adequacy requirements and their reported load curtailments. DMM supports efforts to better capture the capacity contribution of demand response whose load reduction capabilities vary across the day, and who may have limited output in general. The CPUC and CEC are currently working to develop an incentive-based qualifying capacity valuation for supply-side demand response resources.[9] DMM has recommended considering a performance-based penalty or incentive structure for resource adequacy resources. An incentive-based methodology for awarding qualifying capacity to resource adequacy demand response may improve the trend in recent years where availability and performance of proxy demand response resources fall below resource adequacy capacity. The CPUC and CEC were to submit a joint proposal in January 2025, but the report has been postponed.

- **Consider removing the exemption for long-start proxy demand response to be available in the residual unit commitment (RUC) process.** This exemption does not exist for other types of long-start resources providing resource adequacy**.** Long-start resources continue to make up a significant portion of the resource adequacy proxy demand response fleet. In July through September of 2024, about 58 percent of supply plan demand response was registered with start-up times of over 255 minutes.[10] If this capacity is not scheduled economically in the integrated forward market, then per the ISO tariff, this capacity has no obligation to be available in RUC.

[9] CPUC Decision (D.) 21-10-002, June 29, 2023, pp 79-81: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M513/K132/513132432.PDF

[10] Long-start resources have a cycle time greater than 240 minutes, where cycle time is a resource's startup time plus minimum run time.

- **Ensure that non-CPUC jurisdictional load serving entities that manage utility demand response programs used to meet resource adequacy requirements communicate the available capacity to the ISO on a daily basis, so that the ISO is aware of and can call this capacity when needed.** DMM understands that the ISO has reached out to non-CPUC jurisdictional load serving entities using demand response crediting to better ensure that the ISO has insight into these demand response programs. It will be important that the ISO have the same insight into other local regulatory authority demand response programs which are counted towards meeting resource adequacy, as the ISO does with CPUC-jurisdictional load-serving entity demand response programs.

2 Analysis of demand response market participation

This section provides a summary of findings on demand response resource adequacy capacity participating in the California ISO market on a sample of 20 high load days in summer 2024, when the ISO issued a Restricted Maintenance Operations (RMO) notice or an Energy Emergency Alert (EEA).[11] In this report, we refer to this sample of 20 days as *high load days*.

2.1 Demand response as resource adequacy

Demand response accounted for about 2.6 percent of total system resource adequacy capacity in July through September 2024, meeting an average of 1,414 MW of system resource adequacy requirements. This represents a decline from 3 to 4 percent of total system resource adequacy capacity in the previous four summers. The reductions from the previous summers are mainly the result of the CPUC excluding planning reserve margin and transmission loss adders previously applied for utility demand response.

This resource adequacy capacity is comprised of the following types of demand response:

- **Utility demand response programs.** These resources are operated and scheduled by utilities, and the capacity from these resources is subtracted from the resource adequacy obligation of these load serving entities. These include reliability demand response resources (RDRR), and proxy demand resources (PDR), which together account for about 76 percent of demand response used to meet resource adequacy requirements.

- **Supply plan (third party) demand response.** These resources are developed, bid and scheduled by non-utility (or third party) providers under contract to supply resource adequacy capacity for utilities. This capacity is often referred to as *supply plan demand response* since it is explicitly shown on monthly resource adequacy plans as supply that is providing resource adequacy capacity. These providers account for about 18 percent of demand response used to meet resource adequacy requirements.

- **Non-CPUC jurisdictional load serving entities** (such as municipal utilities) utilize an average of about 75 MW of demand response — or about 6 percent of demand response used to meet total ISO system resource adequacy requirements. Since this capacity is not bid or scheduled into the ISO market, DMM cannot assess the availability or performance of this demand response capacity.

Table 2.1 summarizes the breakdown between credited utility and supply plan demand response capacity counted towards resource adequacy requirements in July through September 2024. Capacity values for demand response under the CPUC local regulatory authority (LRA) include distribution loss factors averaging about 6 percent.

[11] The ISO declared an Energy Emergency Alert (EEA) Watch on July 24, and issued Restricted Maintenance Operation (RMO) notices on July 3-11, 14, 24-25, August 5-7, and September 4-6 and 9.

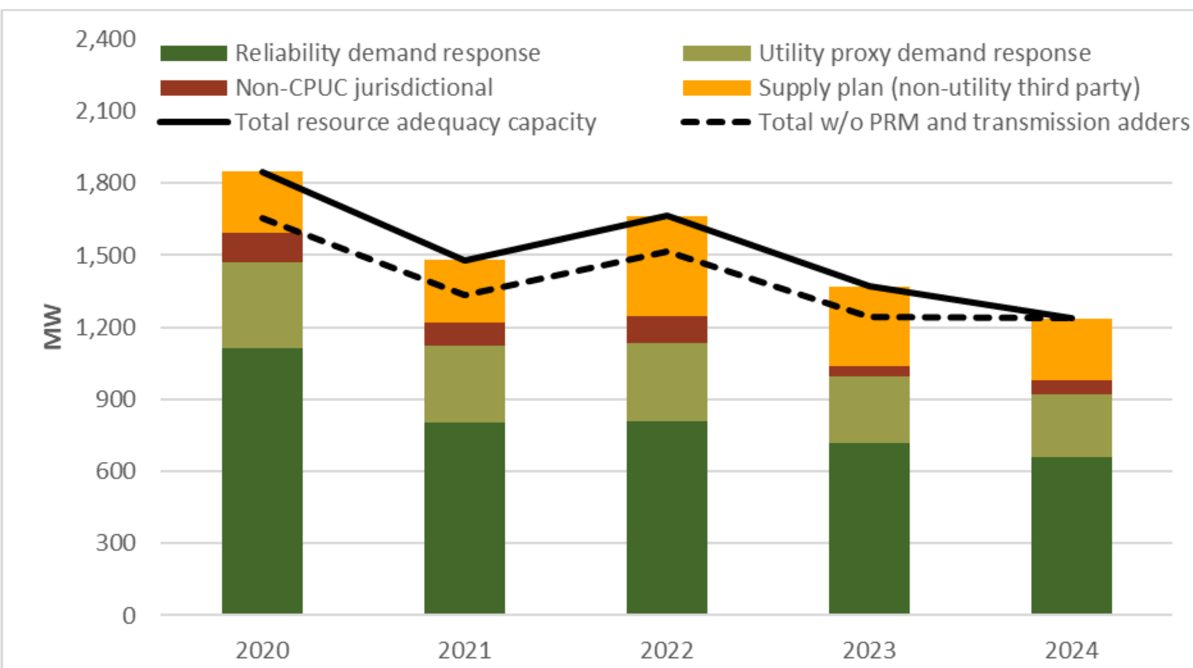
Table 2.1 Demand response resource adequacy capacity in 2024 (megawatts)

Month	Credited demand response (CPUC)	Credited demand response (Other LRA)	Supply plan demand response	Total MW
July	1,084	89	245	1,418
August	1,097	58	261	1,416
September	1,069	81	258	1,409

Figure 2.1 below shows a decline in average resource adequacy demand response capacity in August, from 2020 to 2024, for different categories of demand response. Over this period, total resource adequacy capacity met by demand response has dropped from 1,847 MW to 1,416 MW, or about 23 percent. The trend is similar in the surrounding summer months.

The elimination of the transmission and planning reserve margin adders in 2024 resulted in a decrease of over 11 percent in resource adequacy capacity met by this type of demand response capacity from 2023. Without the transmission and planning reserve margin adders, CPUC-jurisdictional demand response capacity has declined by 227 MW, while supply plan demand response has dropped 75 MW. There was a 15 MW increase in resource adequacy demand response for non-CPUC jurisdictional entities in 2024.

Figure 2.1 Resource adequacy demand response in August (2020-2024)



Utility demand response

Utility demand response represents programs that are operated by load serving entities in various local regulatory authority jurisdictions. This capacity is credited toward meeting resource adequacy requirements by being subtracted from the resource adequacy requirements of each load serving entity. In July through September 2024, this type of demand response capacity accounted for about 1,150 MW of resource adequacy credits.[12]

Almost all of utility demand response capacity (94 percent) is from programs run by investor-owned utility (IOU) programs under the jurisdiction of the CPUC, with the rest being demand response capacity used from public utilities not under CPUC jurisdiction. Historically, the CPUC has allowed IOUs to reduce their resource adequacy requirements by an additional percent above the reported capacity of their demand response resources. Prior to 2024, utility demand response resources included adders for the planning reserve margin, and transmission and distribution losses totaling over 11 percent. In 2024, only distribution loss adders of about 6 percent are included in demand response resource adequacy capacity ratings.

