



*Pacific Gas and
Electric Company*[®]



Supply Side DR Pilot 2015-2016 Summary and Findings (Public Version)

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1 Acknowledgements

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2 Abstract

The Supply Side DR Pilot (SSP) was designed to study the feasibility of demand-side resources to participate into the California Independent System Operator (CAISO) wholesale market as proxy demand resources (PDR). The pilot study focused on understanding the issues related with direct participation of third-parties and customers including customer acceptance; market transformation challenges (wholesale market and technology); technical and operational feasibility; and value to the rate payers, demand response (DR) resource owners and the utility on providing an enabling mechanism for DR resources into the wholesale markets.

The customer had the requirement of committing to four contiguous hour blocks across 18 unique days for a total of 72 bid hours with day-ahead notification that aligned with the CAISO integrated forward market. As a result of their availability, the customer was paid from \$6 to \$10/ kilowatt (kW)-month for capacity in addition to CAISO energy settlements.

Five participants successfully engaged in the pilot with three of them becoming fully operational. In this report, we provide the description of the pilot, participant performance results, costs and value to participants, as well as outline some of the issues encountered throughout the pilot.

Results show that participants chose to participate with storage and the value of CAISO settlements were significantly lower than the capacity payments provided by the utility as incentive payments. In addition, this pilot revealed issues both on the participant side and system operations side. These issues are summarized in the report.

3 Table of Contents

1	Acknowledgements	2
2	Abstract	3
3	Table of Contents	4
4	Introduction	6
4.1	Background	6
4.2	The First Two Phases of the Demand Response Pilot	6
4.3	The Supply Side Pilot: The Third Phase	6
5	SSP Participation	9
5.1	SSP Resources and Eligibility	9
5.1.1	The resource must meet a minimum of 100 kW of load curtailment	9
5.1.2	Customers must not be enrolled in any other CAISO resource	9
5.1.3	Customers must be served by one Load Serving Entity (LSE)	10
5.1.4	Customers must be located within a single Sub-LAP	10
5.1.5	Customers must not be enrolled in any other DR program or rate	10
5.1.6	Residential Option	10
5.2	SSP Rules	10
5.2.1	Qualified Capacity (QC)	11
5.2.2	Nominations	11
5.2.3	Bidding Requirements	11
5.2.4	Bid Price & Quantity Limits	12
5.2.5	Capacity Incentives and Wholesale Opportunity	12
5.2.5.1	Awards	12
5.2.5.2	Wholesale Payments	12
5.2.5.3	Distribution Loss Factor (DLF)	13
5.2.5.4	PDR Baseline	13
5.2.5.5	Statistical Sampling / ISO Type 2 Baseline	16
5.2.5.6	Capacity Settlement	17
5.2.6	Real-time Bidding	18
6	Pilot Operations	20
6.1	Recruitment and Enrollment	20
6.1.1	Enrollment Process	20
6.1.2	Enrollment Details	20
6.1.3	Enrolled Participants	22
6.2	Example Events	23
6.3	Resource Operations	25

6.3.1	Bidding and Time of Day	27
6.3.2	Bid Structure	27
6.4	Value of Participation	28
7	Lessons Learned	29
7.1	Enrollment	29
7.2	Value to participants	29
7.3	Operational Issues	30
7.4	CAISO Settlement Issues	30
7.4.1	55B Clawback	30
7.4.2	Disappearing Events	31
7.4.3	Incorrect Event Times	32
7.4.4	Incorrect Holiday Treatment	32
7.4.5	Baselines ignore event days on registration change	33
7.5	Default Load Adjustment	33
8	Conclusion and Next Steps	34
8.1	Participant	34
8.2	Scheduling Coordinator	34
8.3	Next Steps	34
Appendix A: 2015 - 2016 Monthly Net Benefits Test Prices		35
Appendix B: 2015 - 2016 Monthly Bids and Awards		36
Appendix C: Monthly Payments to Participants		49
Appendix D: CAISO Settlement Issues		53

4 Introduction

4.1 Background

New California policies in addition to the establishment of other new state goals and penetration of new end use technologies continuously add complexity to future grid needs. Furthermore, the California Independent System Operator (CAISO) identified that with a 33% penetration of renewables, net load to be served will have steep ramps during both winter and spring. These changes in net load, policy and technology, require California to evaluate which resources can address future grid needs. In this project, demand responsive loads are being considered as one of the many resources that can support economic and reliability needs of the future grid. In addition to traditional demand response that addresses summer peak shaving, new demand response offerings must be constructed in order to meet future transmission and distribution grid needs. This pilot program was developed by PG&E and Olivine to facilitate demand response on the commercial and residential side of the grid. This pilot -- the Supply Side DR Pilot (SSP) -- stems from earlier pilots, described in the following sections.

4.2 The First Two Phases of the Demand Response Pilot

There have been three phases to date of the SSP, each with a slightly different name and objectives. The first phase was called the Intermittent Renewable Resources (IRR) pilot. During this phase, three facilities, two commercial buildings and one industrial facility, were equipped with automated demand response, and telemetry equipment were tested for response time, duration and latencies (Kiliccote et al. 2010). On April 2, 2013, the California Public Utilities Commission (CPUC) approved PG&E's Advice Letter 4077-E-B, which included approval of the next phase, known as the Intermittent Renewable Management Pilot Phase 2 (IRM2). The objective for this second phase was to demonstrate with third-party aggregators and large commercial and industrial customers that DR resources can participate in the CAISO wholesale market and provide flexible resources. The IRM2 was designed so resources could bid into the CAISO wholesale day-ahead energy market as proxy demand resources (PDR). This involved a monthly participation with CAISO bidding requirements. Each participant had the option of committing to either three contiguous hour blocks for 24 days per month or six contiguous hours for 12 days per month with day-ahead notification that aligned with the CAISO integrated forward market (IFM). As a result of their availability, the customer was paid \$10/kilowatt (kW)-month for capacity. Olivine, Inc. served as the program administrator and took on scheduling coordination for third party and customer resources. For initial participation, prospective participants were required to commit their resources for six months and the minimum resource size was 100 kW. The pilot concentrated on understanding issues related to direct participation of third-parties and customers including the following:

- Customer acceptance;
- Market transformation challenges (wholesale market, technology);
- Technical and operational feasibility; and
- Value to the rate payers, DR resource owners and the utility on providing an enabling mechanism for DR resources into the wholesale markets.

4.3 The Supply Side Pilot: The Third Phase

As part of the 2015-2016 DR bridge funding Decision, the Commission approved a continuation and expansion of the IRM2 in D.14-05-025. This next phase, known as the Supply Side DR Pilot (SSP), continues with the objective of engaging participants in a third-party wholesale integrated capacity program. This phase was designed to facilitate daily energy bids into the wholesale market in usable blocks. Retail capacity incentives were provided from the utility so as to understand the following:

1. Whether DR is able to provide valuable capacity through utility agreements;
2. The process of enablement of resources to bid directly into the wholesale market

Better understanding of these mechanisms would enable the provision of support for the integration of intermittent renewables into the grid and subsequently be valued as a supply resource.

The SSP moves beyond day-ahead energy provided by C&I customers in the IRM2, enabling:

- Participation by residential customers
- Participation in real-time energy and non-spinning reserves (for non-residential participants)
- A simplified program design, particularly around the wholesale market pricing rules
- A program design that is more closely tied to resource-adequacy must-offer-obligations. For example, this results in a single 4-hour contiguous block instead of the 3 and 6-hour block options in IRM2.

The SSP was initially scheduled to run from 2015 through 2016. However, PG&E subsequently received approval from the CPUC in D.16-06-029 to extend the SSP for an additional year.

Figure 1 displays the concept for integration of the retail resources with wholesale PDR model.

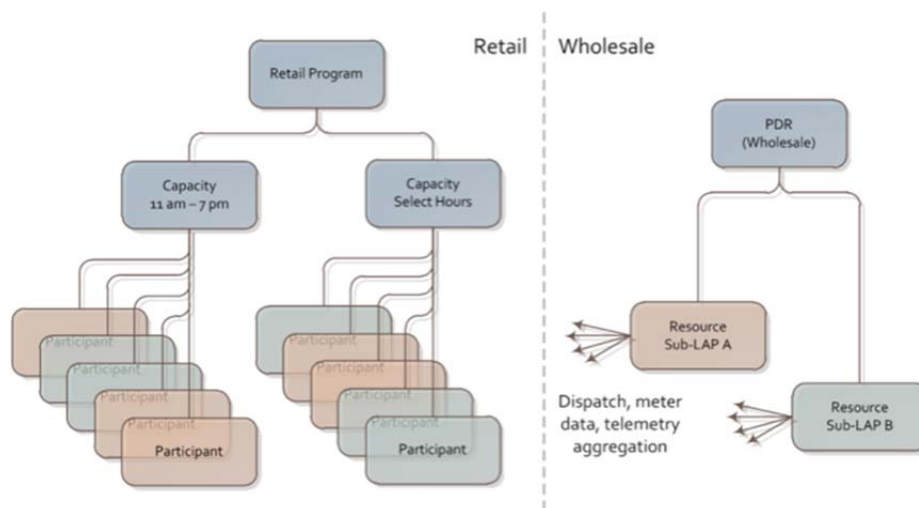


Figure 1: Concept for integration of retail and wholesale DR. Courtesy of Olivine, Inc..

The pilot team roles and responsibilities are identified in Figure 2. Both large single customers and aggregators can participate in the SSP. Olivine serves as a scheduling coordinator (SC) and wholesale market demand response provider (DRP). It provides the sole interface between participant and pilot, including the CAISO market, and handles recruitment, enrollment and registration; nominations and bidding; award and dispatch notifications; meter data aggregation and submissions; resource certification; credit and collateral; and settlements and payments.



Figure 2: Entities involved in the SSP and their roles

5 SSP Participation

To participate in the SSP, participants needed to meet several requirements for eligibility as well as enroll through many steps, detailed here.

5.1 SSP Resources and Eligibility

To facilitate the integration of wholesale-integrated demand response, the CAISO developed a resource model known as Proxy Demand Resource (PDR). Like other conventional resource models (e.g., Multi-Stage Generator or MSG), the PDR models the physical characteristics of a resource supplied to the CAISO and is the basis for bidding, awards, dispatch, outages, and settlement.

The PDR is composed of either a single customer location or an aggregation of customer locations. For example, a commercial or residential aggregator can assemble a collection of residential customers into a resource that can then bid into the wholesale market as a PDR. A large customer may also directly enroll one or more locations, as long as the set of locations meets the eligibility requirements. For consistency, Olivine uses the term participant to indicate the party that enrolls in the Pilot (i.e., the aggregator or the direct customer). The term customer identifies end-customers (i.e., the aggregators' customers).

In general, each participant in the SSP was allowed to enroll a single PDR resource, composed of an aggregation of one or more customer locations¹. Due to the volume of residential customers required to achieve the 100 kW PDR requirement, the SSP also had a residential-only 30 kW option that could be leveraged to participate without market integration. In this case the participant would follow all of the same requirements but be allowed to participate at this lower capacity.

Each PDR in the CAISO market must meet certain CAISO requirements for enrollment and participation, detailed in the following sections.

5.1.1 The resource must meet a minimum of 100 kW of load curtailment

Any PDR at the CAISO is required by tariff to be able to achieve a minimum of a 100 kW load curtailment. Note that this requirement is not defined any further so does not reference seasonality, time of day, or any other operational limitation. For example, if a resource is made up of locations that can achieve a 100 kW load drop only during hot summer days, it would be considered a valid PDR even though on most days it would not be able to achieve that load drop. In addition, the CAISO does not have any requirements for testing energy-only PDRs in the wholesale market and so the actual curtailment is not verified before market entry by the CAISO. Because of this, the Pilot required a qualified capacity test before entry.

5.1.2 Customers must not be enrolled in any other CAISO resource

The CAISO prohibits customer locations from enrolling in more than one market resource at a time. If a customer was found to be enrolled in another CAISO resource, they would be deemed ineligible for the SSP, noting that this did not occur during the life of the SSP.

¹ [REDACTED] was one exception to this rule since its existing resources were grandfathered into the SSP. In addition, other providers were given the option of an additional resource as long as adding that resource would create further benefit for the Pilot.

5.1.3 Customers must be served by one Load Serving Entity (LSE)

Individual CAISO demand response resources cannot include customer locations served by different LSEs. The LSE is the entity responsible for procuring electricity for its customers. For bundled service utility customers, the LSE is PG&E. For Direct Access customers, the LSE is an Energy Service Provider (ESP) other than PG&E (e.g., Constellation Energy). Another example of an LSE is a Community Choice Aggregator.

5.1.4 Customers must be located within a single Sub-LAP

All of the locations within the resource must be located within a single Sub-LAP. A Sub-LAP is a geographically defined area, such as PG&E East Bay or PG&E San Francisco. Thus, a resource cannot contain locations from both the East Bay and San Francisco.

5.1.5 Customers must not be enrolled in any other DR program or rate

In addition to the CAISO requirement limiting any customer location to a single CAISO resource, PG&E and the CPUC generally limit customers to a single utility demand response program or rate. As such, customers were not allowed to enroll in the SSP if they were on another program or on the “demand-response”-like rates of SmartRate or Peak Day Pricing.

Note that there was an exception in that a customer could participate in the SSP and the PG&E Excess Supply DR Pilot (XSP) as long as the resource met certain criteria. This condition did not occur during the 2015-2016 SSP but it is expected it will in the 2017 extension.

5.1.6 Residential Option

As noted in section 4.1, residential participation had a slightly lower barrier to entry into the SSP. Instead of requiring the 100 kW minimum curtailment, residential aggregators were given the option of enrolling at 30 kW. In this case, such participation would not be integrated into the wholesale market, but would still be simulated as being in the market. The Participant would bid and receive dispatches in the normal way, although dispatches would be triggered based on Olivine interpreting the market-clearing price instead of actual CAISO market dispatches. In this case, there would be no wholesale market settlement and no energy payments. The rationale was that the enrollment process turned out to be very difficult for residential aggregators, particularly with the somewhat manual process of obtaining customer authorization forms from customers.

Note that [REDACTED] attempted to enroll at [REDACTED] but was unable to achieve that capacity. In addition, [REDACTED] had the option of enrolling at [REDACTED] after having failed two attempts at achieving [REDACTED]; however, they opted out of the Pilot at that point.

5.2 SSP Rules

Aside from the eligibility requirements enumerated above to gain entry into the Pilot, Participants had several requirements for qualification and ongoing participation to earn their capacity payment. This is outline in the following figure:

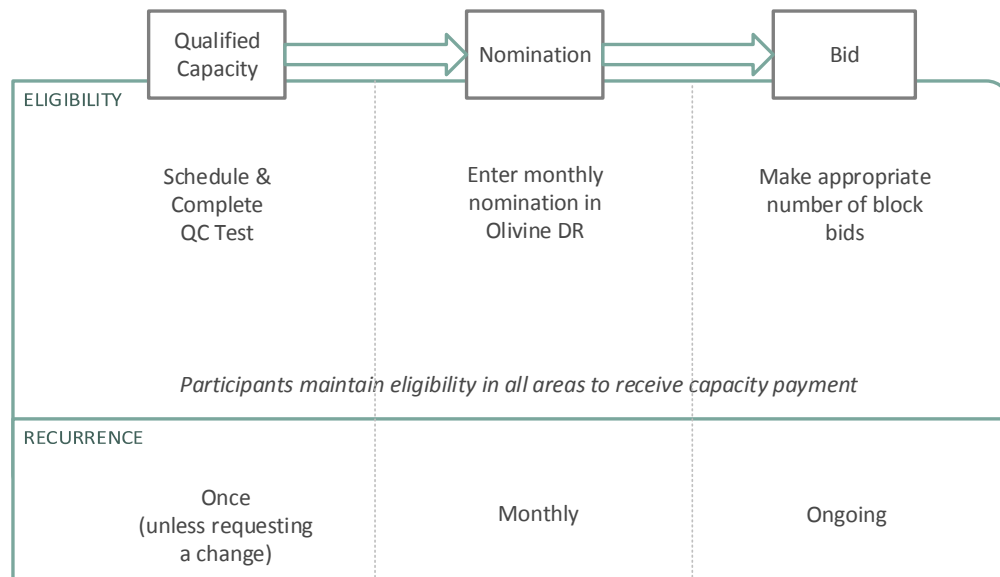


Figure 3: Participant Operational Tasks. Courtesy of Olivine, Inc..

5.2.1 Qualified Capacity (QC)

Participants were tested outside of the wholesale market before becoming operational. The tested result was the average energy delivered over a four-hour period against the PDR baseline. This value became the Qualified Capacity (QC) for the resource.

This test served two purposes. First, it was used to ensure that the participant was able to meet the relevant resource minimums of 100 kW or 30 kW. If the tested resource did not achieve the 100 kW or 30 kW minimum required by the Pilot, then the resource had to be re-tested or modified to achieve entry. Second, it was used to set a potential capacity value for the resource (i.e., a ceiling on the nomination described in the next section).

5.2.2 Nominations

Participants provided a monthly nomination value for each resource. The nomination could not exceed the Qualified Capacity (QC), and was the basis for incentive payments in the Pilot.

Note that if a Participant routinely delivered below their nomination, the program administrator had the option of lowering their QC going forward; however, this did not happen during the pilot.