About 72 percent of this CPUC-jurisdictional utility demand response capacity consists of reliability demand response resources (RDRR), which are primarily called upon under emergency conditions after the ISO issues a system warning.[13] In 2023, the CPUC clarified that the ISO should be able to dispatch RDRR in the real-time, for economic or exceptional dispatch, upon the declaration of an Energy Emergency Alert (EEA) Watch, rather than an EEA 2.[14] RDRR resources are also able to economically bid into the ISO day-ahead market.

Capacity from IOU demand response programs are bid and scheduled as supply in the ISO market, but is not shown on resource adequacy supply plans and therefore is not subject to ISO must-offer-obligations or the ISO's resource adequacy availability incentive mechanism (RAAIM). Pursuant to D.21-06-029, once the CPUC confirms that the ISO has implemented a FERC-approved exemption to the RAAIM penalty for demand response resources, each investor-owned utility will be directed to move their demand response portfolios onto supply plans.[15]

In addition to CPUC-jurisdictional demand response credits, other non-CPUC jurisdictional regulatory authority load serving entities (such as municipal utilities) accounted for about 75 MW of demand response resource adequacy credits in July through September. This capacity was not bid or scheduled into the ISO market, and the ISO did not have operational insight into this capacity. However, DMM understands that the ISO is working with these local regulatory authorities to develop processes similar to those that exist with CPUC-jurisdictional utilities in order to be able to call on these demand response programs when needed.

[12] Credited values includes distribution loss factor gross-ups.

[13] Reliability demand response programs are primarily comprised of Base Interruptible Program (BIP) customers and agricultural and pumping loads. While reliability demand response can only be dispatched in the real-time if the ISO is in an EEA Watch, it may be economically scheduled in the day-ahead market.

[14] Under these protocols, the ISO's interpretation was that RDRR could only be dispatched in the real-time if the system was in an EEA 2 or higher. The CPUC clarified that the ISO should be able to use resource-adequacy qualifying resources prior to an emergency in decision (D.) 21-10-002 on June 29, 2023.

[15] https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/resource-adequacy-compliance-materials/final-2022-ra-guide-clean-101821.pdf

Supply plan (third party) demand response

Demand response that is shown on monthly resource adequacy supply plans (referred to as *supply plan demand response*) currently represents capacity that is scheduled by third party non-utility demand response providers who contract to sell capacity to load serving entities. Supply plan demand response resources only include proxy demand response resources and are generally subject to ISO must-offer-obligations and the ISO's resource adequacy availability incentive mechanism (RAAIM).[16]

Supply plan demand response capacity averaged 255 MW from July through September 2024, a 23 percent reduction compared to summer 2023. Supply plan demand response capacity is contracted either through the CPUC's Demand Response Auction Mechanism (DRAM) or bilaterally between third party providers and load serving entities. Previously, most third party demand response was contracted through DRAM but increasingly, more capacity is being contracted bilaterally.

2.2 Availability of demand response resource adequacy capacity

On days when the ISO issued an Energy Emergency Alert (EEA) or a Restricted Maintenance Operations (RMO) notice, about 80 percent of resource adequacy capacity from demand response was bid into the ISO market across peak net load hours. This is a small decrease in the availability of resource adequacy demand response capacity compared to summer 2023. This is partially because four of the 19 days in 2024 were holidays or weekends, when there may be reduced bidding requirements for demand response.

In summer 2024, the bid-in capacity of utility demand response averaged about 85 percent of resource adequacy credits, compared to 81 percent last year. While supply bid in from reliability demand response met or exceeded resource adequacy capacity for reliability demand response, proxy demand response fell substantially short of resource adequacy credits, at 44 percent availability. Third party demand response was available on average to 86 percent of their resource adequacy capacity in the day-ahead market and 62 percent in the real-time market. Greater availability of supply plan demand response, compared to utility proxy demand response, is likely due to supply plan resources being subject to potential penalties for failing to bid in up to their resource adequacy capacity, while utility demand response resources do not face the same penalties.

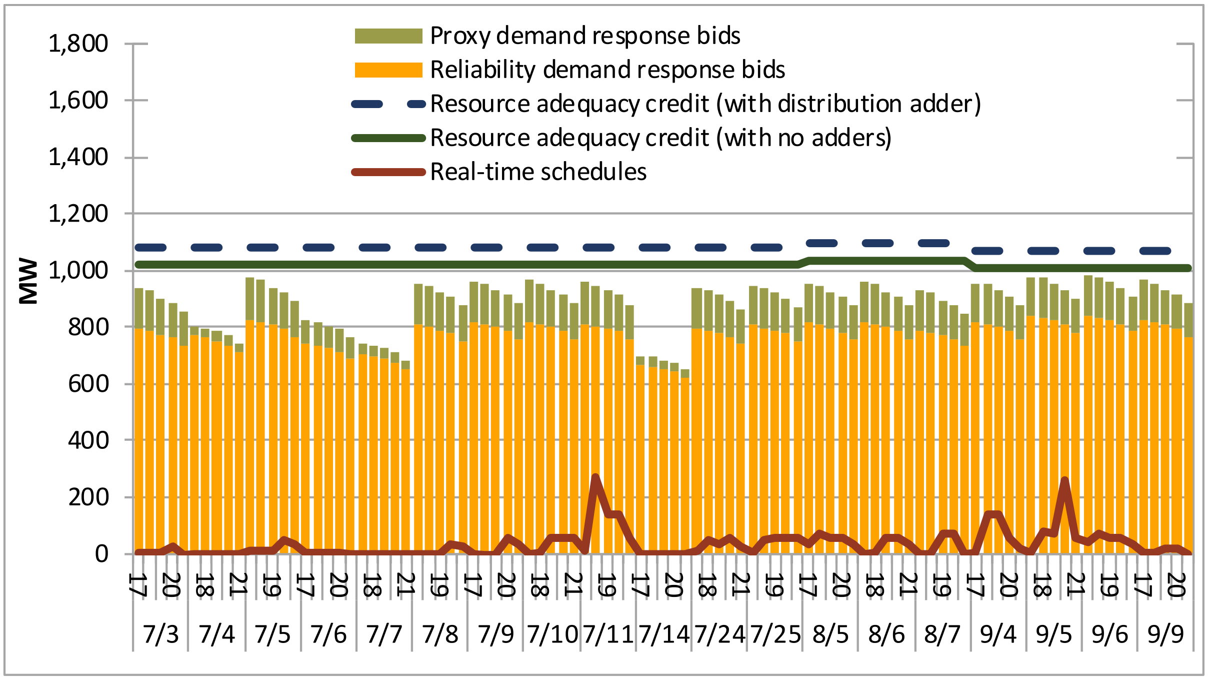
Utility demand response availability

Figure 2.2 shows the availability of CPUC-jurisdictional credited demand response capacity on high load days, compared to total resource adequacy credits in respective months. Figure 2.2 also shows the real-time schedules of ISO-integrated CPUC-jurisdictional utility demand response capacity (both proxy demand response and reliability demand response). Program availability is based on demand response resource bids into the ISO markets. On average, utility demand response bid in about 85 percent of resource adequacy credits on high load days in 2024. This is an increase in availability compared to 2023, when utility demand response bids fell short of resource adequacy credits by 19 percent. The shortfall of

[16] RAAIM is a financial incentive mechanism applied to resource adequacy capacity where suppliers could be penalized for not being available (bid) into the ISO market in Availability Assessment Hours, which are currently peak net load hours (4:00pm to 9:00pm) on non-holiday weekdays. Resources with a Pmax less than 1 megawatt are exempt from RAAIM under the ISO Tariff, Section 40.9.2(a)(1). In August 2024, 15 percent of supply plan demand response capacity was associated with resources sized less than 1 megawatt and thus were exempt from RAAIM.

bid-in capacity compared to resource adequacy credits was primarily associated with proxy demand response.

Figure 2.2 CPUC-jurisdictional utility demand response availability and resource adequacy credits



The availability of credited utility demand response varied significantly between reliability demand response resources and proxy demand response resources. Figure 2.3 and Figure 2.4 show the bid-in capacity for reliability demand response resources and proxy demand response resources separately.[17]

As seen in Figure 2.3, bids from reliability demand response resources met or exceeded the CPUC-jurisdictional credited resource adequacy values for reliability demand response programs. The only days the RDRR did not bid in their full resource adequacy value were weekend days, but overall averaged 115 percent of resource adequacy.

The percentage of credited utility proxy demand response capacity that bid in during these tight system days was substantially lower, averaging 44 percent of resource adequacy values (including distribution gross-ups). Because credited utility demand response is not shown on supply plans, utility proxy demand resources are not subject to RAAIM if they fail to bid in their resource adequacy capacity. This may explain why such a large portion of this capacity was unavailable to the ISO during peak hours on high load days in summer 2024.

In addition, non-CPUC jurisdictional load serving entities claimed an average of 75 megawatts of demand response resource adequacy credits in July and August, which reduced these entities' system resource

[17] The aggregate resource adequacy values in Figures 2.3 and 2.4 vary slightly from Figure 2.2. This is due to Figure 2.2 using data from the CPUC's CIRA Generic Obligations Report which has total RA Obligations met by demand response (DR), while Figures 2.3 and 2.4 use the individual load serving entity (LSE) reports that break down DR capacity between PDR and RDRR, and there are some slight data discrepancies between these two sources.

adequacy obligations. The ISO does not have insight into the availability of non-CPUC jurisdictional utility demand response programs as this capacity is not integrated in the ISO market.

Figure 2.3 Utility reliability demand response availability and resource adequacy credits

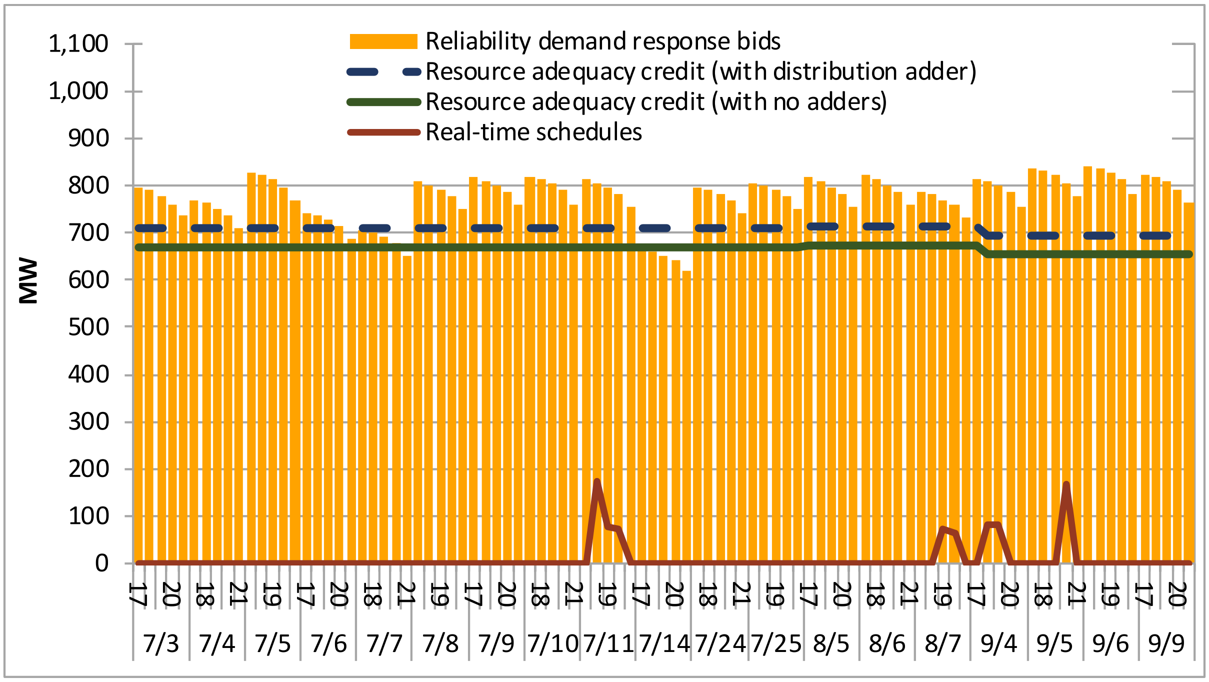
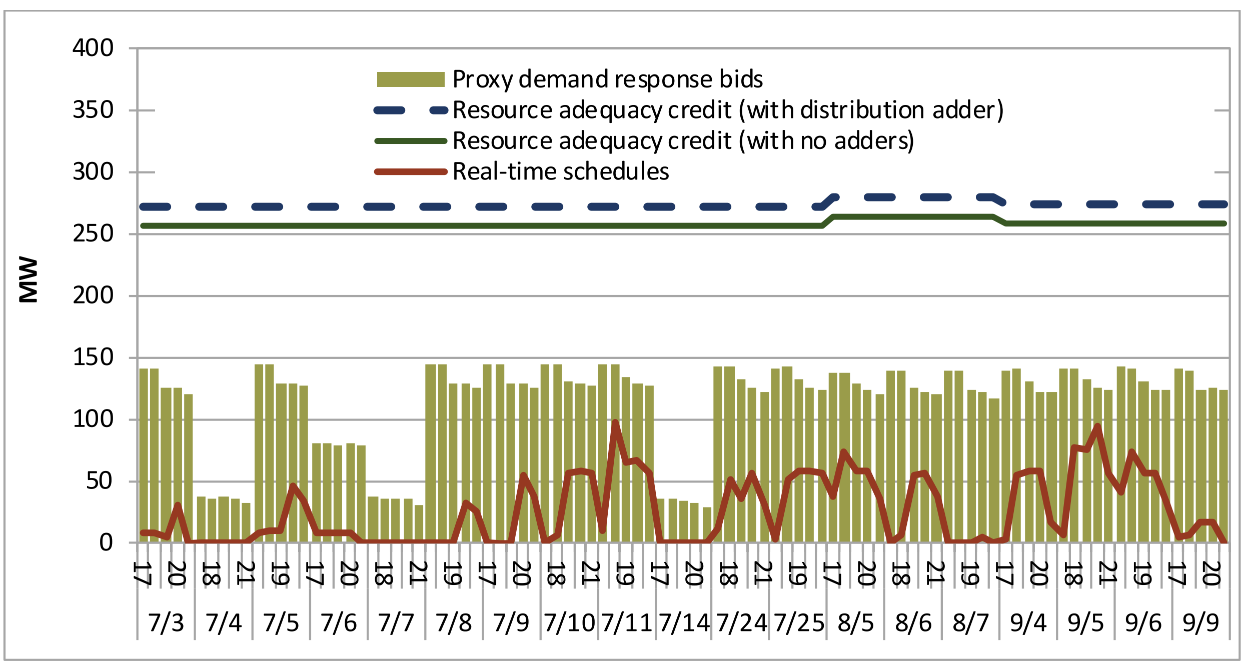


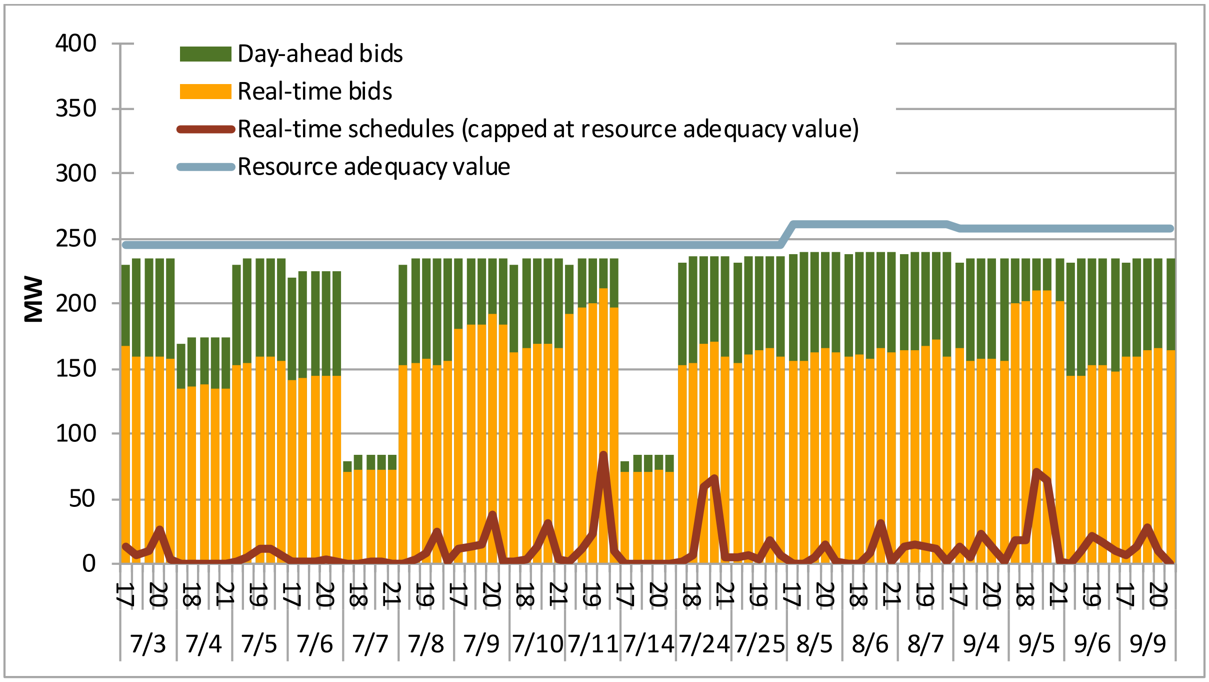
Figure 2.4 Utility proxy demand response availability and resource adequacy credits