5.2.3 Bidding Requirements

To receive capacity payments in the SSP, the participant was required to bid into the wholesale market by entering bids into the Olivine Distributed Energy Resource (DER) management system through the user interface or APIs. In the case of the sub-100 kW resource, bidding was still performed in the Olivine DER system.

The requirements for bidding were met by bidding energy at or above the qualified capacity level (i.e., the energy equivalent of the nominated capacity), called a *qualified bid*. To be eligible for a capacity payment, participants met the following requirements:

- Made 4-hour contiguous blocks of qualified bids on 18 unique days a month (totaling 72 bid hours)
- Be available for dispatch 24-hours per month

Additional bids at any valid quantity and price, whether or not they are contiguous had no effect on the qualified block requirement; however, they did provide opportunities for increased market revenue for the participant. Note that all qualified bidding obligations are met after 24 hours of qualified award.

In the early months of the Pilot (from 1/1/2015 through 9/30/2015), participants were expected to bid half of all hours at the Demand Response Net Benefits Test (NBT) price. As of 10/1/2015, this requirement was removed enabling participation at any price between the NBT and the \$150 price ceiling.

5.2.4 Bid Price & Quantity Limits

In the SSP, the day-ahead (DA) bid price ceiling of \$150/MWh was enforced². In addition, bid prices could not be lower than the NBT, as published by the CAISO³. All bid quantities were enforced to be greater than or equal to 10 kW and less than or equal to the Qualified Capacity:

$$NBT \leq Bid\ Price \leq Ceiling$$

$$10\ kW \leq Bid\ Quantity \leq Qualified\ Capacity$$

Each month, the CAISO publishes two NBT values, for on-peak and off-peak periods. These wholesale on-peak and off-peak periods differ from the on-peak and off-peak periods defined in retail rates. The on-peak periods are defined by the North American Electric Reliability Corporation (NERC) as Monday through Saturday from 6:00 AM to 10:00 PM. Off-peak periods include the complement of the above weekday times, Sundays, and six holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. For a table of monthly net benefit prices during the SSP, please refer to Appendix A. When bidding into the real-time market, the Pilot did not enforce a price ceiling other than the CAISO \$1000/MWh.

5.2.5 Capacity Incentives and Wholesale Opportunity

The SSP provided customers with two main forms of compensation:

1. A performance-based monthly retail capacity payment of \$10/kW-month.
2. Payments – net any imbalance energy charges – arising from wholesale market awards and the resulting settlements. These net charges specifically exclude CAISO Grid Management Charges (GMC), which were paid by PG&E.

5.2.5.1 Awards

In the day-ahead market, an award is the signal to the Participant that the offer bid to the CAISO has been accepted and should be delivered over the awarded hour(s). Note that although qualified bids must be submitted in contiguous blocks of 4 hours, awarded hours may not be contiguous.

Award notifications generally post by 2 PM the calendar day before the trade date. Award notifications will be delivered through email or SMS; and are also made available through various standard APIs, including OpenADR 2.0b. Note that in rare cases, the wholesale market publishes awards after 2 PM, in which case awards will be posted to participants as soon as feasibly possible after the market results are available.

5.2.5.2 Wholesale Payments

Participants receive payments, net any wholesale charges, arising from ISO market operations. These settlements are calculated by the CAISO and are passed through to the Participant by Olivine. These payments and charges include:

² The CAISO enforces a \$1000/MWh price ceiling, but prices above \$150 are quite rare particularly at the aggregated-PNode level at which PDRs are priced; the lower price ceiling was designed to ensure that CAISO market awards would not be a rarity in the Pilot.

³ FERC Order No. 745 requires the CAISO to implement a net benefits test that establishes a price threshold above which demand response resource bids are deemed cost effective. The CAISO must perform a monthly analysis based on historical data from the previous year's supply curve to identify the price threshold estimate that shows where customer net benefits occur and publishes them to the CAISO web site. The CAISO usually publishes the monthly NBT values by the middle of the preceding month.

- Day-ahead Awards were paid at the day-ahead aggregated PNode locational marginal price (LMP) associated with the PDR.
- Over-delivery was paid at the Real-time Uninstructed Imbalance Energy (UIE) price.
- Under-delivery was charged the Real-time UIE price.

5.2.5.3 *Distribution Loss Factor (DLF)*

Distribution Loss Factors (DLFs) are applied to the metered quantities utilized within the Pilot reflecting the fact that power is lost through distribution and transmission. This results in the quantities used for operations (i.e., in nomination values, awards, and settlements) being slightly higher than the quantities metered at the participant’s location. The exact amount the DLF fluctuates differs hourly and is specified by PG&E. Participants will find that the loss factors range between 3% and 7%. For more information on DLFs please consult the following report: http://mads.pge.com/dlf/dlf_rsif.doc.

5.2.5.4 *PDR Baseline*

For the SSP (with the exception described below in the section on the use of ISO Type 2 / statistical sampling), the load drop is calculated according to the ISO Type 1⁴baseline methodology, which is the default baseline methodology set forth by the CAISO for the PDR product. The SSP utilized the whole premise meter data (i.e. no sub-metering). The baseline is a “10-in-10” calculation that takes the average of a target number of the most recent similar day-type non-event days, subject to a morning-of adjustment with a ± 20% cap. Below is a detailed example of the baseline calculation process.

1. Identify the target number of previous similar day-type non-event days
 - Day-types are defined as weekdays (Monday – Friday) and weekends/NERC holidays.
 - The target number of days for each day-type are,
 - Weekdays: 10 days
 - Weekends/holidays: 4 days
 - Previous event days are excluded.
 - The maximum look-back window is 45 days.
 - If 10 non-event “Weekdays” cannot be identified within the 45-day look-back window, but at least 5 days can be identified, the baseline is calculated using the available days.
 - If at least 5 non-event Weekdays or 4 non-event Weekends/holidays cannot be identified in the look-back window, the highest usage prior event days within the look-back window are then included as needed to reach the minimum number of days.

⁴ The ISO Type 1 methodology is based on the North American Energy Standards Board (NAESB) Baseline Type-I methodology which is described in the NAESB WEQ Business Practice Standards WEQ-015, Measurement and Verification of Wholesale Electricity Demand Response.

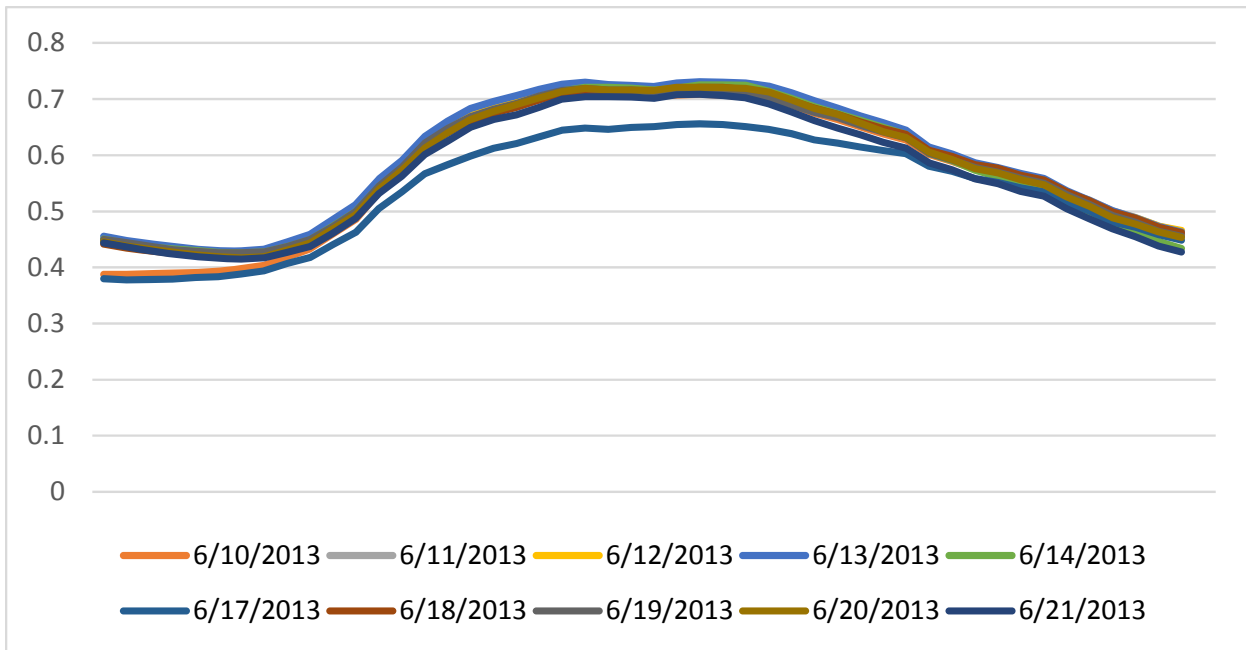


Figure 4: Identify 10 similar non-event days. Courtesy of Olivine, Inc..

2. Calculate average profile

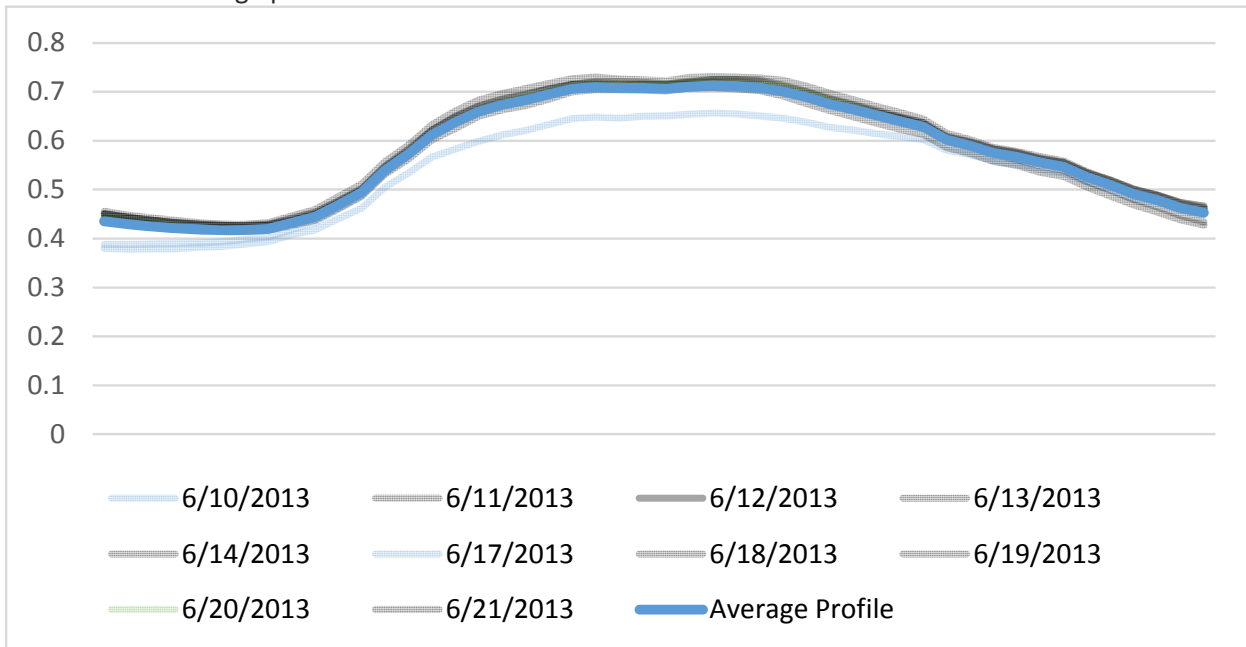


Figure 5: Calculate average profile. Courtesy of Olivine, Inc..

3. Determine day-of adjustment

- The day-of adjustment is based on the first three of the four hours prior to the event.
- A multiplier of the ratio of the average load for these three hours to the three hour average from the baseline is calculated.
- The day-of adjustment is bi-directional (i.e. may be positive or negative) and is capped at $\pm 20\%$.

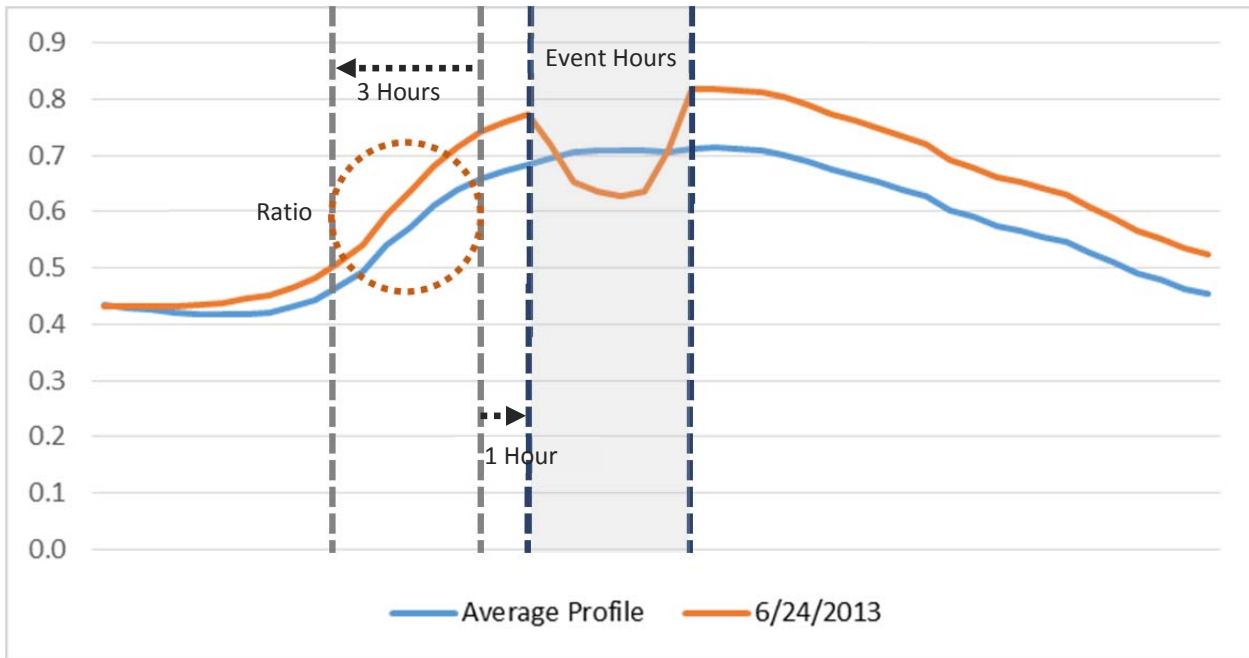


Figure 6: Determine day-of-adjustment. Courtesy of Olivine, Inc..

4. Apply day-of-adjustment to create baseline

- The day-of-adjustment multiplier is applied to the average profile for all hours of the event to produce the baseline.
- In the example included, the result is a baseline with higher quantities than the average profile.

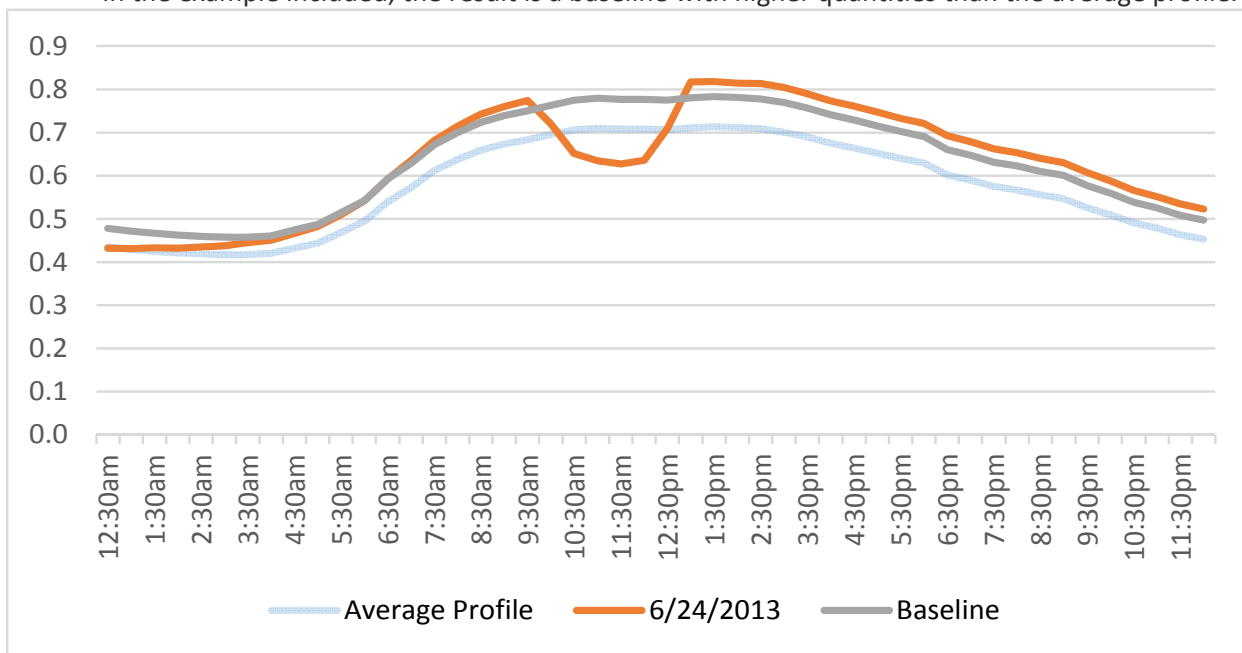


Figure 7: Apply day-of-adjustment to create baseline. Courtesy of Olivine, Inc..