Supply plan demand response availability

Figure 2.5 shows the availability of supply plan demand response capacity as reflected by day-ahead and real-time bids, where bids are capped at individual resource shown resource adequacy values. The high availability of supply plan demand response resources in the day-ahead market is due in part to these resources being subjected to Resource Adequacy Availability Incentive Mechanism (RAAIM) penalties for failing to bid in resource adequacy values during net peak hours. The lower availability of bids in real-time can primarily be attributed to demand response programs with start-up times more than 255 minutes, which are not subject to RAAIM and therefore are not penalized for being unavailable in real-time.

Figure 2.5 Day-ahead and real-time availability of supply plan demand response



Day-ahead bids from supply plan demand response resources averaged 86 percent of resource adequacy capacity during high load days this summer. This is a decrease from summer 2023 when bid-in capacity in the day-ahead market averaged 96 percent of resource adequacy values. High load days in summer 2024 included a holiday and weekends, which reduced bidding requirements. Comparing weekdays between 2024 and 2023, the decrease was much smaller, with 94 and 96 percent bid in, respectively.

In the real-time market, only about 62 percent was bid in. Limited availability of demand response capacity in real-time can primarily be attributed to demand response programs with start-up times more than 255 minutes, which qualify these resources as long-start. Long-start resources are not subject to RAAIM in the real-time if they are not scheduled economically in the day-ahead market, and therefore are not penalized for being unavailable. In July through September of 2024, around 58 percent of supply plan demand resource adequacy capacity was associated with long-start resources.

2.3 Demand response bidding

Figure 2.6 shows day-ahead bid prices and day-ahead schedules of utility and third party proxy demand response resources counted towards resource adequacy requirements across peak net load hours. For each date, there are two columns of data. Each column includes data for hours-ending 17 through 21. The left column is for utility resources, while the right column is for third party resources. The presentation of the data is the same for Figure 2.6 and Figure 2.7.

Figure 2.6 Proxy demand response resource adequacy day-ahead bids

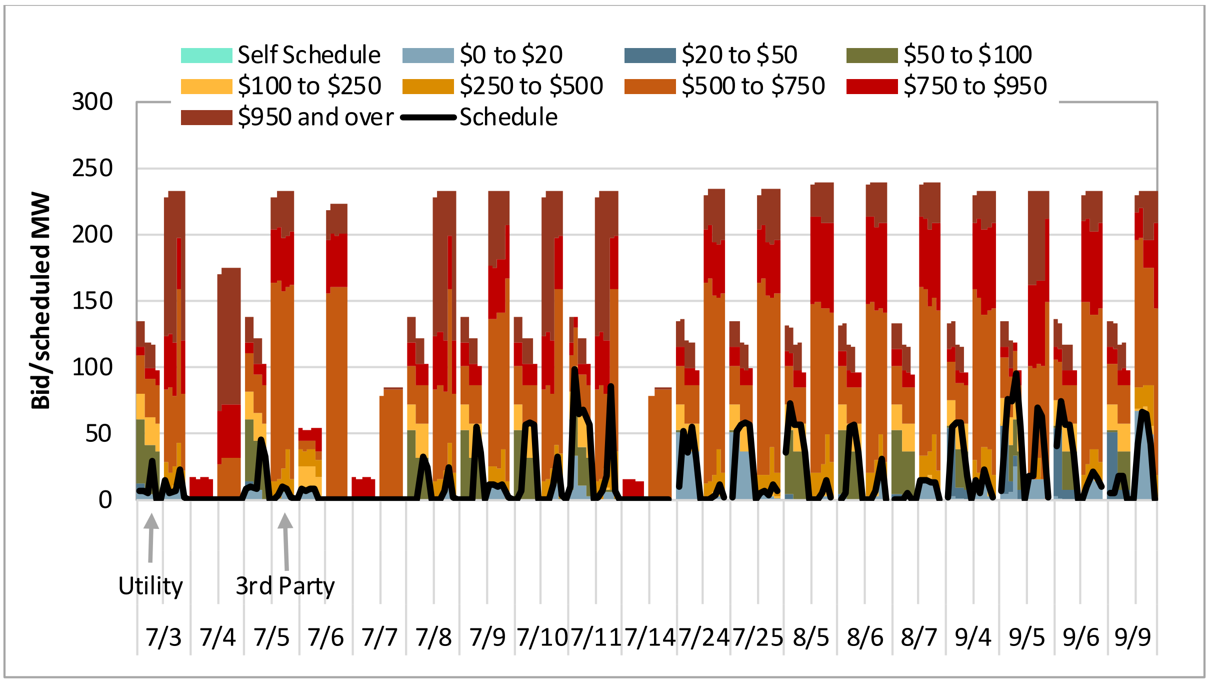


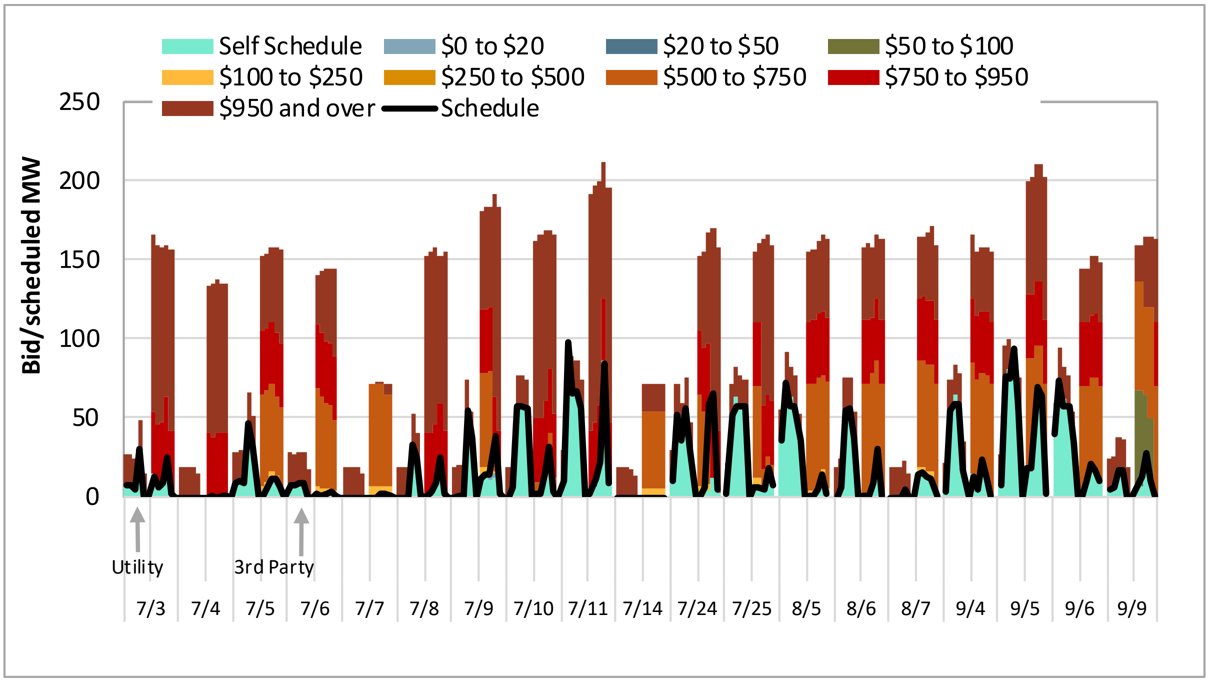
Figure 2.6 highlights the pattern of proxy demand response bids in the day-ahead market. Across high load days in summer 2024, around 52 percent of utility demand response bids and 90 percent of third party demand response bids exceeded $500/MWh. These high bid prices led to a small percentage of demand response capacity being scheduled in the day-ahead market. Over this period, about 21 percent of the utility proxy demand response that bid into the day-ahead market was scheduled, while about five percent of bid-in third party demand response was scheduled.

Figure 2.7 shows real-time bids of proxy demand response (utility and third party) counted towards resource adequacy requirements across peak net load hours. Figure 2.7 highlights proxy demand response capacity incremental to day-ahead awards was largely offered at or near the $1,000/MWh soft offer bid cap. Under certain conditions, the bid cap can be increased from $1,000/MWh to $2,000/MWh, however proxy demand response, as with all internal resources, must submit reference level change requests to bid over $1,000/MWh.[18] Although the hard bid cap of $2,000/MWh was in

[18] It is not clear to DMM if proxy demand response resources can submit reference level change requests and whether the ISO would be able to validate these requests. DMM has recommended the ISO open a policy initiative to consider improvements to the reference level change request process to ensure non-gas resources are able to submit requests to accurately reflect their costs. See *Comments on Policy Initiatives Catalog and Roadmap Process 2024*, Department of Market Monitoring, Feb 29, 2024: https://www.caiso.com/Documents/DMM-Comments-on-2024-Policy-Roadmap-Feb-29-2024.pdf

effect for two hours on September 5, no proxy demand response resources submitted a reference level change request and thus were unable to bid over $1,000/MWh.

Figure 2.7 Proxy demand response resource adequacy real-time bids



Beginning in 2024, non-DRAM resource adequacy proxy demand response resources contracted with LSEs under the CPUC jurisdiction are subject to a bid cap of $949/MWh.[19] This change was implemented by the CPUC in order to ensure that proxy demand response resources are dispatched prior to reliability demand response resources who are required to bid in at 95 percent of the current market bid cap.

On high load days in 2024, 20 percent of third party demand response and nine percent of utility proxy demand response bid in at $950 or above in the day-ahead market. In the real-time market, these percentages increase to 41 and 60 percent, respectively. As a reference, on high load days in 2023, 41 percent of third party demand response and 31 percent of utility proxy demand response bid in at $950 or above in the day-ahead market. In the real-time market, these percentages are even higher averaging 43 percent for utility demand response and 78 percent for third party demand response.

Figure 2.8 shows day-ahead and real-time bids for reliability demand response counted towards resource adequacy requirements. Reliability demand response resources may bid economically in the day-ahead market, however incremental reliability demand response capacity offered into real-time must submit bids at or above 95 percent of the ISO's current energy bid cap, and can only be dispatched under an Energy Emergency Alert (EEA) Watch or greater. This change was implemented in summer 2023. Prior to this change, reliability demand response could only be dispatched in the real-time if the ISO was in an EEA 2 or greater. In July 2023, the CPUC clarified reliability demand response should be

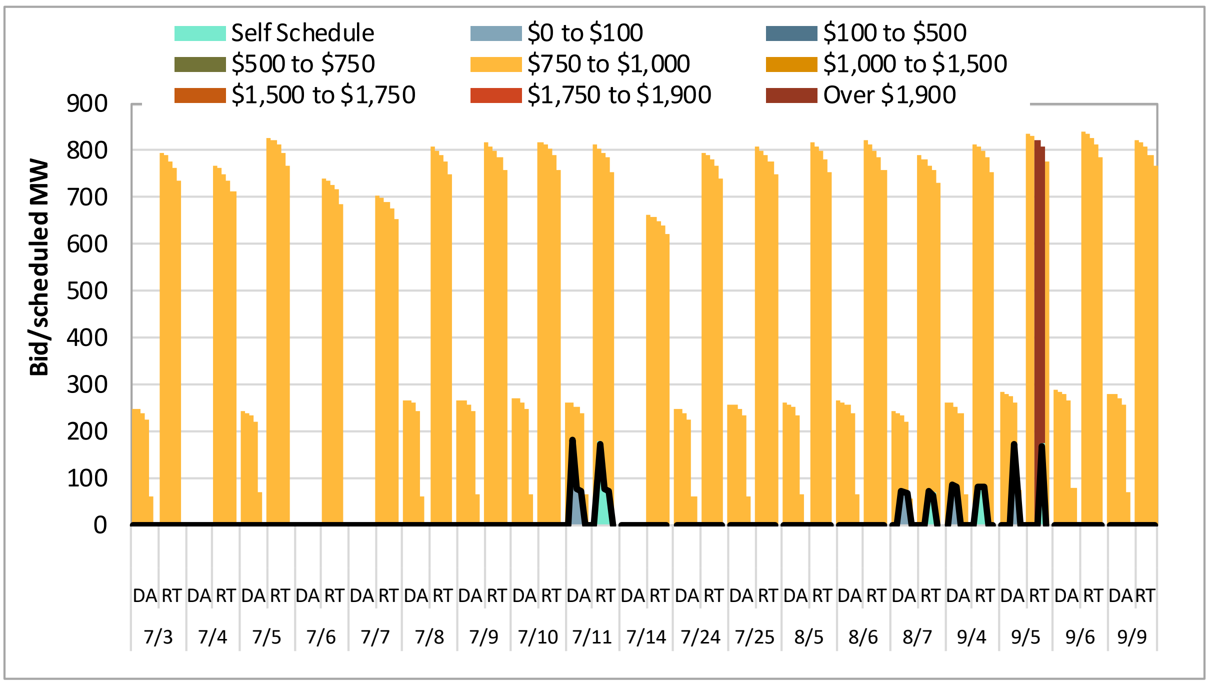
[19] Beginning in 2024, the CPUC directed non-DRAM proxy demand response resource bids may not exceed $949 per megawatt-hour in either the day-ahead or real-time. DMM does not know which proxy demand response resources are procured under DRAM, so cannot verify if the proxy demand response resources are in compliance with the CPUC ruling. The CPUC decision (D.) 23-06-029 was issued on July 5, 2023.

available prior to an emergency, and instructed the ISO to allow operators to dispatch RDRR in an EEA Watch.[20]

Figure 2.8 also shows that reliability demand response resources were scheduled on four days in summer 2024. On July 11, August 7, and September 4 and 5, reliability demand response resources were scheduled economically in the day-ahead market. All of the day-ahead schedules were self-scheduled and dispatched in the real-time.

Bids from reliability demand response resources must be at least 95 percent of the bid cap in the real-time market. Under normal conditions, the bid cap is $1,000/MWh but under stressed system conditions, the bid cap is raised to $2,000/MWh.[21] During two peak hours on September 5, the bid cap in the market was $2,000/MWh and thus reliability demand response resources were required to bid in at least $1,900/MWh. None of the resources dispatched on September 5 were bidding at $1,900/MWh because they were economically scheduled in the day-ahead, and there was no EEA Watch to enable economic bids in the real-time.

Figure 2.8 Reliability demand response resource adequacy bids



2.4 Demand response performance

This section details the self-reported performance of both utility demand response and supply plan demand response resources on high load days in the summer. The aggregate performance of utility demand response, both proxy demand response and reliability demand response, averaged about 90

[20] Following this CPUC decision, the ISO updated their operating procedures: https://www.caiso.com/Documents/4420.pdf

[21] FERC Order 831. See additional information on conditions in DMM's *Q1 2021 Market Issues and Performance* report, June 9, 2021, pp 93-96: http://www.caiso.com/Documents/2021-First-Quarter-Report-on-Market-Issues-and-Performance-Jun-9-2021.pdf