The same baseline is used by the CAISO for measuring delivery as well as by Olivine for calculating performance for capacity settlement.

5.2.5.5 Statistical Sampling / ISO Type 2 Baseline

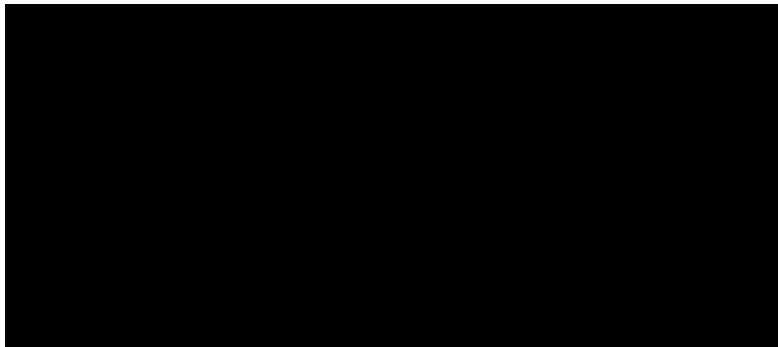
As discussed above, the default methodology that the CAISO uses to evaluate PDR and RDRR market performance is known as the ISO Type 1 baseline methodology. Under the ISO Type 1 baseline methodology, a DR resource's performance is based on an aggregation of the interval Revenue Quality Meter Data (RQMD) for all locations in the resource. The interval RQMD for all resources are used to create Settlement Quality Meter Data (SQMD) that is submitted to the CAISO for settlement.

In addition to the ISO Type 1 methodology, the CAISO allows the usage of another methodology known as the ISO Type 2 baseline, which is based on the NAESB Baseline Type-II⁵. ISO Type 2 is available for resources that do not have interval RQMD available for all locations in the resource. Instead of relying on interval RQMD for all locations in the resource to generate the SQMD for the resource, ISO Type 2 utilizes statistical sampling to calculate the SQMD for the entire resource based on interval RQMD for a subset of the locations in the resource. To use the ISO Type 2 methodology, a proposal must be submitted to and approved by the CAISO, and this proposal must include the sampling plan and model used to come up with the sampling plan, which had never been done prior to the SSP.

Though residential customers with SmartMeters have interval data available, currently interval RQMD is not available for all residential customers because PG&E only creates interval RQMD for customers who are interval billed (e.g. customers who are on a time-of-use rate). As a result, resources composed of these customers are unable to participate in the CAISO market using the ISO Type 1 methodology. Instead, such resources must utilize the ISO Type 2 methodology in order to participate in the CAISO market.

An objective of the SSP was to develop and get CAISO approval of a statistical sampling plan for the provision of SQMD for mass market residential customers using the ISO Type 2 baseline methodology as a way to increase the number of customers that could be integrated into the wholesale market. The approach could subsequently be used for the SSP as well as other programs.

A proposed resource submitted by [REDACTED], a residential aggregator was selected as a test case. The proposed resource had characteristics detailed in the table below.



⁵ As described in the NAESB WEQ Business Practice Standards WEQ-015, Measurement and Verification of Wholesale Electricity Demand Response.

⁶ Additional locations were subsequently added to the resource, but these were the values for the original sampling plan submitted to and approved by the CAISO.

⁷ Based on the statistical sampling methodology outlined in the CAISO's Revised Draft Final Proposal of the Energy Storage and Distributed Energy Resources (ESDER) Stakeholder Initiative (dated December 23, 2015 and approved by the CAISO Board of Governors on February 3, 2016).



At an aggregator estimated resource size of [REDACTED] and with [REDACTED] total locations, the proposed resource was not necessarily a great candidate for statistical sampling. Nevertheless, this resource was deemed a good test case because the limited set of locations would provide a unique testing bed for establishing a solid operational and procedural foundation upon which larger resources may subsequently be created.

The sampling plan was submitted to the CAISO on 4/29/2016 and was based on and in accordance with the ISO Type 2 statistical sampling methodology outlined in the CAISO’s Revised Draft Final Proposal of the Energy Storage and Distributed Energy Resources (ESDER) Stakeholder Initiative, which was approved by the CAISO Board of Governors on February 3, 2016. The CAISO tentatively approved the plan mid-May 2016, with some follow-up questions. After reviewing responses from PG&E and Olivine, the CAISO gave final approval of the sampling plan in July 2016. However, as discussed elsewhere, [REDACTED] ultimately decided not to participate in the pilot and thus the sampling plan was never utilized. Nonetheless, by working through the application and approval process for an ISO Type 2 baseline sampling plan with the CAISO, it was demonstrated that this approach can be used for future DR resources, including mass market residential.

5.2.5.6 Capacity Settlement

The monthly capacity payment is calculated using the following equation. The capacity price is \$10/kW-month:

$$(Monthly\ Performance) \times (Nomination) \times (Capacity\ Price)$$

Monthly performance is computed from a weighted average of hourly adjusted performance, computed from raw performance and awarded energy:

- a. *Raw performance*: the hourly measurement of performance represented by the ratio of actual hourly delivery to the nomination⁹ for each qualified award hour. Note that these performance numbers utilize the PDR baseline, calculated by the CAISO. The meter data used for retail performance calculations will be based on the PDR registration in effect during that trade date.

⁸ The amount that the available hourly interval RQMD meter data is scaled to represent the total population.

⁹ Note that in the context of a qualified bid, the bid quantity will always be equal to or greater than the nomination; however, under some unusual conditions the awarded quantity may be below the bid quantity. In this case, the raw performance is the ratio of actual hourly delivery to the awarded quantity, not the ratio to the nomination.

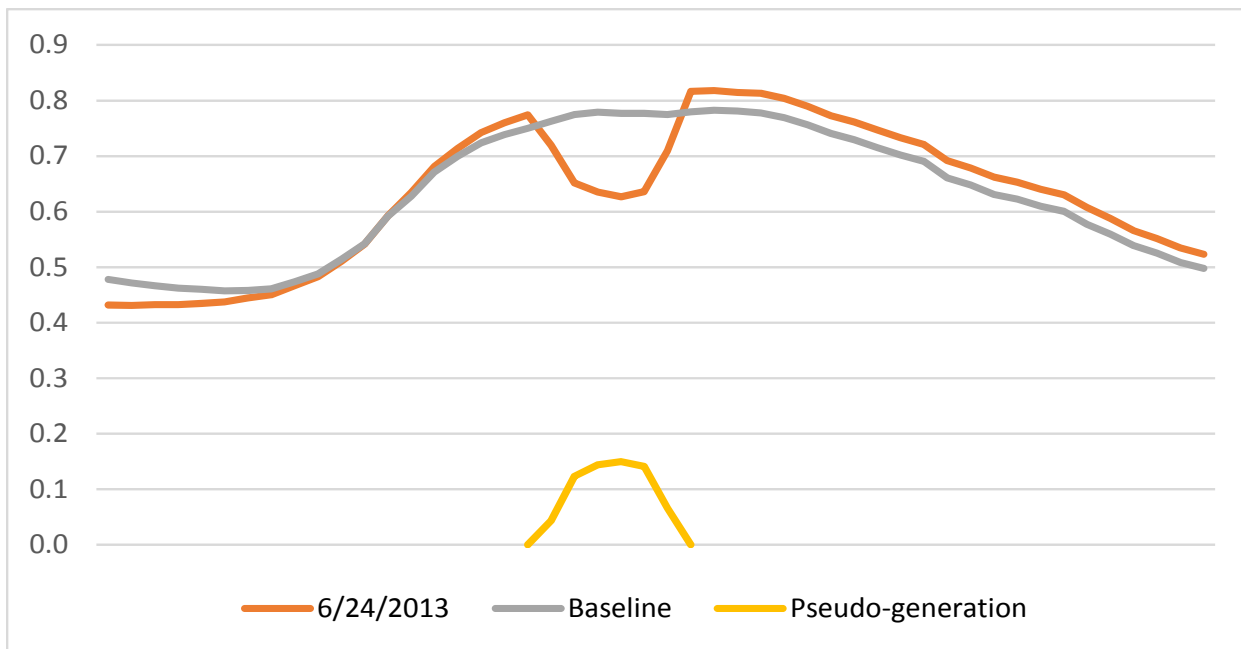


Figure 8: Calculate performance. Courtesy of Olivine, Inc..

- b. *Adjusted performance*: an adjustment to the raw performance for use in Pilot settlement payment calculations using the following step function:

Raw Performance	Adjusted Performance
$0.75 < x$	1.00
$0.50 < x \leq 0.75$	0.75
$0.25 < x \leq 0.50$	0.50
$0 < x \leq 0.25$	0.25
$x \leq 0$	0

- c. *Monthly performance*: The monthly performance is an average of all hourly adjusted performance values, weighted by hourly energy award.

If a resource does not meet the Pilot bidding or award requirements for a given month, the Participant will forfeit the entire capacity payment for that month.

The capacity payments had no penalties though were adjusted by actual event performance. They were settled at the enrollment but payment was forfeited if bidding requirements were not fulfilled. Wholesale energy settlements were provided to the participants at the PDR level, and they were paid for over-delivery at the real-time price and charged the replacement cost for under-delivery at the real-time price. All grid management charges were covered by PG&E.

5.2.6 Real-time Bidding

Participants in the SSP were given the option to participate in real-time bidding as long as they met the following requirement:

- The SSP resource must have successfully participated successfully in the day-ahead market for at least three months preceding adding the real-time option.
- The participant must integrate with Olivine DER for real-time dispatch signals using either OpenADR or the PAP 19 Deployment API.

Real-time bidding in the SSP did not alter any of the SSP participation and bidding requirements: such resources were still required to meet the same day-ahead bidding requirements. In addition, there was no additional capacity payment for participating in the real-time market. Any income earned in the real-time market was passed through to the participants.

6 Pilot Operations

6.1 Recruitment and Enrollment

The first step in recruiting participants into the pilot was to perform a marketing outreach effort to as many appropriate entities as possible. A list of 32 possible organizations and their contacts was drafted using participation list including IRM2 prospective participants, from other PG&E programs, and from Olivine contacts. The contacts on the list were notified in this outreach phase, both via email and phone. Olivine developed education and enrollment materials which were initially provided in a public presentation at the PG&E Pacific Energy Center in January, 2015. Education materials included presentation materials, a summary of the enrollment process with timelines, a checklist of all required documentation, and a list of frequently asked questions¹⁰. Olivine also developed training materials and held training sessions for potential participants.

6.1.1 Enrollment Process

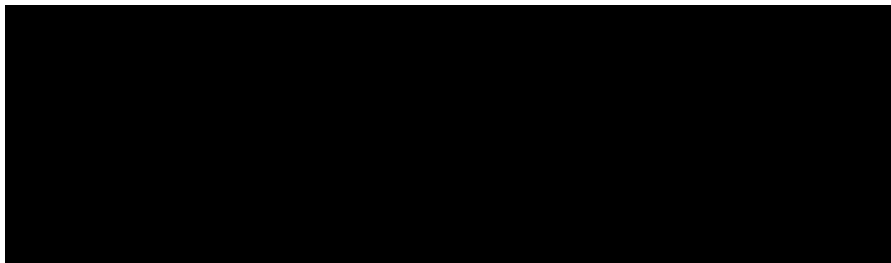
Potential participants filled out a declaration of interest (DOI), and provided detailed information on customer locations and DR capacity. In the case that the participant was not a direct customer, the participant also provided customer-executed agreements authorizing PG&E to release customer data to the participant. These forms, called Customer Information Service Request (CISR) forms, also acknowledged that the customer was enrolling in the pilot.

Once submitted, Olivine reviewed the enrollment materials and submitted them to PG&E for final review. PG&E proceeded with manual validation of the CISRs and checked eligibility of customers for enrollment, including identifying Sub-LAP and LSE membership. Ultimately the participant would acknowledge the enrollment of the eligible customers with the intention of placing them into a single PDR for participation, or in the case of the 30-kW option, a simulated PDR.

Following the enrollment, the participant signed a participation agreement with Olivine. Two training sessions were held: one on the rules, requirements and process of the pilot, and one on using the Olivine DER system to place bids and manage the participant's resource. A qualified capacity test was then arranged to ensure the participant could meet the minimum curtailment requirements.

6.1.2 Enrollment Details

From the original list of 32 organizations, 12¹¹ filled out a DOI, and three followed the steps to enrollment. These organizations are detailed in Table 1.



¹⁰ <http://olivineinc.com/wp2/wp-content/uploads/2015/02/PGE-Supply-side-Pilot-FAQ-v2.pdf>

¹¹ Note that IRM2 participants were not required to re-submit declarations of interest for the SSP.

Table 1: Initial outreach organizations interested in participation

Of these organizations, Olivine had ongoing discussions over several months, with many of the organizations failing to submit prospective locations, with reasons enumerated here:

- Delays with the project at [REDACTED] and potentially metering issues stopped [REDACTED] from completing enrollment.
- [REDACTED] delayed and ultimately chose not to enroll into the pilot due to not being awarded [REDACTED].
- [REDACTED] was interested in utilizing existing or new storage assets to enroll in the pilot. Ultimately the lack of [REDACTED] and [REDACTED] resulted in no enrollment.
- [REDACTED] separately provided a declaration of interest into the SSP from before [REDACTED]. There was no further communication from [REDACTED].
- [REDACTED] ultimately told the SSP team that they had “no interested locations”.
- [REDACTED] did not provide a reason for not pursuing enrollment; however, it is public knowledge they received contracts in the [REDACTED] and may have chosen to focus on delivering those contracts.
- [REDACTED] was in the same situation as [REDACTED] regarding [REDACTED] contracts and they did acknowledge to the SSP team that they were focusing on DRAM with the hope of enrolling into the SSP if it continued into 2017.
- [REDACTED] ultimately decided to focus on other opportunities, partially because of the perception that the paper CISR process would be onerous and result in marketing costs incurred with few customers ultimately enrolled.

Three organizations went further into the enrollment process with Olivine, detailed below.

- [REDACTED], a commercial aggregator, submitted a complete enrollment package to Olivine in [REDACTED]. The customers involved were deemed eligible and removed from [REDACTED] by [REDACTED] to enroll in the SSP. This disenrollment from [REDACTED] threatened an [REDACTED] that the customer was due – and was tied directly to [REDACTED] – as a result, [REDACTED] decided to re-enroll the customers in [REDACTED] and not pursue enrollment in the pilot. Note that since [REDACTED] was made the

commitment that unenrolling from [REDACTED] would not result in a financial shortfall, the SSP paid [REDACTED] the equivalent in missed [REDACTED] funds for the duration that the customers were unenrolled from that program.

- [REDACTED] began enrollment in [REDACTED] with the intention of achieving the [REDACTED] level of participation. After going through the entire process of authorization and eligibility checks, a capacity test was performed on [REDACTED] with a tested result of [REDACTED]. While this made [REDACTED] eligible for the [REDACTED] option, [REDACTED] decided to hold off on completing the enrollment process to add more customers. Ultimately a retest was performed on [REDACTED]. This test included a larger number of customers, but the result was [REDACTED]. Although the SSP team offered them enrollment at the [REDACTED] level, [REDACTED] decided to cease their enrollment in the pilot.
- [REDACTED] also began enrollment in [REDACTED] with the intention of achieving a [REDACTED] level of participation. After following the steps to schedule a test, one was performed on [REDACTED] with a test result of [REDACTED]. A retest was performed on [REDACTED] with a result of [REDACTED]. At that time, [REDACTED] determined that the [REDACTED] of their locations during their test hours was such that they would not be able to perform in the pilot. At that point they withdrew.

6.1.3 Enrolled Participants

Of the potential participants, six submitted locations for validation and three ultimately enrolled in the SSP, providing four PDR resources in total.

An issue that was common for many of the prospective participants was an overestimation of the number of locations that would pass validation as well as the DR potential for those locations. Table 2 summarizes the attrition of locations and load from initial submission by the prospective participants through validation and QC testing. As described elsewhere, this resulted in two of the prospective participants for ultimately enrolling in the SSP.

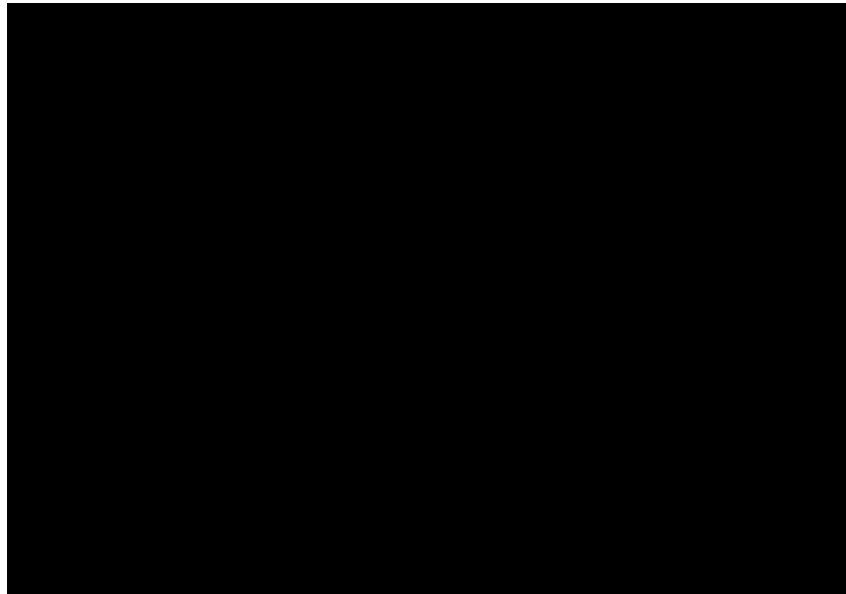


Table 2: Prospective participants that went through validation

Table 3 summarizes the amount of reduction and the sources used to deliver these reductions by participant.