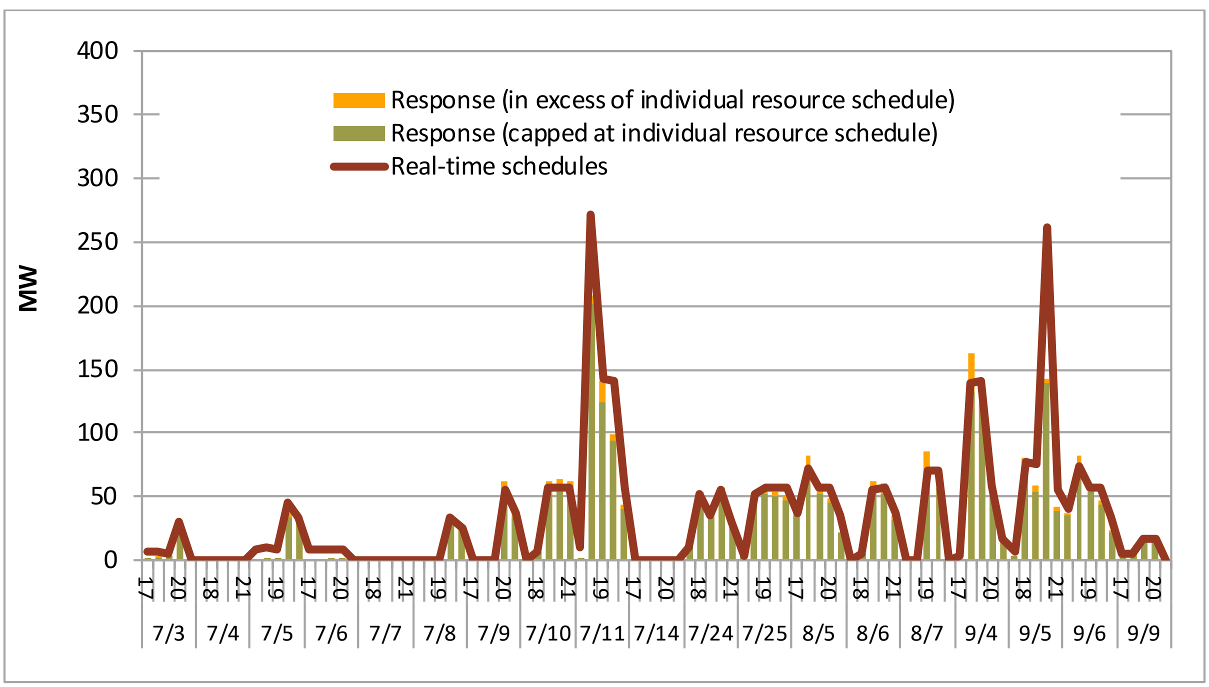
percent of their scheduled load curtailment during high load days, similar to summer 2022 and 2023. The performance of third party demand response averaged higher at 113 percent of their scheduled curtailments, considerably higher than the previous summers.[22] The high performance of third party demand response appears to be due to the lower level of resources that were scheduled compared to previous years. Reviewing performance data across years, performance appears to be higher at lower levels of dispatch.

Utility demand response performance

Figure 2.9 shows real-time dispatches and self-reported response of CPUC-jurisdictional utility demand response capacity on high load days. Figure 2.9 reflects both proxy demand response and reliability demand response capacity scheduled by CPUC-jurisdictional investor-owned utilities. Non-CPUC jurisdictional demand response programs are not currently tied to specific resources in the ISO market and thus are not included in Figure 2.9.

Figure 2.9 depicts self-reported response capped at individual resources' dispatch instructions (green bar), and self-reported response in excess of individual resource dispatches (yellow bar). These metrics indicate that some individual resources under-performed while other resources reported to curtail load in excess of dispatch instructions.

Figure 2.9 CPUC-jurisdictional utility demand response performance



[22] Performance here refers to uncapped performance where responses are not capped at each resource's scheduled load curtailment.

The performance of CPUC-jurisdictional demand response resources, capped at individual resource schedules, averaged 81 percent of their real-time schedules during high load days this summer. In aggregate, the total CPUC-jurisdictional utility demand response fleet, including excess curtailed load, averaged 89 percent of their real-time schedules. Overall, this is very similar to performance during high load days in summer 2023.

The largest amount of utility demand response was dispatched on July 11, with about 270 MW scheduled during hour-ending 18. Resources reported to curtail about 200 MW in hour-ending 18. These reported curtailments include load curtailment in excess of individual resource dispatches and suggest a performance of 74 percent.

Figure 2.10 and Figure 2.11 show CPUC-jurisdictional demand response performance, split between proxy and reliability demand response capacity. Including curtailments above individual resources' schedules, the performance of proxy demand resources averaged 91 percent of their scheduled curtailments and reliability demand response resources averaged 83 percent during the high load days of this summer when the resources were dispatched. Compared to summer 2023, proxy demand response resources performed with a lower performance while reliability demand response resources performed better on average on high load days in summer 2024, when dispatched.

Figure 2.10 CPUC-jurisdictional utility proxy demand response performance

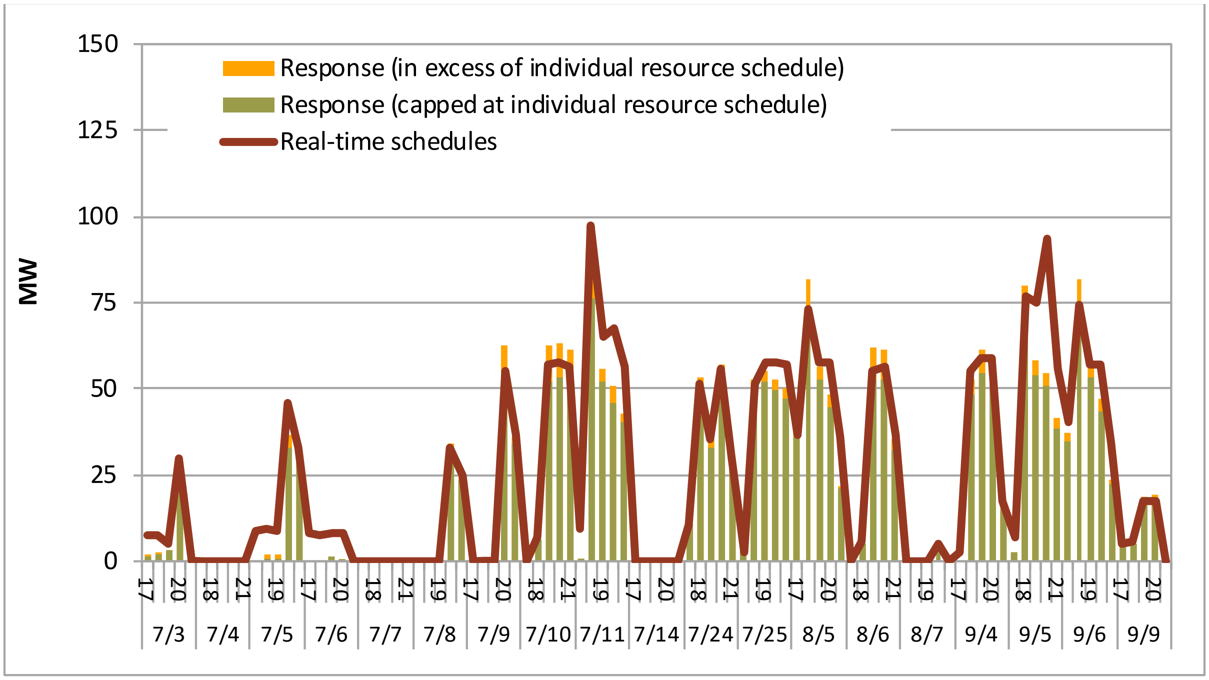
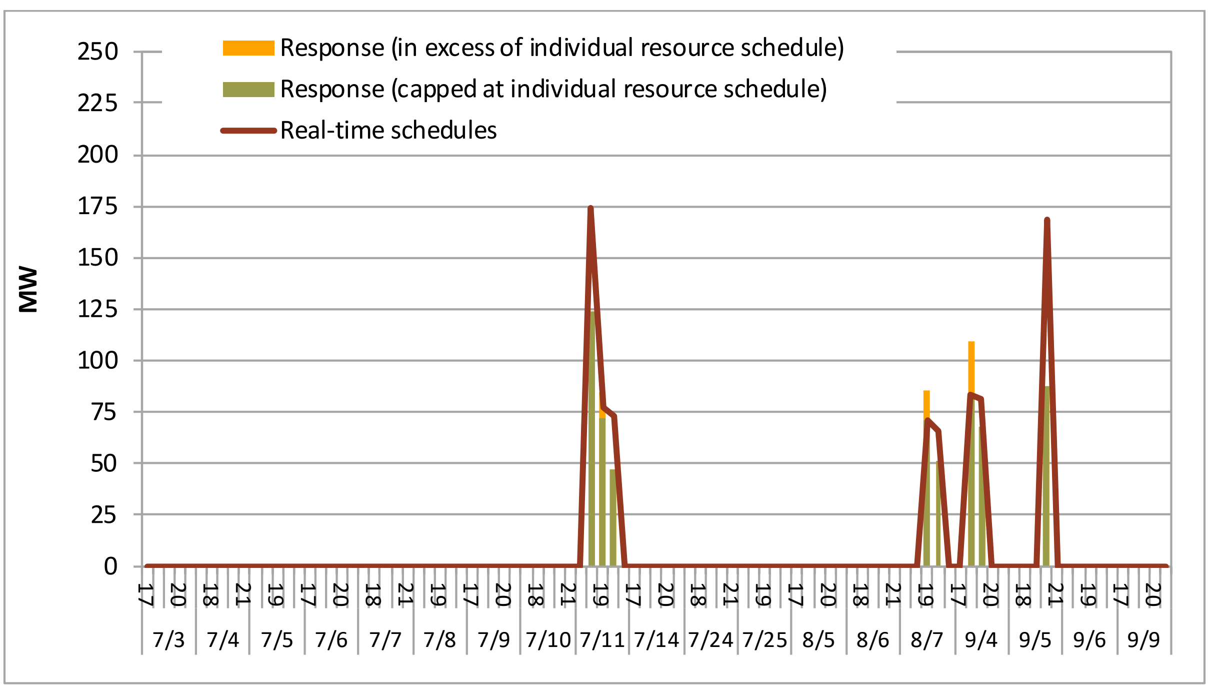