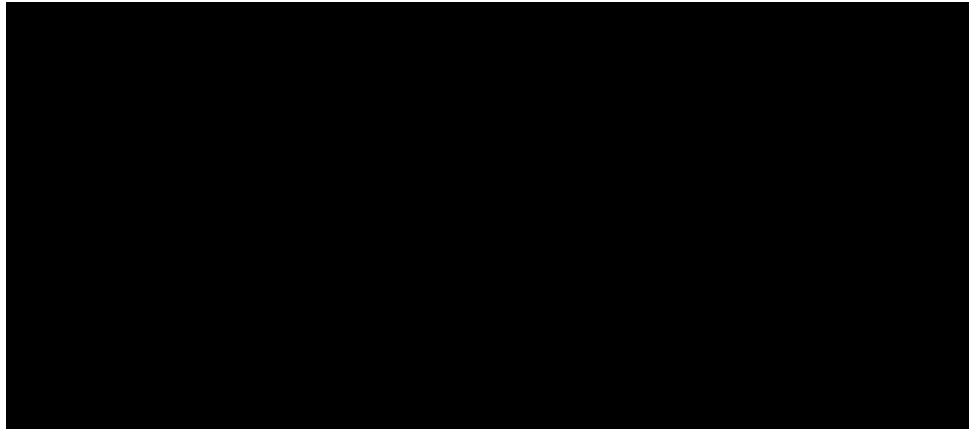


Table 3: Participants, their qualified capacity and end uses

The two [REDACTED] resources provided reductions by rescheduling their employee electric vehicle charging combined with HVAC control, noting that as early as [REDACTED], [REDACTED] no longer included EVs in their delivery strategy.

Both [REDACTED] and [REDACTED] participated using an aggregation of distributed storage systems.

[REDACTED] participated in the real-time market from [REDACTED] through [REDACTED]. To meet the real-time dispatch integration requirement of the SSP, [REDACTED] utilized the Olivine DER API modelled on the PAP 19 Deployment¹² interface.

6.2 Example Events

The following figures provide example event dispatches in the SSP.

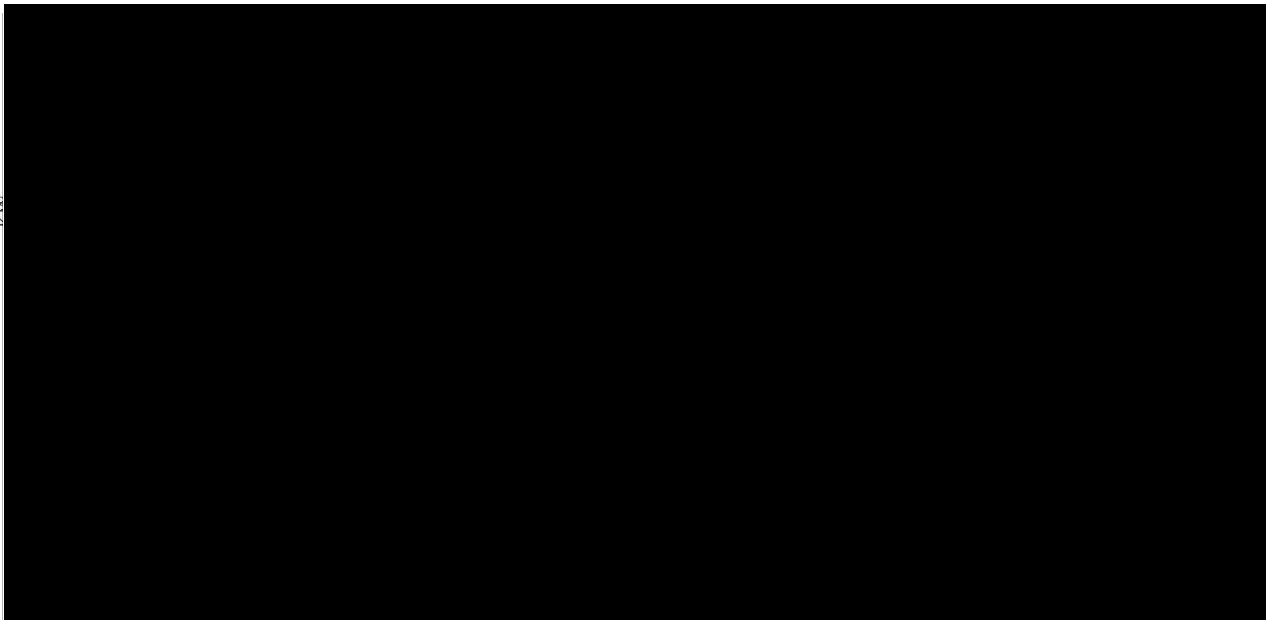


Figure 9: [REDACTED]

¹² <http://www.sqip.org/PAP-19-Wholesale-Demand-Response-DR-Communication-Protocol>

Figure 9 displays calculated baseline and the measured load from the [REDACTED] resource on July 26, 2016 with 15 minute data granularity. On this day, the site was awarded [REDACTED] for two hours between [REDACTED]. The [REDACTED] resource performed well, easily achieving the awarded energy requirement.

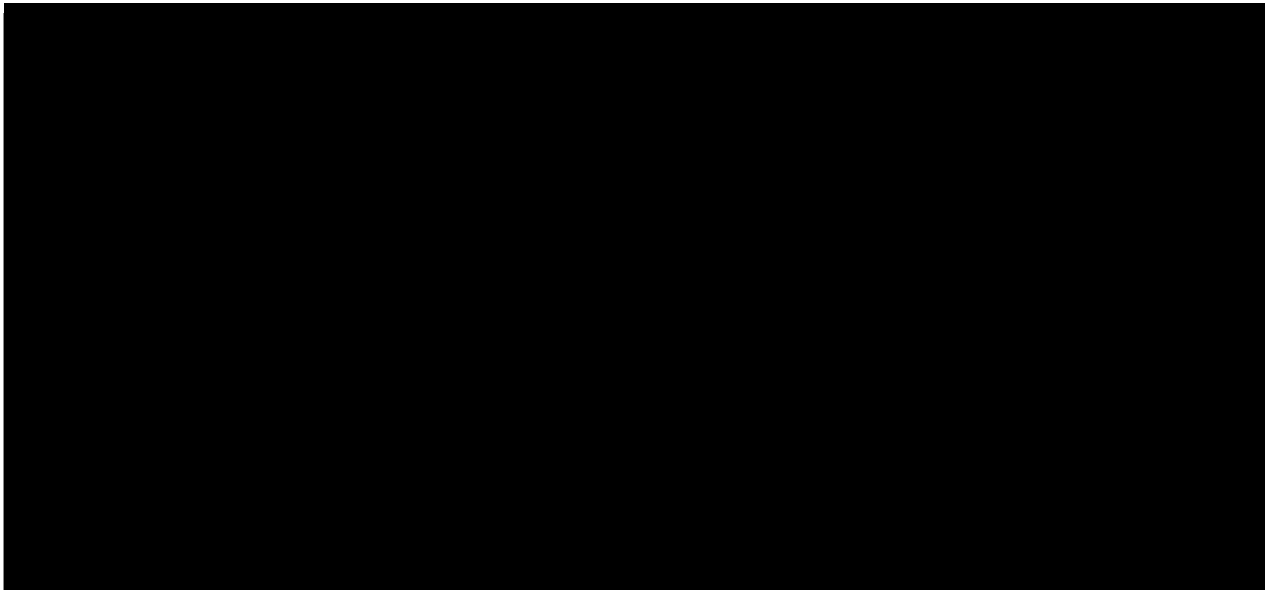


Figure 10: [REDACTED]

Figure 10 and Figure 11 show an event for the [REDACTED] resource showing both real-time dispatch from [REDACTED], and a day-ahead award from [REDACTED]. In each case, the resource is expected to deliver the energy equivalent of [REDACTED]. Figure 6 shows a close up of the event. Note that these two different events occurring in the same day are the result of [REDACTED] submitting day-ahead bids to meet the SSP requirements followed by real-time bids. There is no market prohibition against their being multiple discrete events within a single day as we see here.

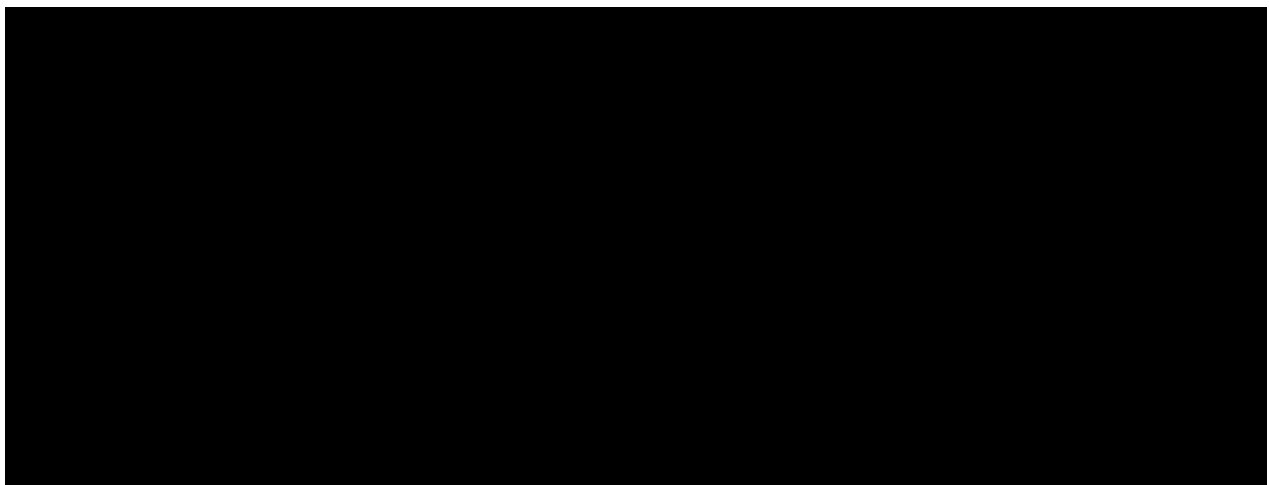


Figure 11: [REDACTED]

6.3 Resource Operations

The customers receive payments for awarded energy at the day-ahead price adjusted by their real-time performance. If they over-deliver, they receive additional payments at the real-time market price. If they under-deliver, they are charged the replacement cost at the real-time market price. Note that typically a participant would be exposed to CAISO grid management charges (GMC), but these were paid for by PG&E under the pilot.

Table 4 below provides a summary of total number of days, the total number of hours and average price bid by and awarded to each participant. For a summary by month, please refer to Appendix B.

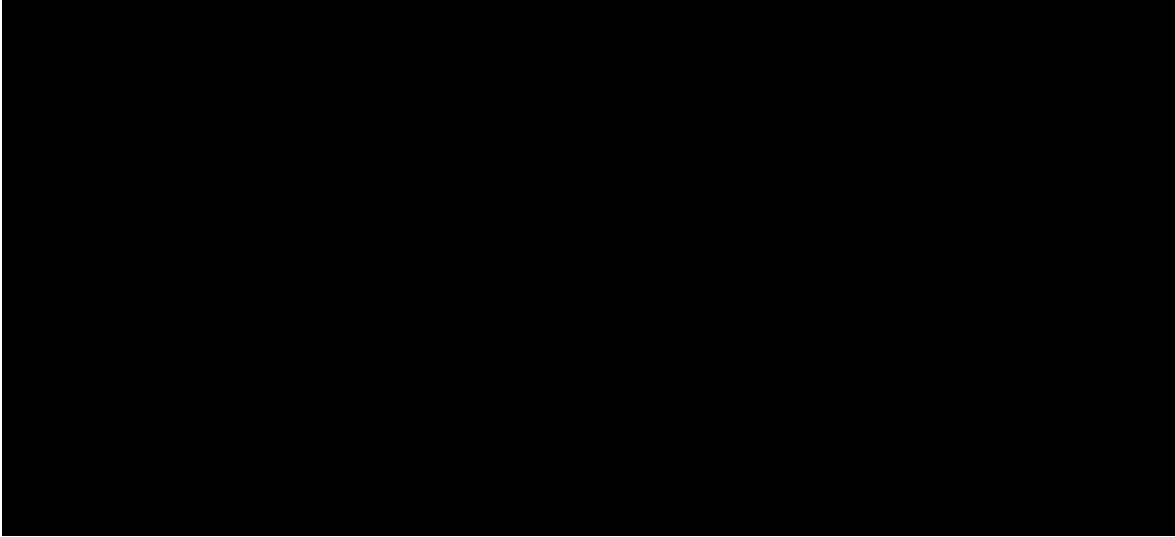
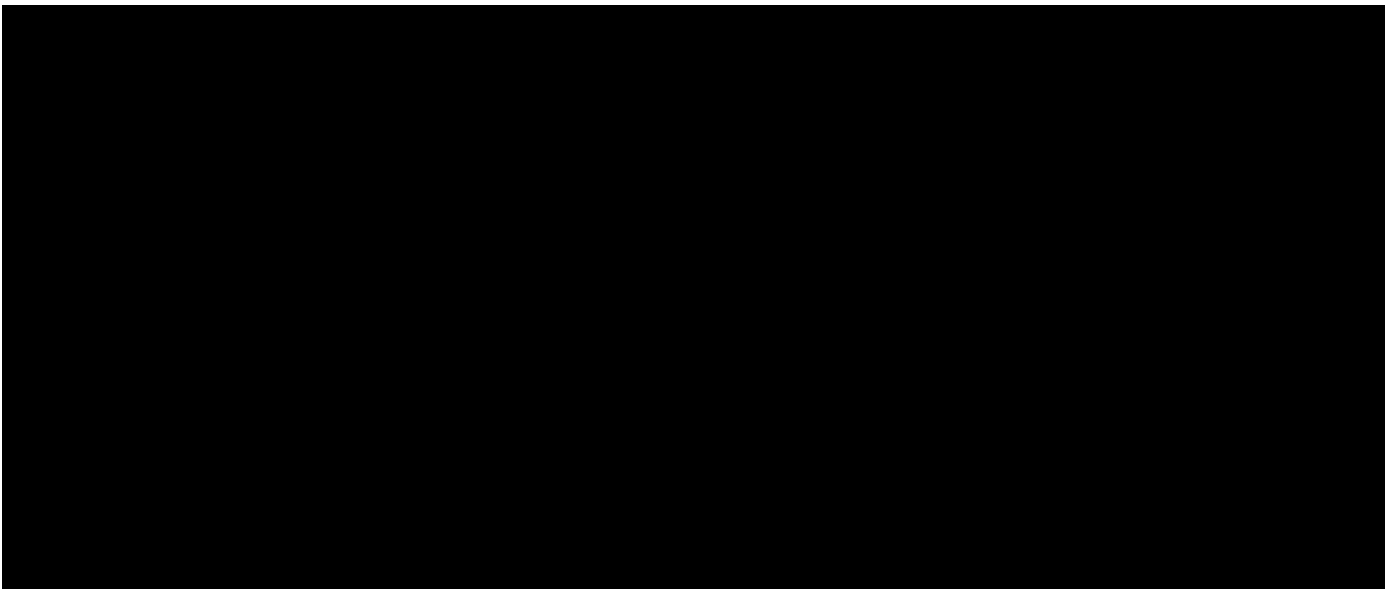
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Table 4: Summary of 2015-16 bids and awards

Table 5 provides a monthly summary of the awards given and the performance achieved by each resource over the period of the pilot.

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¹³ Value reflects price of minimum priced bid segment.