Figure 2.11 CPUC-jurisdictional utility reliability demand response performance



Supply plan demand response performance

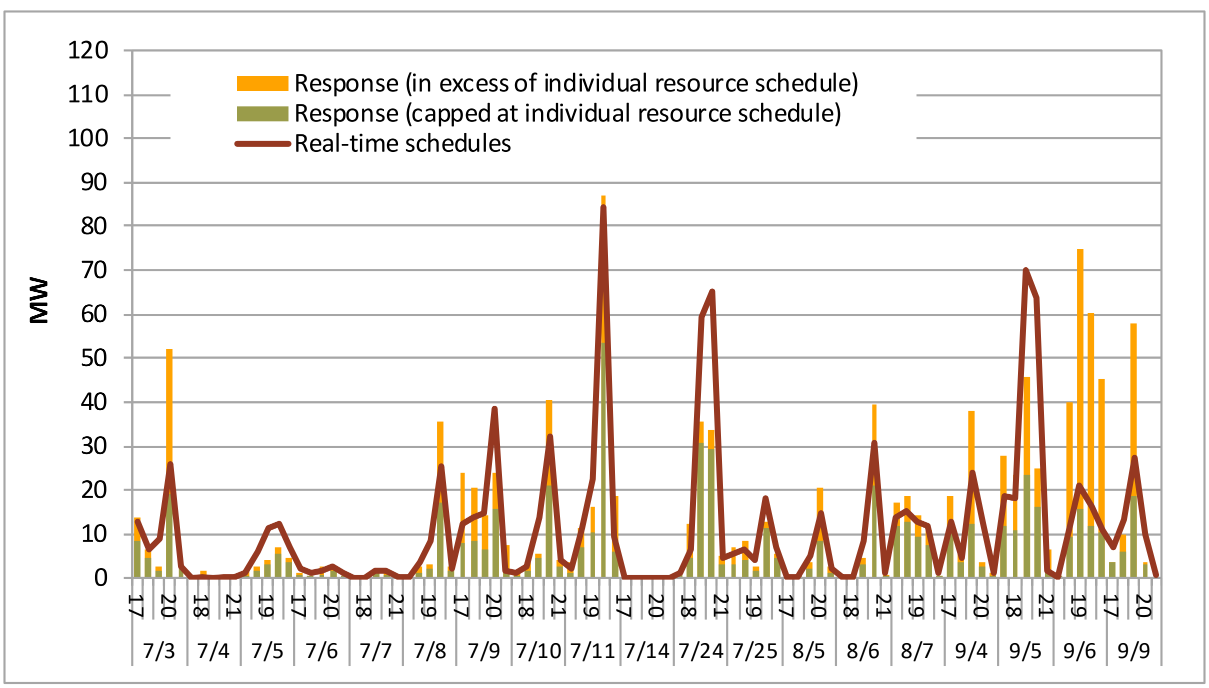
Figure 2.12 shows the self-reported response of third party demand response resources shown on resource adequacy supply plans. The aggregated self-reported response of all third party demand response resources can be measured in two ways. First, aggregated performance can be measured with the response of each individual resource capped at the scheduled load reduction for each resource. Second, aggregated performance can be measured without capping the response of each individual resource capped at the scheduled load reduction for each resource. These two measures can vary significantly when the reported load reductions are well below scheduled reductions for some resources, while reported reductions for other resources are well above scheduled levels.

Figure 2.12 shows self-reported response capped at individual resources' scheduled level (green bars) and self-reported response in excess of scheduled reductions for in excess of individual resource schedules (yellow bar). When reported demand reductions are capped at the scheduled reductions for individual resources, aggregate reductions averaged 54 percent of total scheduled reductions during high load days this summer. When adding in load curtailments in excess of individual resource schedules, aggregate performance of supply plan demand response resources averaged 113 percent.

While some difference can be expected between these two measures of overall demand response performance, the large difference between these measures in summer 2024 raises some concern over the performance of this type of demand response and the way this performance is measured. To the extent some resources underperform while others over perform during the same time interval, aggregate performance may still be close to scheduled levels.

However, as shown in Figure 2.12, the aggregate performance of these demand response resources tended to vary significantly from scheduled load reductions during many high load hours. While supply plan demand response tends to bid in close to their resource adequacy values, their average performance compared to their schedules suggests this available capacity may be inaccurate during high load days.

Figure 2.12 Supply plan demand response performance

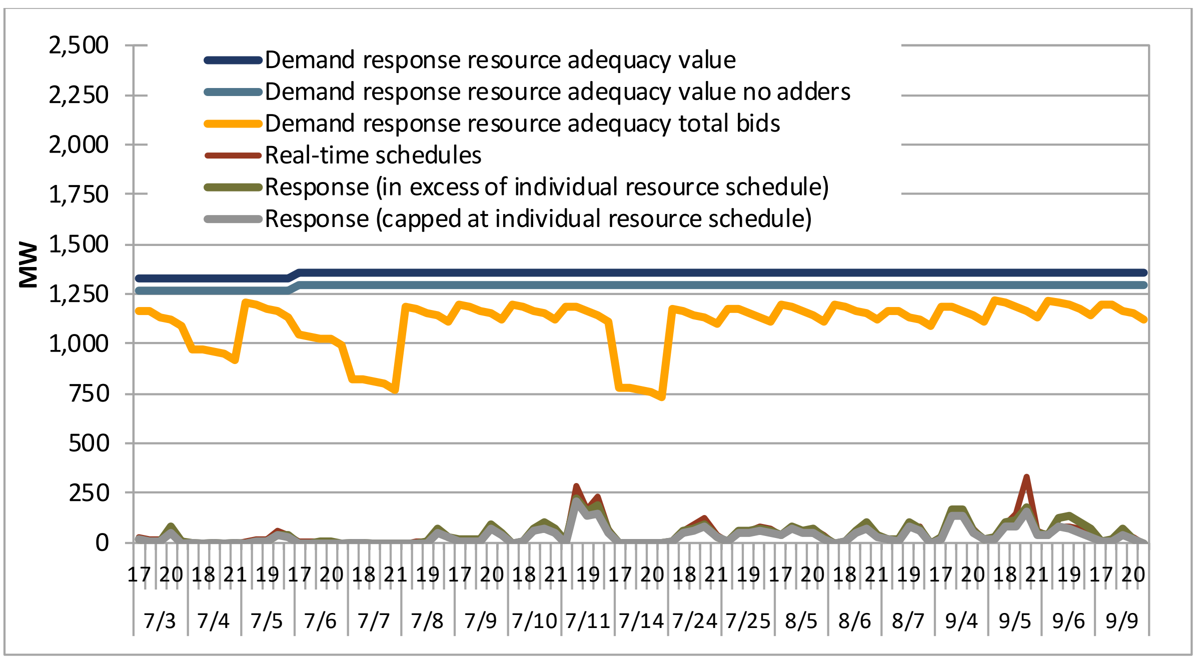


2.5 Demand response aggregate summary of availability, dispatch, and performance

Figure 2.13 shows the availability, dispatch, and self-reported response of *all* demand response capacity (credited utility and supply plan demand response) counted towards resource adequacy obligations on high load days across the summer. Figure 2.13 includes both credited utility and supply plan demand response capacity. Figure 2.13 shows that demand response availability, as reflected through market bids, averaged about 80 percent of resource adequacy values. This is substantially higher than 2021 and 2022, when availability of resource adequacy demand response averaged about 65 percent during high load days in the summer, but lower than 2023 with an 85 percent availability. Availability was lower for both utility and supply plan demand response, in part due to some high load days in summer 2024 falling on holidays or weekends, when availability tends to be lower. In 2023, there were no high load days on holidays and weekends.

Figure 2.13 also depicts the real-time schedule of demand response resource adequacy (red line) along with their reported performance capped at individual resources' schedules (grey line) and reported performance in excess of schedules (solid green line). Including load curtailment in excess of individual resources' schedules, total demand response averaged 91 percent of real-time dispatches across peak net load hours on high load days. This is an increase from 76 percent in the summer of 2023.