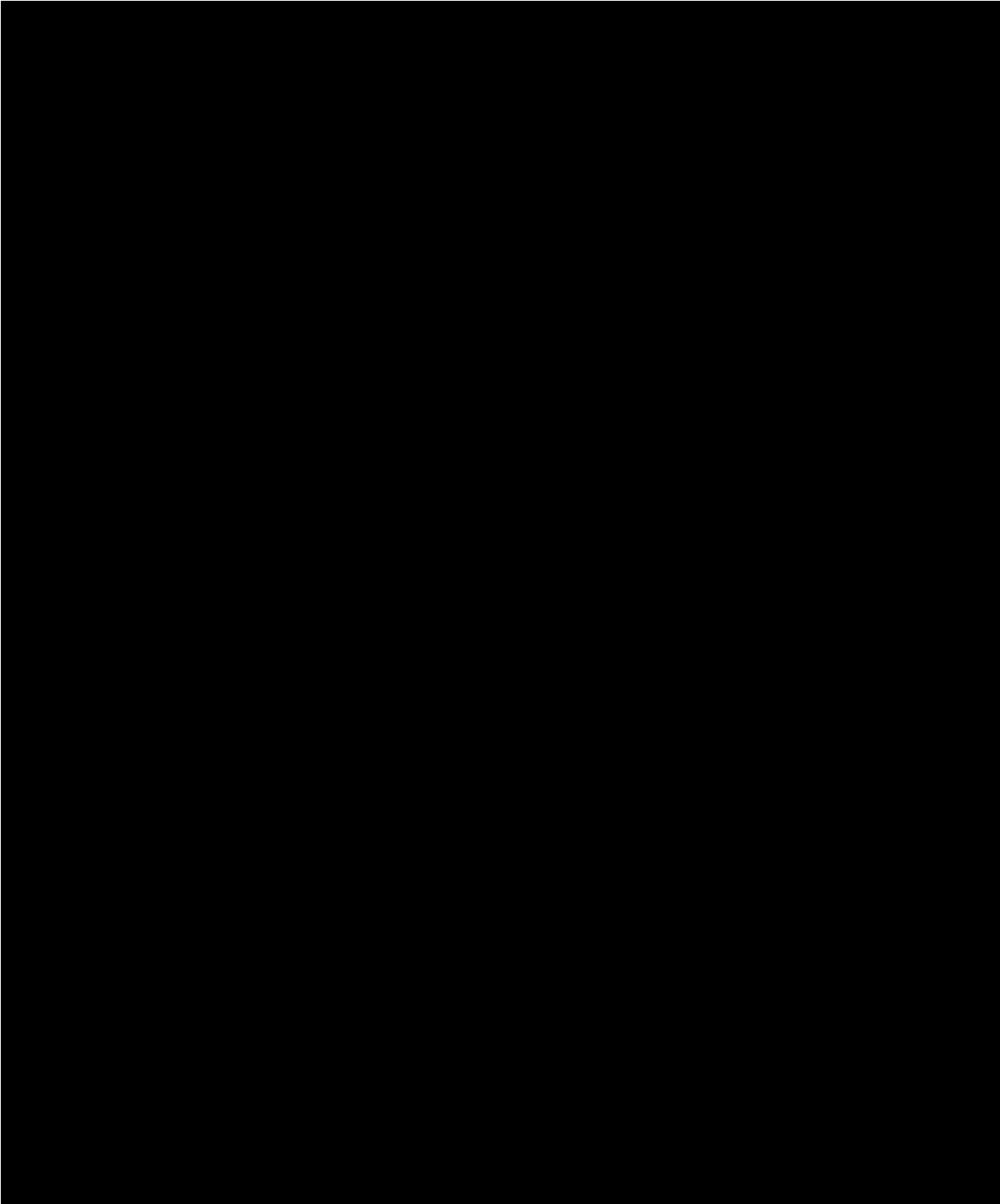


Table 5: Summary of Awards and Performance, 2015-2016

*Gaps in preceding or following months' data indicate awards were not given in those months.

6.3.1 Bidding and Time of Day

At the start of the SSP, each participant experimented with bid hours to find what worked best. Over time, the bid blocks settled into a regular pattern with little to no variation in time. For example, both [REDACTED] and [REDACTED] resources shifted their bidding ranges between the hours of [REDACTED], eventually settling on a mid-afternoon pattern (between [REDACTED]) for the majority of bids. [REDACTED] experimented very little, choosing to remain with an evening bid block – [REDACTED] – for the entire pilot. [REDACTED] bid blocks exhibit more variation due to real-time bids which were not restricted to 4 hour blocks. Figure 12 illustrates the times of day when most participant placed bids. More detail on real-time bids can be found in Appendix B.

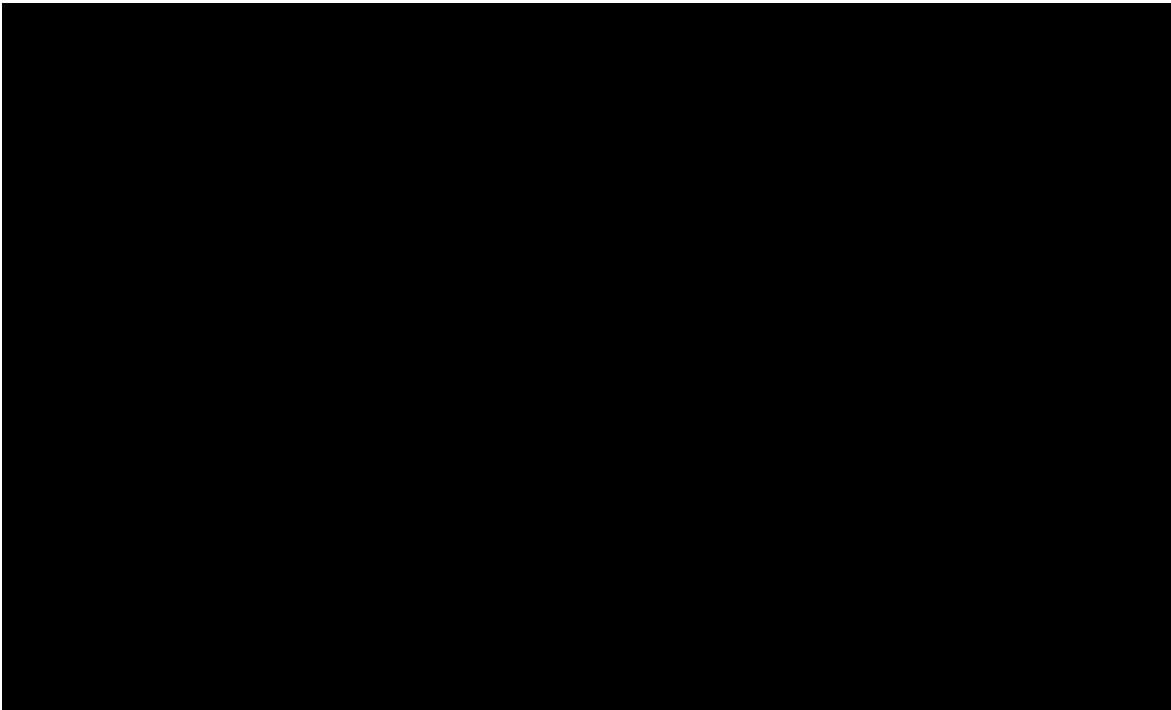


Figure 12: Percent of Bids in Each Hour by Participant

6.3.2 Bid Structure

Most participants bid at one price for the entire bid quantity. However, [REDACTED] structured their bids in segments. [REDACTED]



6.4 Value of Participation

Each participant received capacity incentives for each month they nominated resources as well as payments from CAISO for the energy they delivered. Table 6 summarizes capacity and CAISO settlements received by each individual resource based on its participation. As expected, the capacity payments, which is an incentive offered by the pilot, were significantly higher than the CAISO settlements. A set of monthly data for each resource can be found in Appendix C.



Table 6: Total payments to participants

7 Lessons Learned

In this section, we outline the lessons learned throughout the pilot implementation. We categorize the lessons learned in this pilot into customer acceptance, market transformation challenges (wholesale market, technology), technical and operational feasibility, and value to participants.

7.1 Enrollment

In terms of enrollment, there was much interest from parties, but not as much follow through as one might expect. This can be attributed to several factors:

- Engagement in pilot presentation meetings is a way for parties to learn without any cost other than time. In fact it is the job of many of the attendees to the SSP outreach meetings to network with IOUs, to learn about potential programs, regardless of fit.
- Some prospective participants are looking for funding mechanisms that would help them enroll customers into their own energy management service offerings. As such, a common theme is a declaration of interest, but ultimately the prospect cannot recruit actual customers for the project.
- The DRAM created an alternative for some prospects. This had the effect of forestalling prospects because of their incorrect belief that they would get a DRAM contract, or for those who were awarded a contract, forestalling SSP participation while fulfilling the DRAM.
- Some prospective participants were concerned with the limited duration of the SSP (initially approved for 2 years with a subsequent 1-year extension) and the risk that the pilot might not be extended further. As a result, they felt that the investment in time and equipment needed to qualify for and participate in the pilot was not worth the potentially short duration.
- Residential aggregators found recruitment of enough residential customers to meet the minimum load requirement more difficult than anticipated.

It was common for participants and prospective participants to initially overestimate the number of sites that would pass the validation process as well as the potential load reduction that could be achieved by the final resource. As already discussed, this resulted in several prospective participants either not being able to aggregate enough load to participate in the pilot or deciding that the amount of load that they could control was sufficient to justify participation.

Another major issue, as was seen for both [REDACTED] and [REDACTED], was their inability to understand the actual impact of the 10-in-10 baseline on their viability as a PDR resource. The issue of a potential challenge with the baseline was well known to both organizations, but their ability to only control a portion of the total customer load and lack of whole-premises meter data likely made it difficult for them to determine in advance if their resources could meet the requirements.

7.2 Value to participants

- CAISO settlements do not result in significant value for the participants; while not a lesson learned, it does reinforce that programs like the SSP are necessary for demand response to be successful in the CAISO markets.
- CAISO settlement systems had five major problems, outlined in section 6.4 some of which are still ongoing at the time of this report.
- Several participants and prospective participants have given feedback that learnings from the pilot have been helpful in getting experience in customer recruitment as well as wholesale market participation.

One of the participants, [REDACTED], chose not to continue in the pilot after 2016 and instead decided to take learnings from the pilot and scale up to participate in other DR programs.

7.3 Operational Issues

There are several general issues that are raised within the SSP:

- Problem with the regular retrieval of revenue quality meter data, particularly when site conditions change (e.g., service account changes or meter change out). This has been improved with the investment into the Rule 24 systems and processes, but the underlying issue of remains one that results in ongoing resource management issues.
- Training is needed for customers to understand the basic CAISO market operations, baselines, determining load shed strategies in response to program requirements, quantifying nominations, qualifying capacity, understanding retail incentives and wholesale settlements.
- Despite consistent efforts to engage conventional aggregators, there was no participation. The pilot could be richer if aggregators made use of the training and had first-hand experience in participating in PDR.

There are several lessons resulting from [REDACTED] taking the real-time option in the SSP:

- The real-time market operations result in very short dispatch notifications (i.e., 2.5 minutes before the event period). As such, it is clear that real-time operation is best suited for fully automatic control systems.
- Because of the short notice, pre-charging – whether charging an electric battery or pre-cooling a building envelope – is difficult to accomplish without real-time price forecasting.
- A short coming of real-time dispatch for demand response at the wholesale market, is that the participant is only paid for the interval included in the dispatch even though there may be zero dispatches embedded between actual dispatch. For example, a DR event might receive 10 minutes of dispatch followed by 10 minutes of zero dispatch followed by another 10 minutes. The middle period is not counted as a dispatch by the CAISO so any delivery by the resource is paid \$0. This is different from conventional CAISO resources that are always in the market. In that case, over delivery during the zero dispatch is still paid by the CAISO.

Because there were no participants that had resources that participated in both SSP and XSP, the feasibility of calculating a baseline for load increasing and load decreasing events that occur in close proximity to each other could not be tested.

7.4 CAISO Settlement Issues

There are several persistent issues with CAISO systems that result in incorrect settlement by the CAISO for PDR energy settlement.

7.4.1 55B Clawback

There are frequent issues relating to the CAISO settlement system not syncing with the Demand Response System (DRS). Meter data is sent to the DRS by Olivine, and the system calculates a baseline and event performance in the form of “pseudo-generation” (i.e., the delivered energy from the event as positive MWH values). Under normal conditions, this data is supposed to be sent to the CAISO’s Settlements system to calculate the imbalance energy and resulting financial settlements based on real-time prices; however, very often the data does not get to Settlements. When the Settlements system does not receive meter data –

regardless of the reason – the settlement is deemed as not having been delivered. Thus, the end result is that the 55 business day (55B) settlement is based on zero performance from the PDR. We term this generally as an “55B clawback”.

While the CAISO has acknowledge this issue, and Olivine has disputed these issues as they arise, this continues to be a persistent problem. Unfortunately at the time of this report, Olivine does not have a real understanding of the CAISO’s plans to resolve this issue permanently or a timeline to do so. Note also that after disputing settlements, the next opportunity for a correction is at the 9 month settlement (referred to as 9M). Olivine has found consistently that disputes are not resulting in corrections.

To help mitigate this as an issue for participants, the SSP project team decided to make up for this unfair “55B clawback” by estimating the performance of the resource utilizing the published CAISO baseline algorithm utilizing the same meter data that Olivine submits to the CAISO. We then calculate an approximate financial impact of this error using the 55B net amount (in dollars) and our calculated average performance. This is only done if the total load reduction is greater than zero.

$$55B \text{ Clawback} = 55B_{Net} \times \frac{Q_p}{Q_d}$$

where $55B_{Net}$ is the dollar amount charged in the 55B settlement statement, Q_p is the total load reduction over the dispatch interval (including negative performance), and Q_d is the dispatched quantity. The original clawback is netted out of customer incentives, but this correction is then added back in, resulting in the customer being made whole. Olivine then bills this incentive to PG&E.

Note that there is a special case of this that we deem “partial clawback”. We have only observed this issue on three events but there is an example of the CAISO charging for imbalance energy on the 12B statement and then charging for additional energy on the 55B. The UIE indicated a performance quantity different from the performance in DRS, but still less than what was calculated based on the proper baseline in Olivine’s system. The clawback amount calculated under the above formula was adjusted by the percentage of DA energy ultimately settled as UIE by the ISO.

$$Clawback = 55B_{Net} \times \frac{Q_{OLV} - Q_{ISO}}{Q_d} \times \frac{Q_{UIE}}{Q_d}$$

where Q_{UIE} is the total settlement quantity in the 55B statement.

See Appendix D for a summary of the 55B clawbacks, including descriptions of the types of problems. Most issues were related to the CAISO not processing information from the DRS. Olivine only started calculating “partial clawback” in June 2016, when a large number of missing events (see below) led to significant discrepancies in the baseline calculation. We have also noted event-days where there was a 9 month (9M) settlement. Overall, we have calculated approximately \$6,041.60 from CAISO.

7.4.2 Disappearing Events

Another persistent issue in the CAISO DRS is the issue of missing events. In many cases there are events that were clearly dispatched by the CAISO but never created in DRS. Thus, there is no performance data to perform a settlement calculation. The settlement statements confirm the dispatch with a day-ahead energy settlement, but with no event in DRS, there is no way the CAISO can calculate the real-time imbalance energy. We use the same proxy calculation to approximate the financial impact as for the 55B Clawback. Missing events pose additional problems because if the CAISO does not recognize an event day, the baseline for future events will include it. For a customer with frequent dispatches, this can have an effect on the baseline for more than a month after the day of the missing event. In this case, while there would be no wholesale energy payments to provide the participant, Olivine used the correct event times for the capacity baseline.

See Appendix D Table 9 for a summary of incorrect baseline adjustments due to missing events.

7.4.3 Incorrect Event Times

Another persistent issue in the CAISO DRS was the issue of incorrect start and stop times of DR events. This issue would generally result in a start time 5 or 15 minutes before the actual start time, and an end time similarly extended. This sort of problem results in two issues:

1. Over payment for real-time energy during these extended times (i.e., there should have been no payment for these times, but there would be).
2. In the case of an earlier-start time, the day-of adjustment would be calculated based on a different set of hours. For example, instead of the day-of adjustment relying on the first three hours of the four before the event, it would be the first three hours of the five before the event (e.g., 8 AM - 11 AM instead of 9 AM – 12 PM for a 1 PM event).

In this case, Olivine passed the wholesale energy payments to the participant, but used the correct event times for the capacity baseline.

See Appendix D Table 10 for a summary of incorrect event start times.

7.4.4 Incorrect Holiday Treatment

The CAISO 10-in-10 baseline calculation is intended to treat holiday weekdays as weekends; however, in practice this was not the case. In particular, non-event holidays were wrongly included in weekday baseline calculations and excluded from weekend baseline calculations.

This impact results in a different calculation of the baseline being used by the CAISO than by Olivine systems. The difference in performance between the CAISO and Olivine is used to calculate an approximate settlement implication. The 55B settlement amount is multiplied by the difference between Olivine’s calculated performance and DRS performance. This could result in a positive or negative financial settlement depending on if the CAISO baseline is higher or lower than the baseline using all dispatched events and proper treatment of holidays.

$$Clawback = 55B_{Net} \times \frac{Q_{OLV} - Q_{ISO}}{Q_d}$$

where Q_{OLV} is the performance calculated from Olivine’s baseline and Q_{ISO} is the performance in DRS based on CAISO events and baseline. Olivine only started including baseline errors specifically starting July 2016. However, we used Olivine’s and not CAISO’s calculated baseline when determining clawback amounts for events where the ISO did not follow DRS.

The holidays that were impacted during the SSP were:

- Memorial Day 2015
- July 4th 2015
- Labor Day 2015
- Thanksgiving 2015
- Christmas Day 2016
- New Year’s Day 2016
- Memorial Day 2016
- July 4th 2016

See Appendix D Table 9 for a summary of incorrect baseline adjustments due to incorrect holiday treatment.