Figure 2.13 Aggregate demand response resource adequacy



3 Special Issues

This section discusses a variety of issues related to demand response participation in the California ISO market.

3.1 Baseline adjustment factors

Demand response baseline calculations generally rely on historical like-day metered load to establish the day-of counterfactual load baselines from which demand response performance is measured.[23] The ISO allows for baseline calculations to be adjusted upward and downward to capture intra-day load deviations from historical levels. However, the ISO has developed tariff-defined caps on the amount that intra-day baselines can be adjusted, based on different baseline methodologies.[24]

In 2020, based on supplier-submitted baseline and meter data and historic load trends, there was evidence that baseline adjustments could have been limited in the upward direction by tariff-defined baseline adjustment caps. Based on self-reported meter data and system load trends, certain customer loads on high load days may have deviated from historic days' load by factors greater than the ISO's baseline adjustments allowed. This could have resulted in self-reported performance values that were lower than actual load reduction, if baselines could not be adjusted sufficiently upward.

Given concerns that demand response performance could be under-represented due to the capped baseline adjustment factor, the ISO began to allow demand response providers to apply adjustment factors to baselines in excess of tariff-defined caps for certain baseline methodologies in summer months (May to October), should event day load exceed historic load by more than the ISO's capped ratios.[25] In the summer of 2024, 57 percent of all demand response capacity used alternative adjustment factors (AAF) in summer months, five percent below last year. A combination of proxy demand response and reliability demand response resources using day-matching baseline types were eligible to use alternative adjustment factors.

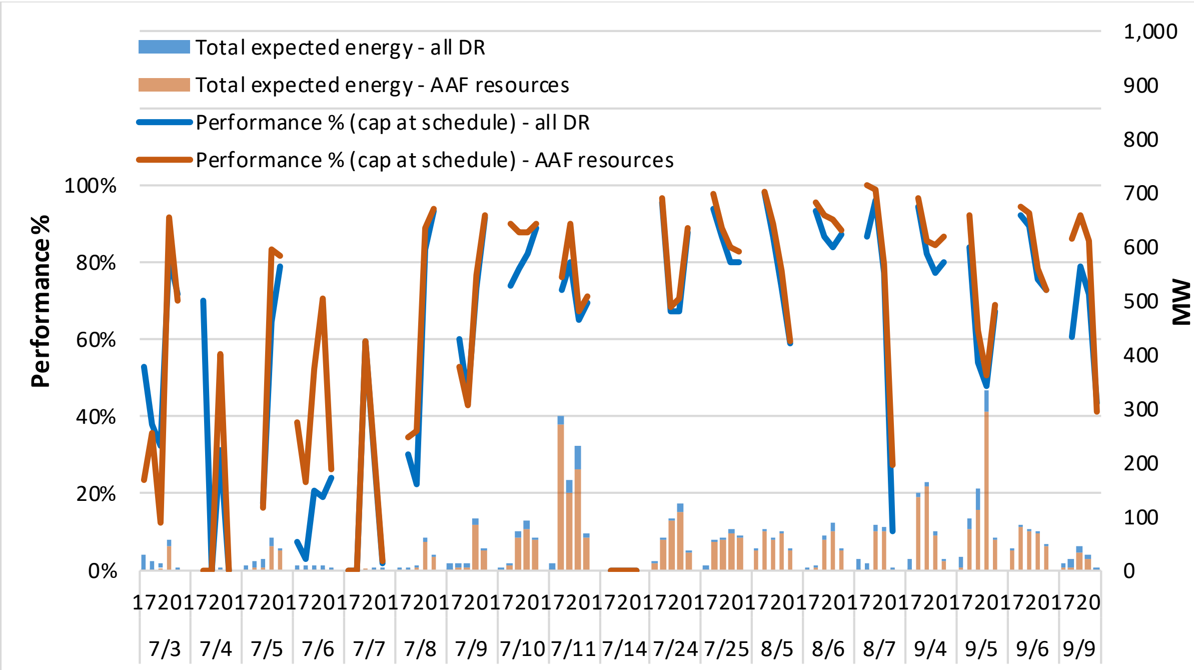
Figure 3.1 shows the performance of demand response resources using alternate adjustment factors compared to all demand response resources. Overall performance is very similar for resources who utilize the alternative adjustment factors compared to the entire demand response fleet. Average performance on high load days for resources using the alternative adjustment factors averaged 70 percent while resources without averaged 64 percent, indicating the uncapped adjustment factors may help demand response resource report slightly higher performance values.

[23] These baseline methodologies include the ISO's Day Matching baseline methodologies which are currently the most commonly used baseline methodologies for demand response resources.

[24] ISO Tariff Section 4.13.4

[25] http://www.caiso.com/Documents/Presentation-DemandResponseCustomerPartnershipGroup-Apr22-2021.pdf

Figure 3.1 Performance of demand response resources with alternative adjustment factors



3.2 Resource adequacy demand response compensation

This section examines the revenue streams for demand response providing resource adequacy. Capacity payments (or value of avoided capacity procurement for utilities) for demand response resources can be much higher than potential net market revenues earned in the energy market. High capacity payments relative to potential market revenues can limit the incentive for demand response resources to participate in the energy market and earn additional market rents on a regular basis. Additionally, while the ISO's resource adequacy availability incentive mechanism (RAAIM) provides some incentives for supply plan demand response resources to remain available, RAAIM does not provide incentives for resources to actually deliver scheduled load curtailment.

Demand response market revenues

Table 3.1 shows net market revenues (market revenues, less bid costs, plus bid cost recovery) of demand response resources counted towards resource adequacy requirements, by resource type. Net market revenues are reflected in dollars per megawatt-hour of energy delivered.

Net market revenue per megawatt-hour of energy delivered varied significantly among demand response resource types. In 2024, utility proxy demand response resources earned about $144/MWh while third party demand response resources earned about $48/MWh of energy delivered. Third party demand response was scheduled with equal frequency, though with higher volumes on days with lower prices. Reliability demand response resources earned the lowest value of about $46/MWh due to these resources only being scheduled through day-ahead economic bids at or below $100/MWh.

Table 3.1 Demand response resource adequacy net market revenues — 2024

Demand response type	MWh scheduled	Energy delivered (MWh)	Energy market revenues ($/MWh delivered)	Bid costs ($/MWh delivered)	Bid cost recovery ($/MWh delivered)	Net energy market revenues ($/MWh delivered)
Utility PDR	7,928	7,701	$241	$98	$1	$144
Utility RDRR	5,159	7,947	$61	$15	$0	$46
3rd party PDR	7,634	7,320	$71	$27	$4	$48

Demand response net market revenues and capacity value

Table 3.2 shows net market revenues accrued by demand response resources counted towards meeting resource adequacy requirements compared to potential capacity values for demand response resources in 2022, 2023, and 2024.

The capacity values shown in Table 3.2 are based on the 85th percentile of resource adequacy prices as reported in the CPUC's 2022 Resource Adequacy report.[26] Annualized capacity prices are based on the 2022-2024 budgets for the CPUC's Demand Response Auction Mechanism (DRAM) and DRAM capacity shown on resource adequacy supply plans.

Table 3.2 Demand response resource adequacy net market revenues and capacity costs (2022-2024)

Year	Demand response type	Net energy market revenues ($/kW-year)	Capacity price - system RA 85th percentile ($/kW-year)	Capacity price - DRAM auction ($/kW-year)
2022	Utility PDR	$26.97	$96.00	$120.20
	Utility RDRR	$3.42		
	3rd party PDR	$15.18		
2023	Utility PDR	$8.22	$96.00	$157.07
	Utility RDRR	$0.75		
	3rd party PDR	$7.30		
2024	Utility PDR	$1.59	$96.00	$206.42
	Utility RDRR	$0.41		
	3rd party PDR	$2.67		

[26] *2022 Resource Adequacy Report*, CPUC Energy Division, May 2024: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/2022-ra-report_05022024.pdf

Table 3.2 shows that in 2024, the primary revenue stream for demand response resource adequacy resources continue to be the capacity payments they receive. Net energy market revenues for all three types of demand response decreased compared to 2022 and 2023, and remains much lower than the estimated capacity prices for resource adequacy. This does not provide a strong incentive for resources to deliver load curtailments. To strengthen incentives to be available and perform, DMM has recommended the ISO consider developing a performance penalty or incentive structure for resource adequacy resources, particularly for demand response resources.