7.4.5 Baselines ignore event days on registration change

When a resource has its registration changed (either due to adding locations or due to re-registering the resource in the new year), the CAISO ignores any previous event-days. Olivine calculates event performance, both for settlement purposes and for performance for capacity payments excluding all previous events from baseline calculations, even if they were from a previous registration. This error only happened to affect [REDACTED], which changed registrations on [REDACTED]. Recalculation of the baseline by excluding event days from the old registration led to an increase in the capacity payment of around [REDACTED] for [REDACTED].

7.5 Default Load Adjustment

The default load adjustment (DLA) is an adjustment made by the CAISO that results in a reduction in the scheduled load of an LSE equal to the amount of energy delivered during a demand response award.

During the life of the IRM2 and throughout the Supply DR Integration Working Groups of 2014, Olivine and PG&E presented to stakeholders that the CAISO calculation of the DLA was incorrectly applied according to the CAISO tariff.

The expectation of stakeholders – based on the public workshops in advance of this decision and the approved CAISO tariff – was that the DLA would only be applied to an LSE load schedule in those cases that the demand response energy was paid at a price below the NBT. While the SSP and preceding IRM2 required participants to bid at or above the NBT in all hours, it is still possible in that case for that participant to be paid for energy at below the NBT if they over-delivered energy and the real-time market price during the award period was below the NBT. The dispute with the CAISO arose when it became clear that when the real-time market price was below the NBT, the entire delivery – including the day-ahead portion paid at a price higher than the NBT – was deducted from the LSE schedule.

While Olivine and PG&E were correct about the tariff not matching the algorithm, ultimately the CAISO made public that their calculation was different and intentionally so. At that point, Olivine dropped the issue, noting that it is our belief that the stakeholders that were a part of the original direct participation / Rule 24 proceedings would not have agreed to the NBT bid price floor in the day-ahead market as a way to eliminate the DLA when in fact the bid price does not determine application of the DLA. This is something that parties may want to undertake in a future DR proceeding at the CPUC.

8 Conclusion and Next Steps

In this pilot project, four resources participated and learned about the process of developing nominations, setting prices for their nominations, and bidding into the wholesale market as PDR. Four of these participants received payments for their participation. In the process, there were lessons learned, both from the participant's perspective, and the SC's perspective. In this section, we summarize the results from each perspective.

8.1 Participant

- Participants with variable loads were concerned about the accuracy of the PDR baseline.
- Participants with loads that were all on or off, without flexibility to move them under the nomination, chose not to participate.
- Where the resource size met the minimum CAISO requirement but the resource was behind large variable loads, though the resource performed as expected, it was not visible from the baseline.
- All participants that received payments participated in using their storage systems or deferring vehicle charging.
- The conventional aggregators approached did not have sites within a single Sub-LAP or did not have time to recruit and enable enough sites to make up for the resource size within a Sub-LAP.
- Most of the sites were semi-automated with manual bid entry and semi-automated response at the sites.
- As expected, the CAISO settlements received by participants for the energy they provided were significantly less than the retail capacity incentives and did not add up to a significant value for the participants.

8.2 Scheduling Coordinator

- Training is needed for customers to understand the basic ISO market operations, how to calculate baselines, how to determine load shed strategies in response to program requirements, how to quantify nominations, how to set qualifying capacity, retail incentives and wholesale settlements.
- Despite consistent efforts to engage conventional aggregators, there was no participation. The pilot could be richer if aggregators made use of the training and had first-hand experience in participating in PDR.
- Problems with CAISO processes, systems and settlement issues were identified and were brought to the CAISO's attention.

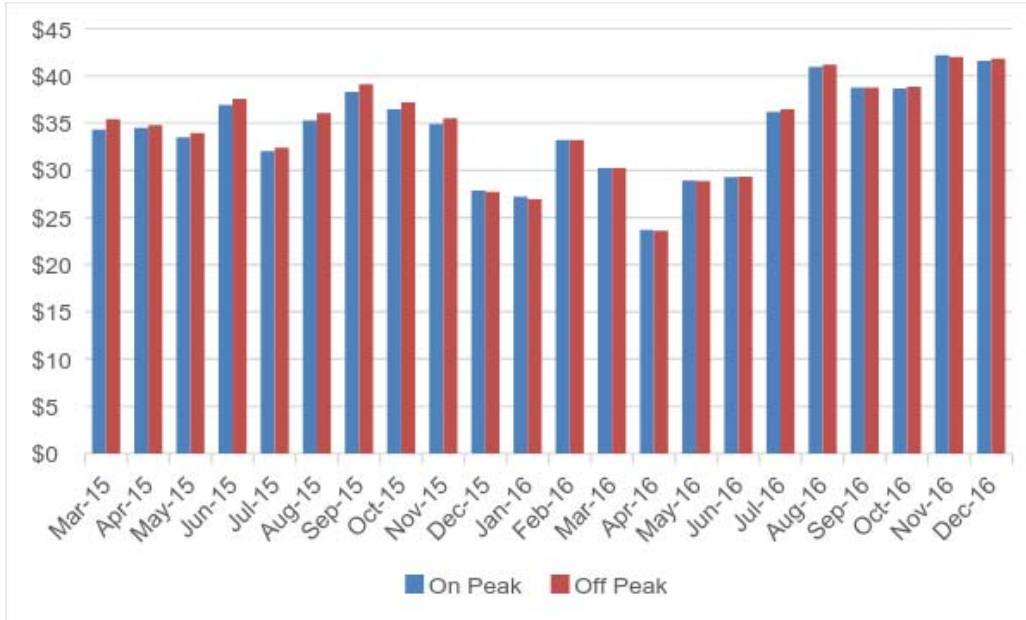
8.3 Next Steps

The next phase of this pilot, the SSP II, is underway through 2017, and PG&E proposed in its 2018 - 2022 DR application to continue the SSP II through the 2018 – 2022 period. While continuing to support the 2015-2016 rule set, the following items are being addressed for 2017:

- Additional outreach, utilizing the new material, to all participants of SSP and XSP, PG&E customer service representatives, industry groups, and any other known contacts provided by PG&E.
- Recruit customers to dually participate in the SSP II and XSP to test bid strategies as well as baseline and settlement interactions between load increasing and load decreasing events.
- Expand the pilot to explore distribution issues, including how to proceed with integrating bid/award information into distribution operations.

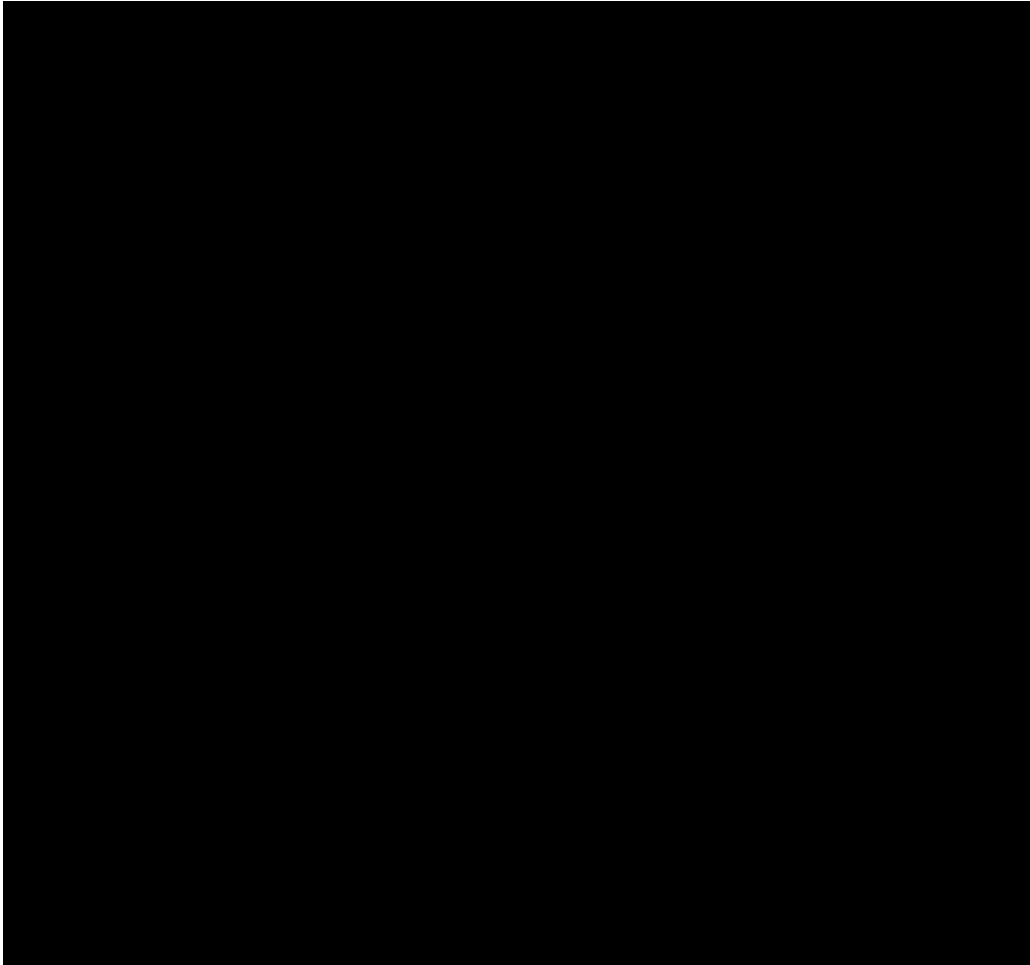
Additionally, learnings for the SSP, including availability of participant DR load outside of the traditional mid-day DR period, participant utilization of multi-segment bidding, and participants having flexibility in determining their bid prices, were integrated into PG&E's 2018 – 2022 proposal for its CBP Elect and Elect+ options.

Appendix A: 2015 - 2016 Monthly Net Benefits Test Prices



Appendix B: 2015 - 2016 Monthly Bids and Awards

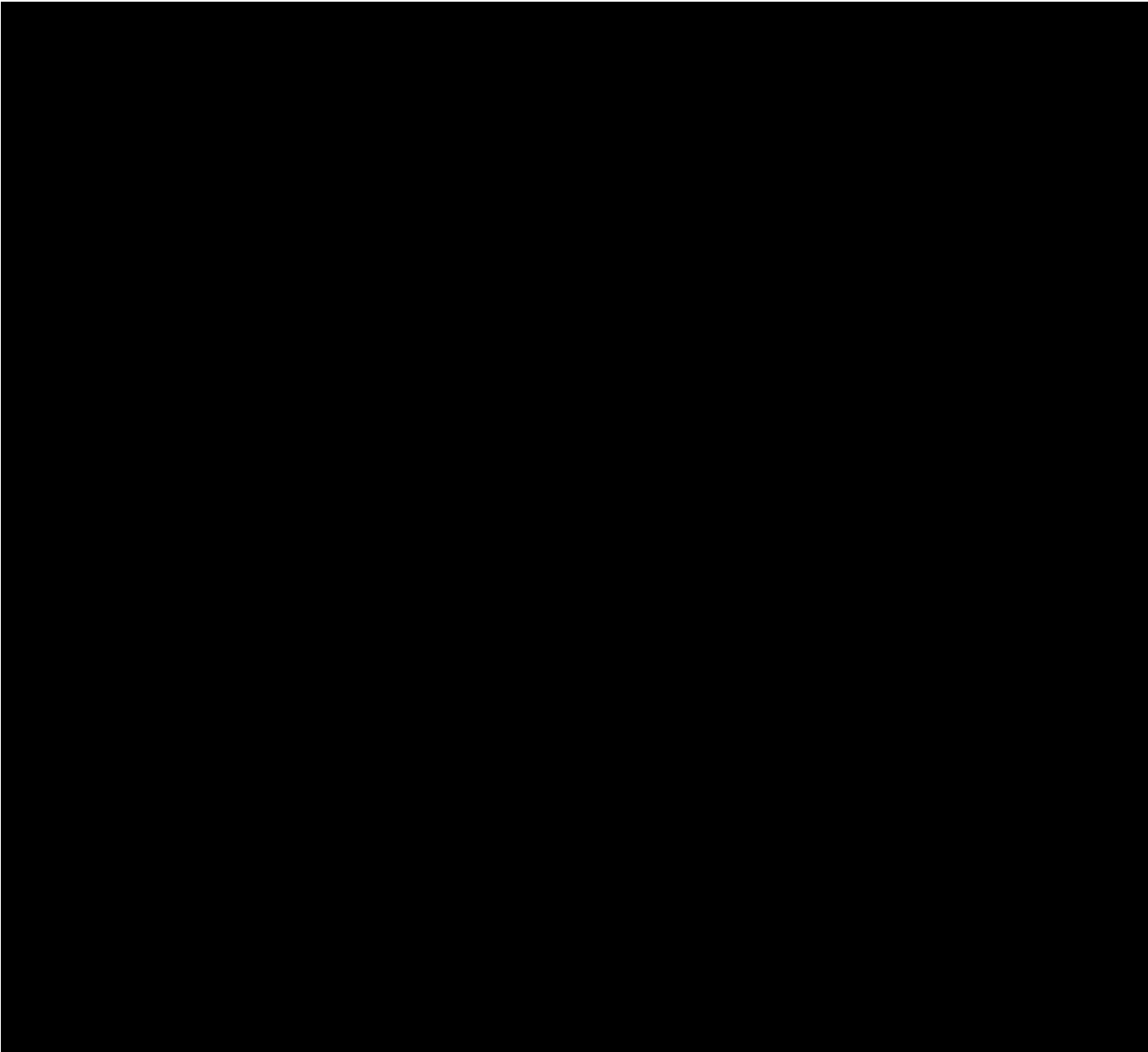
B.1 Monthly Bids and Awards



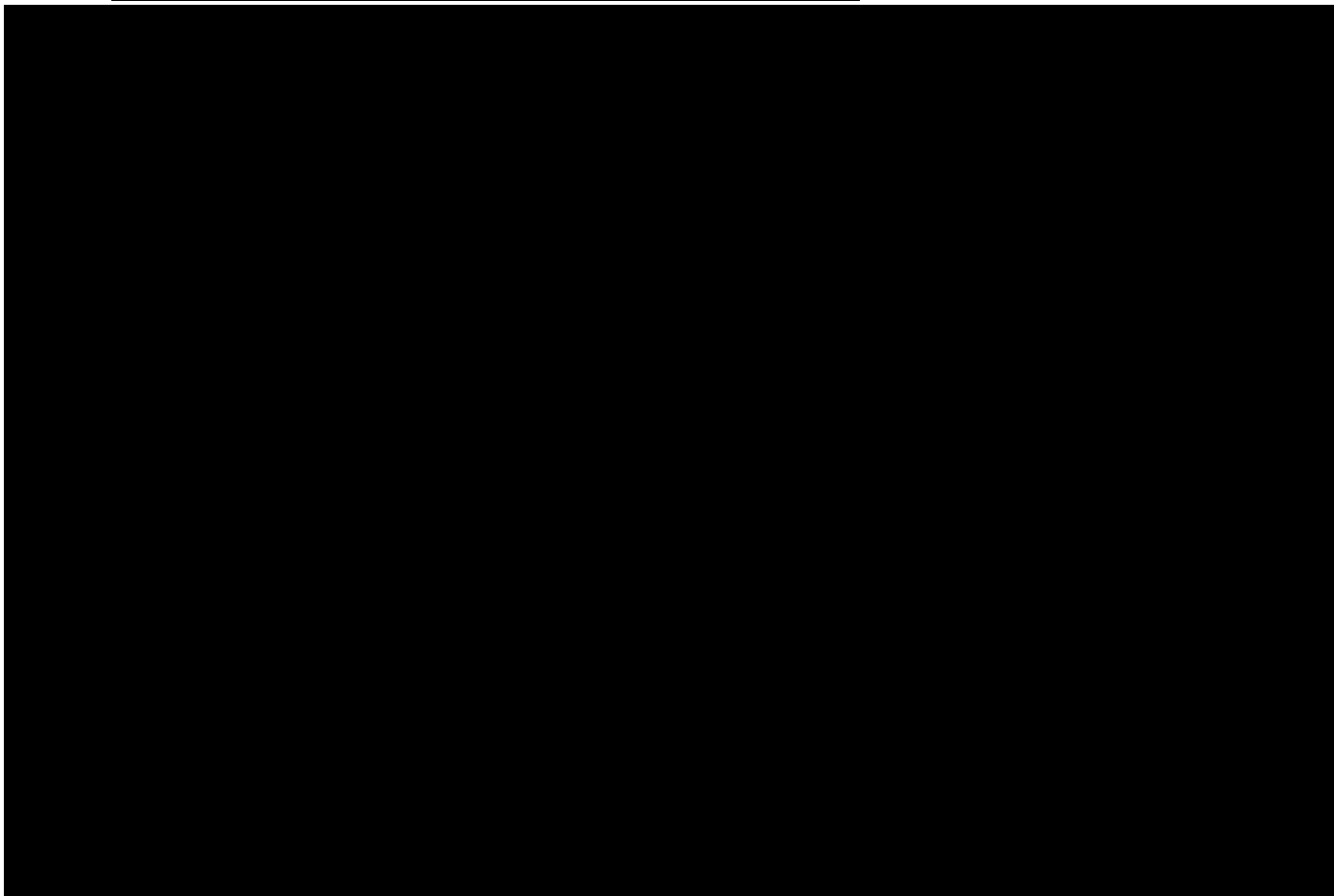
B.2

[REDACTED]

[REDACTED]



B.4



¹⁴ Value reflects price of minimum priced bid segment.

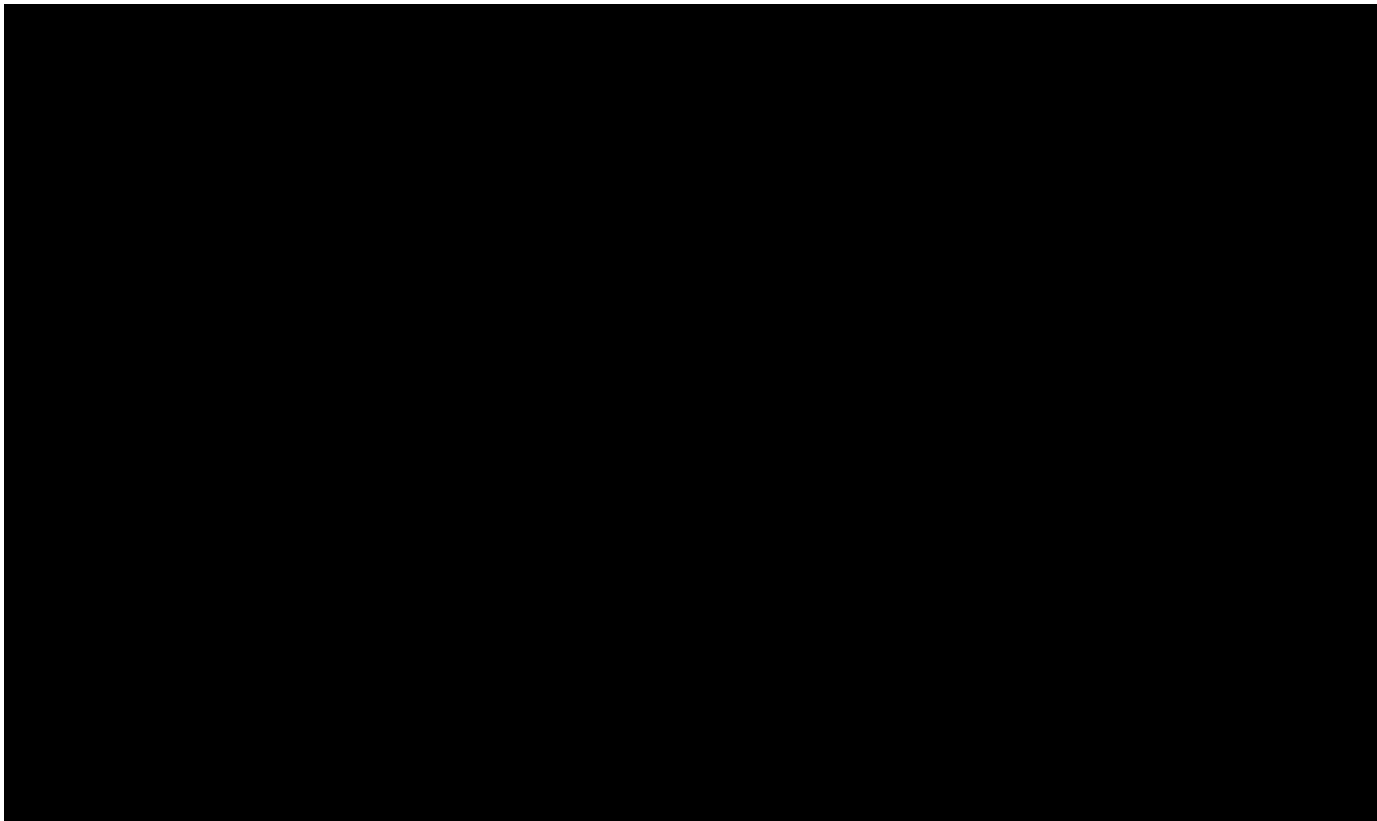
B.5

[REDACTED]

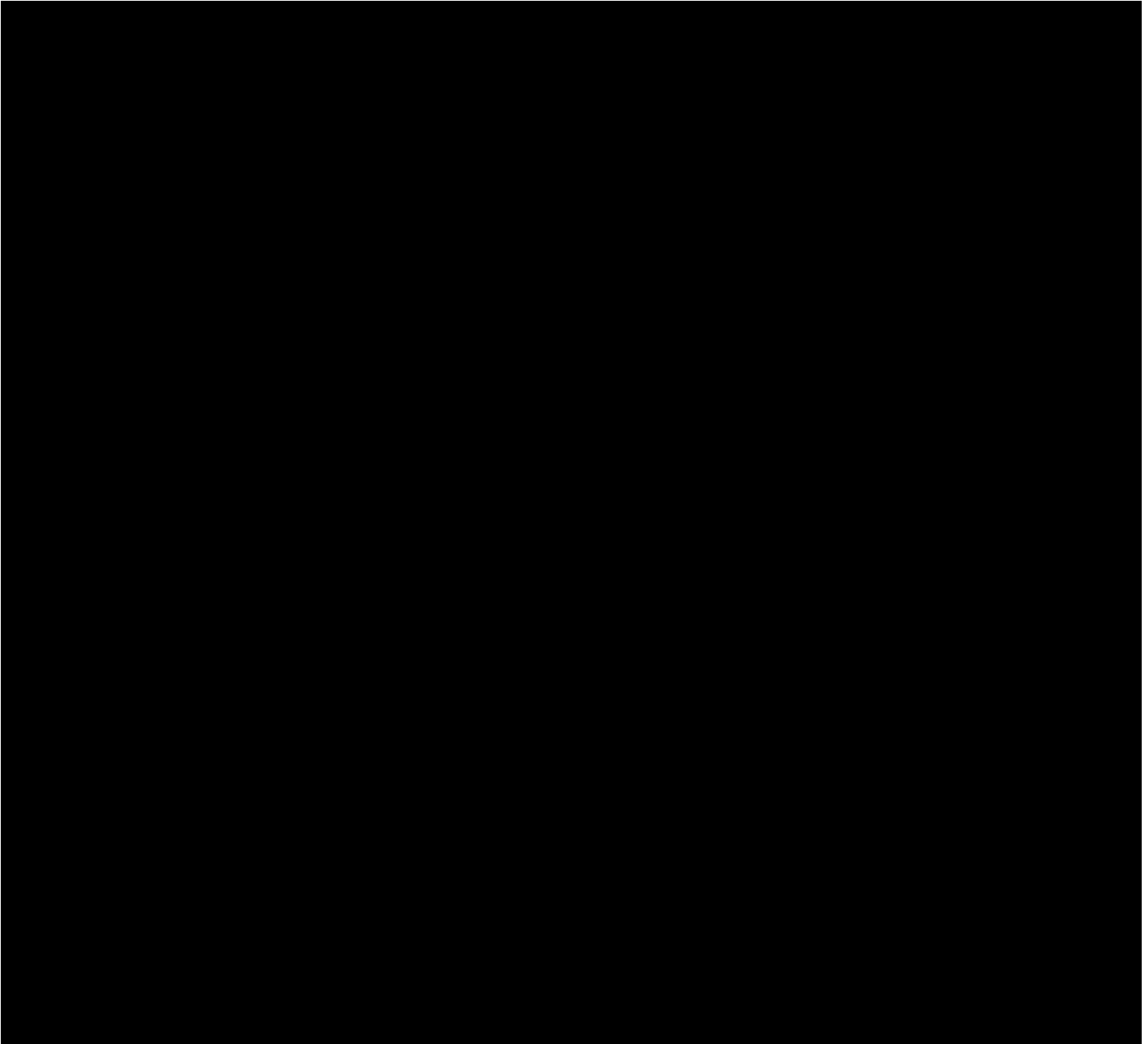
[REDACTED]

B.6

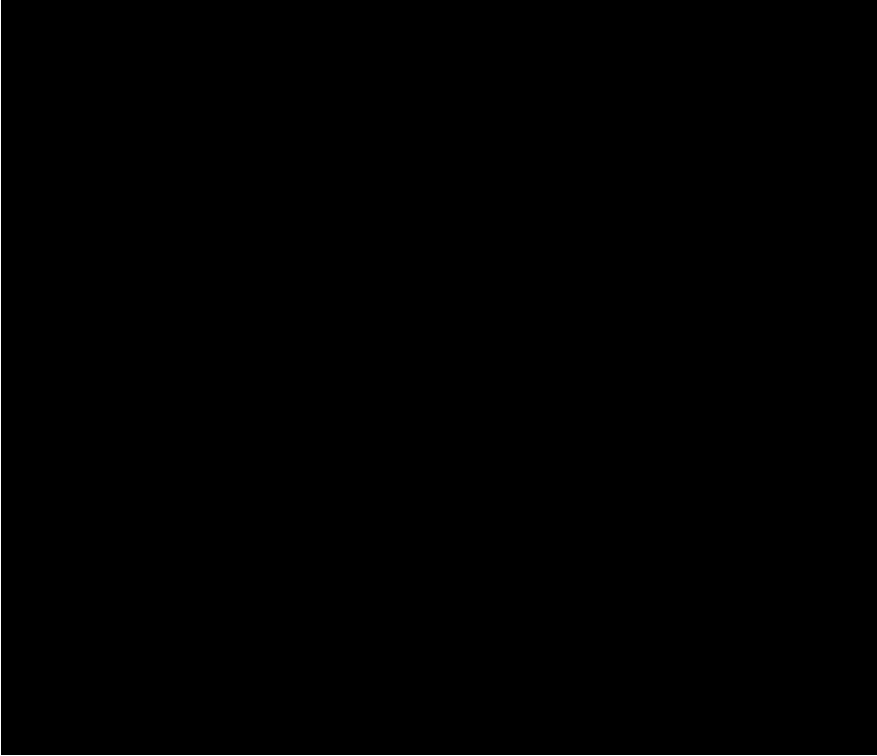
[REDACTED]



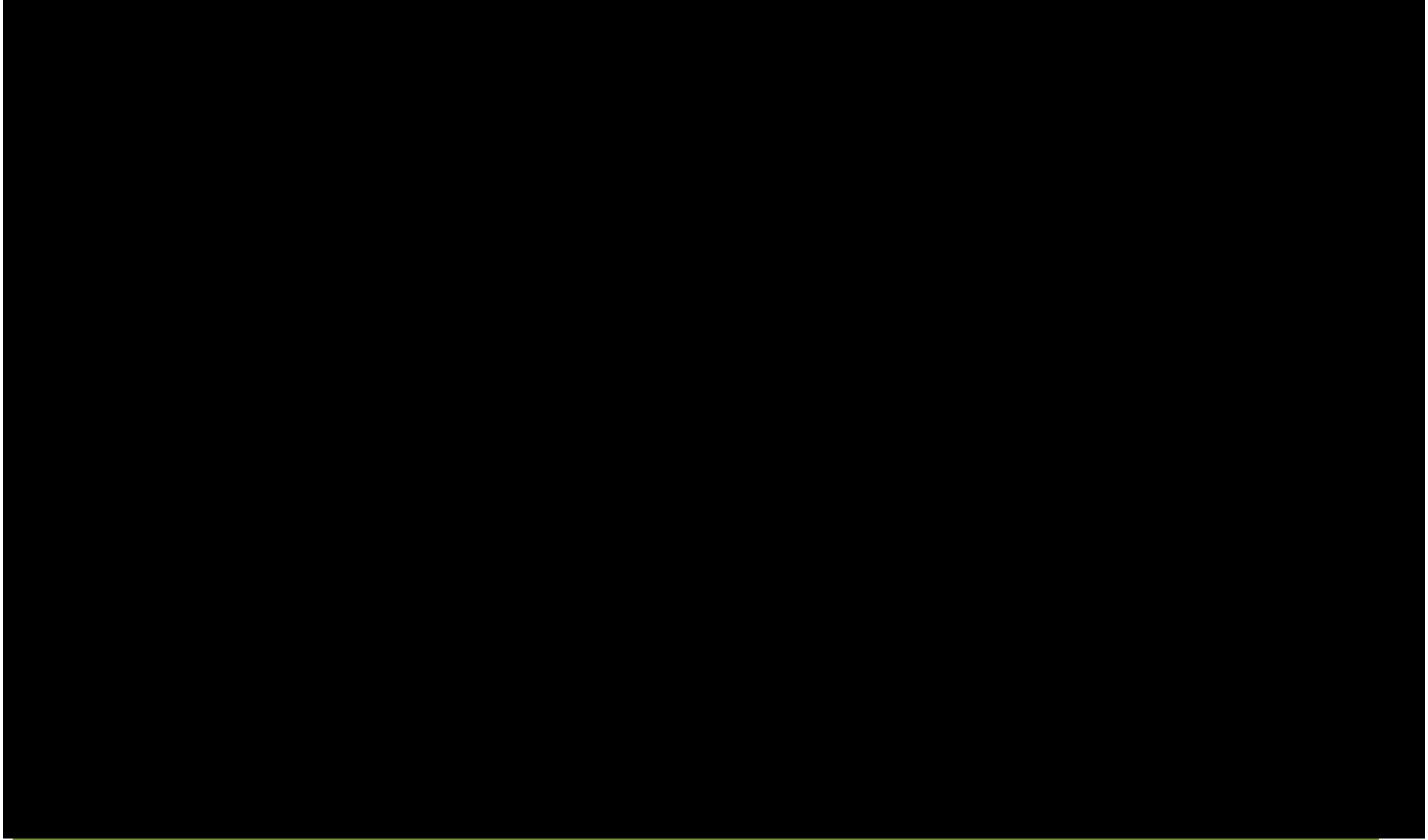
B.7 Real-Time Events

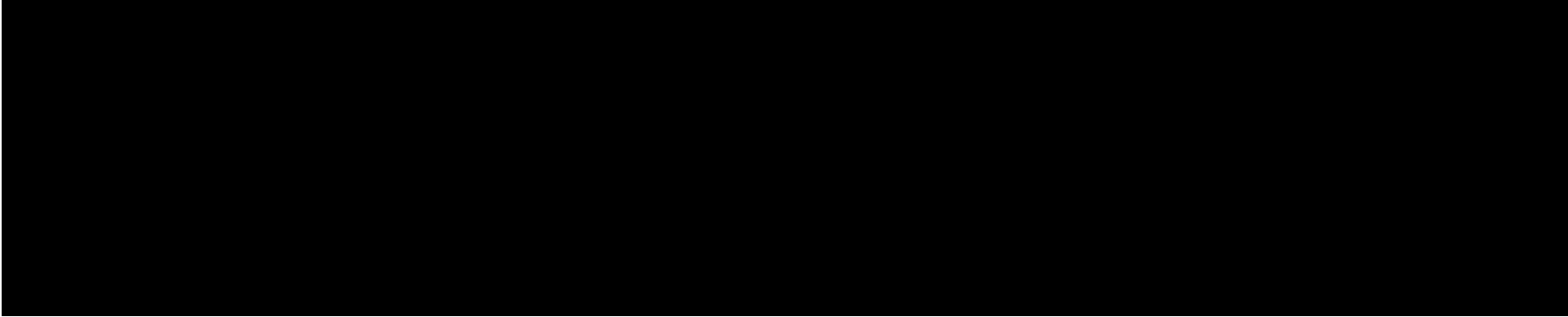


B.8 Real-Time Event Durations per Month

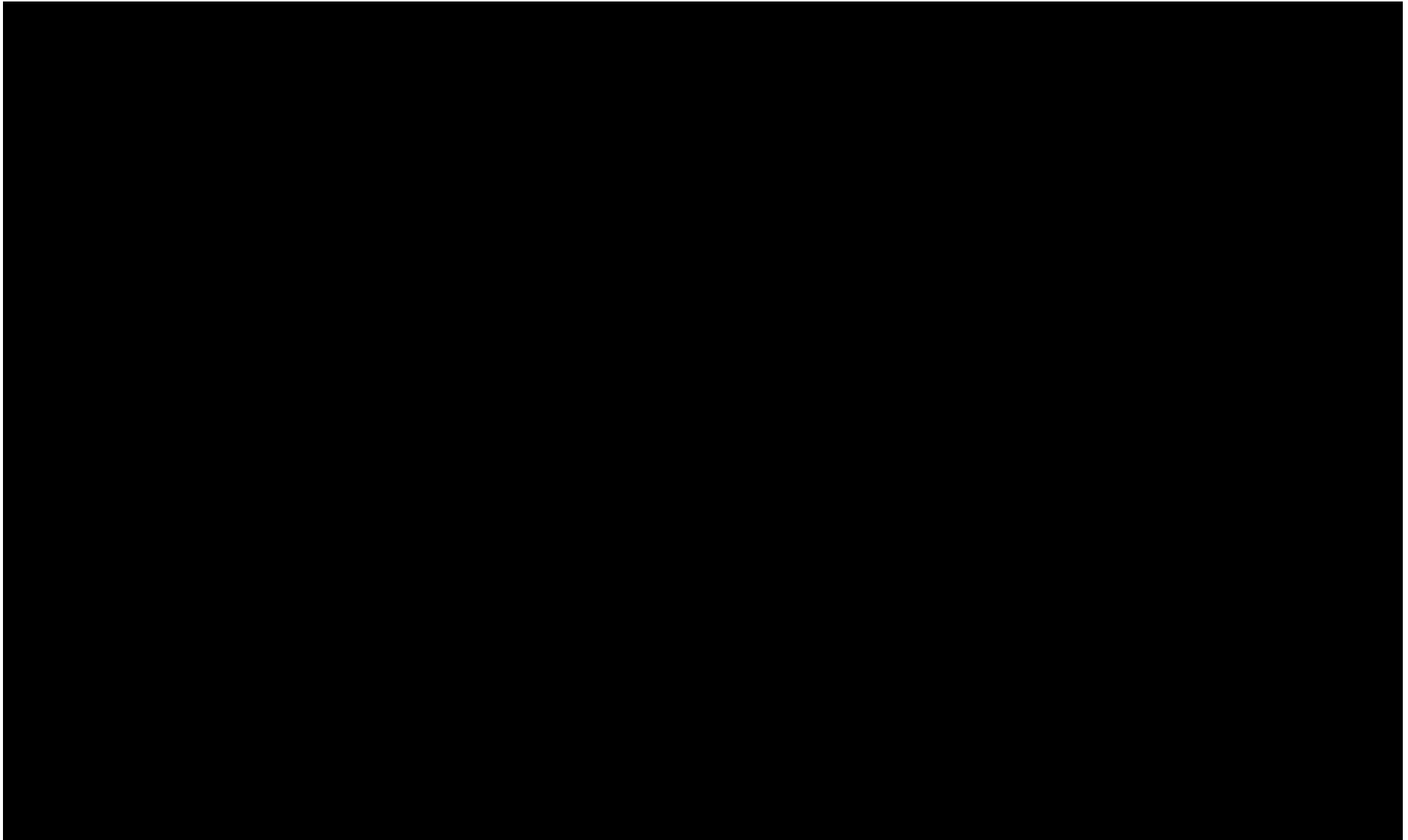


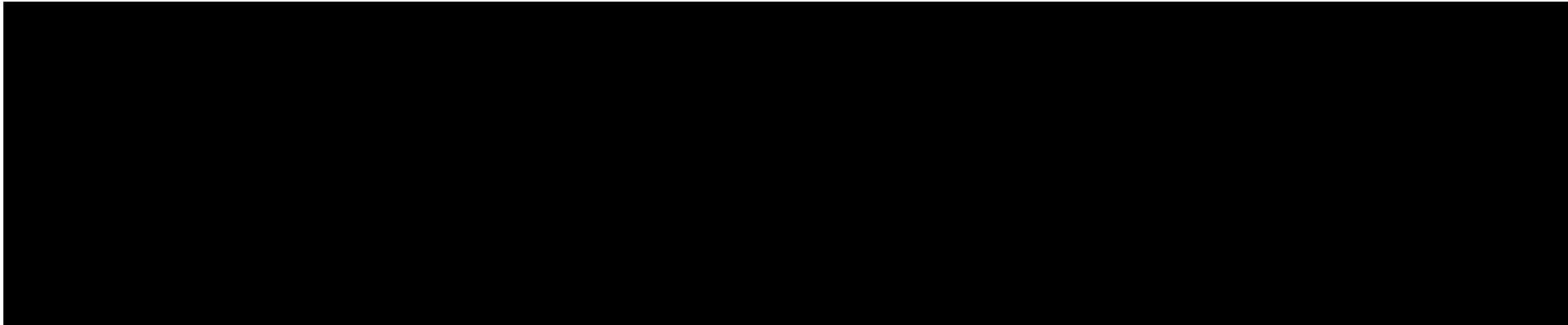
B.9 Number of Day-Ahead Bids per Hourly Interval



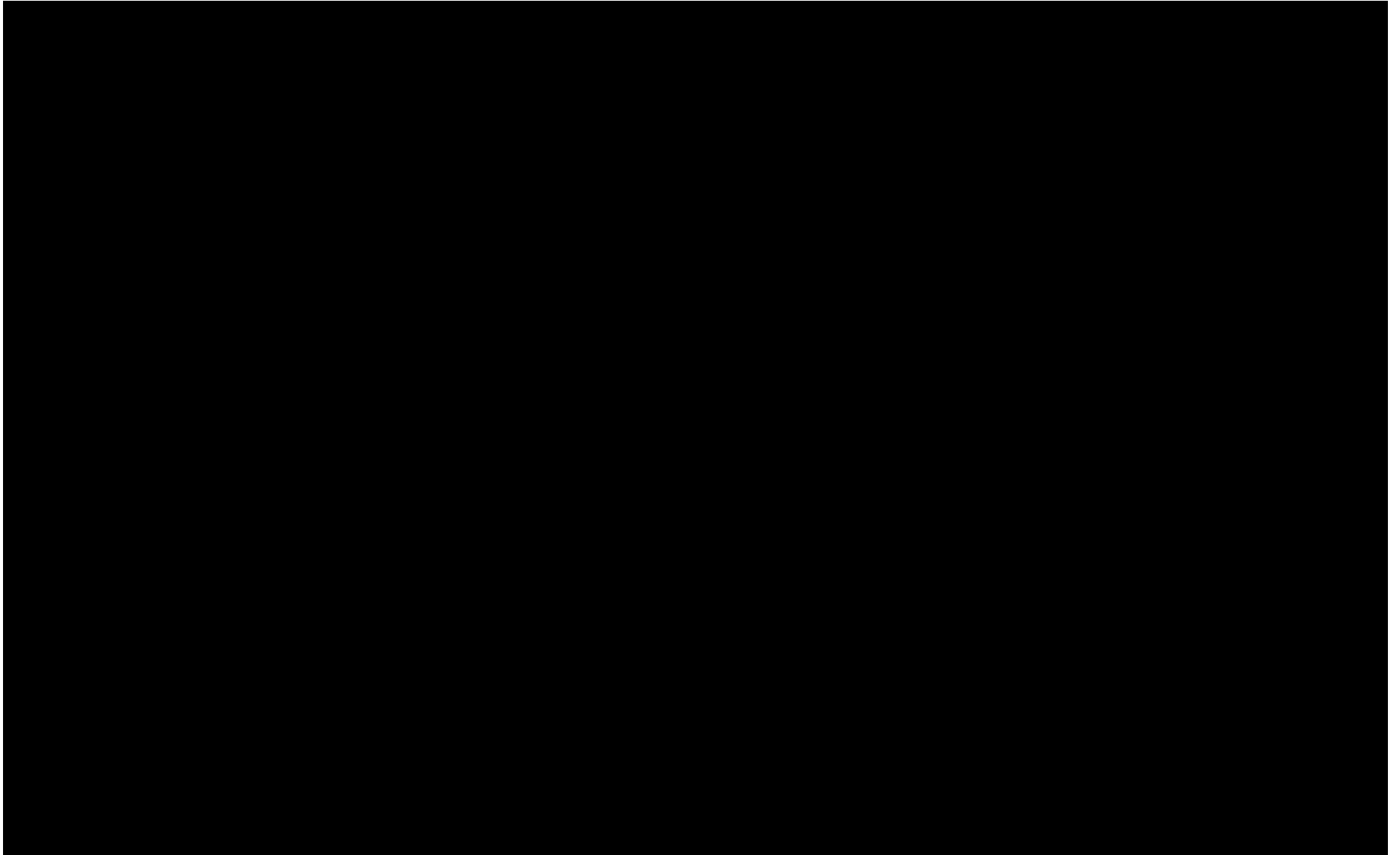


B.10 Number of Day-Ahead Awards per Hourly Interval





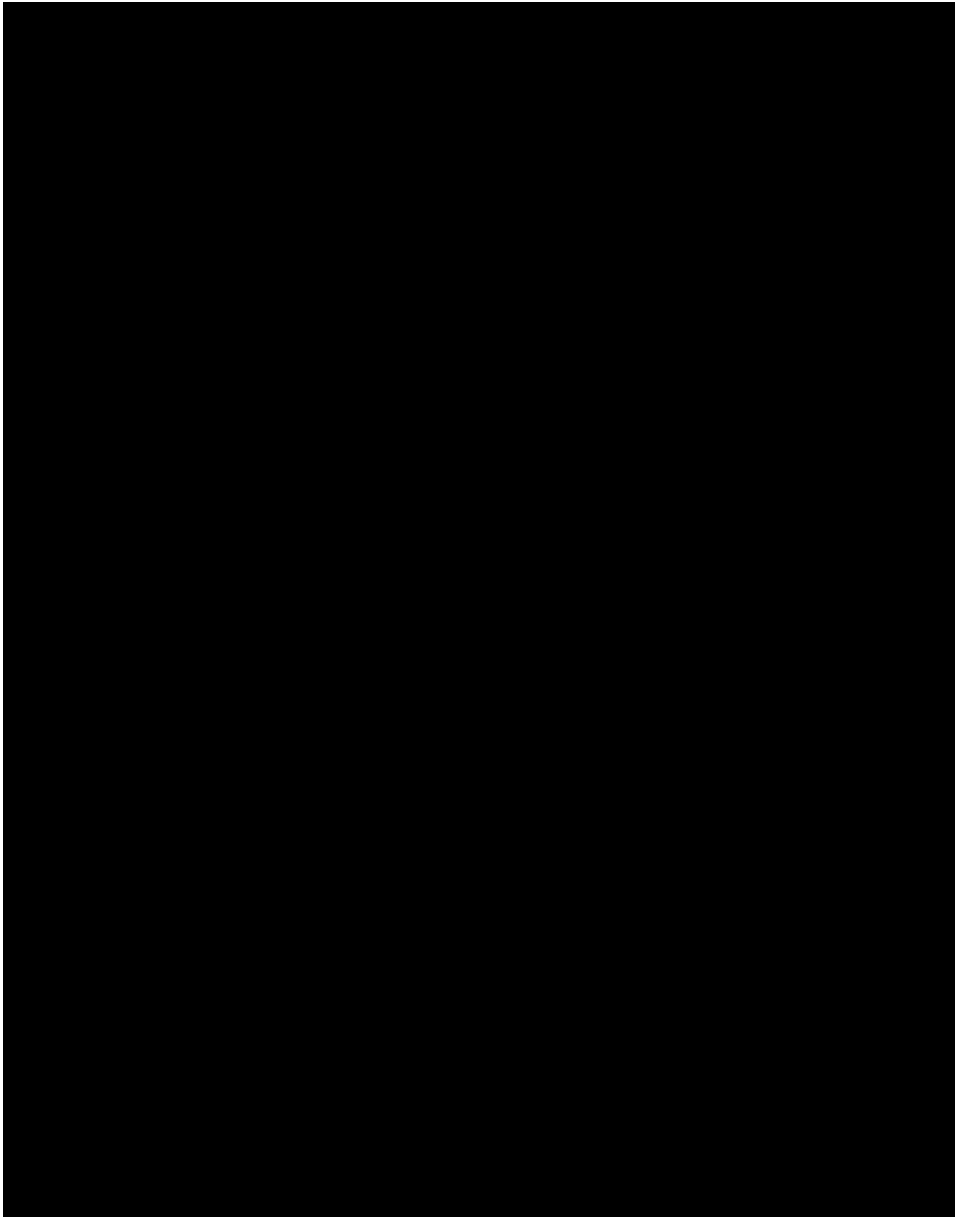
B.11 Number of Real-Time Bids per Hourly Interval



Appendix C: Monthly Payments to Participants

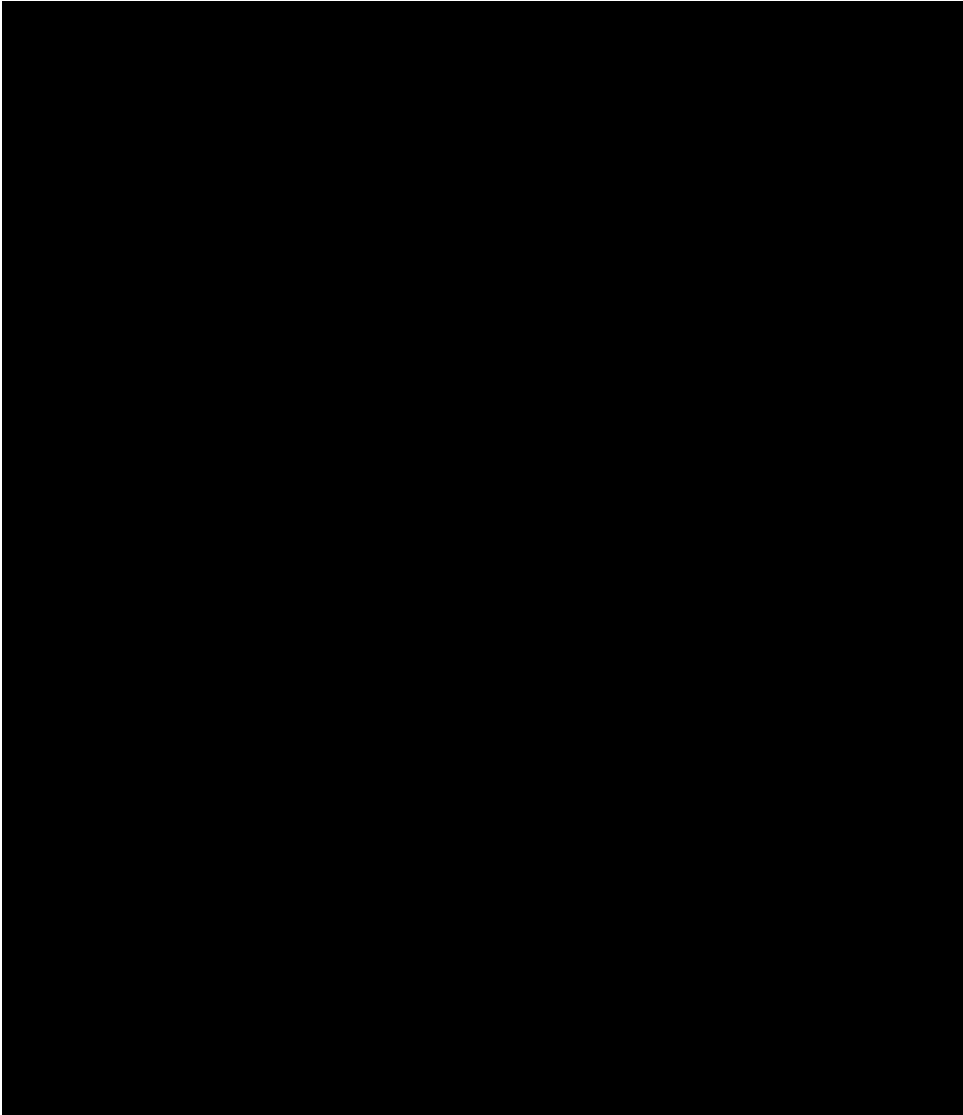
C.1

[REDACTED]

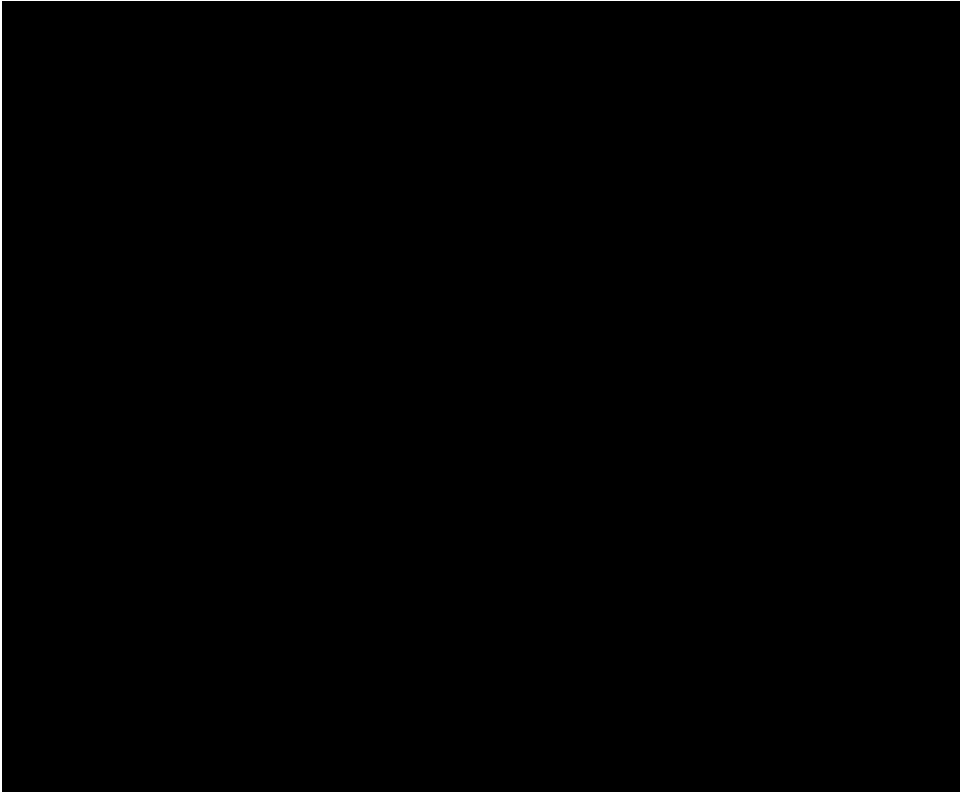


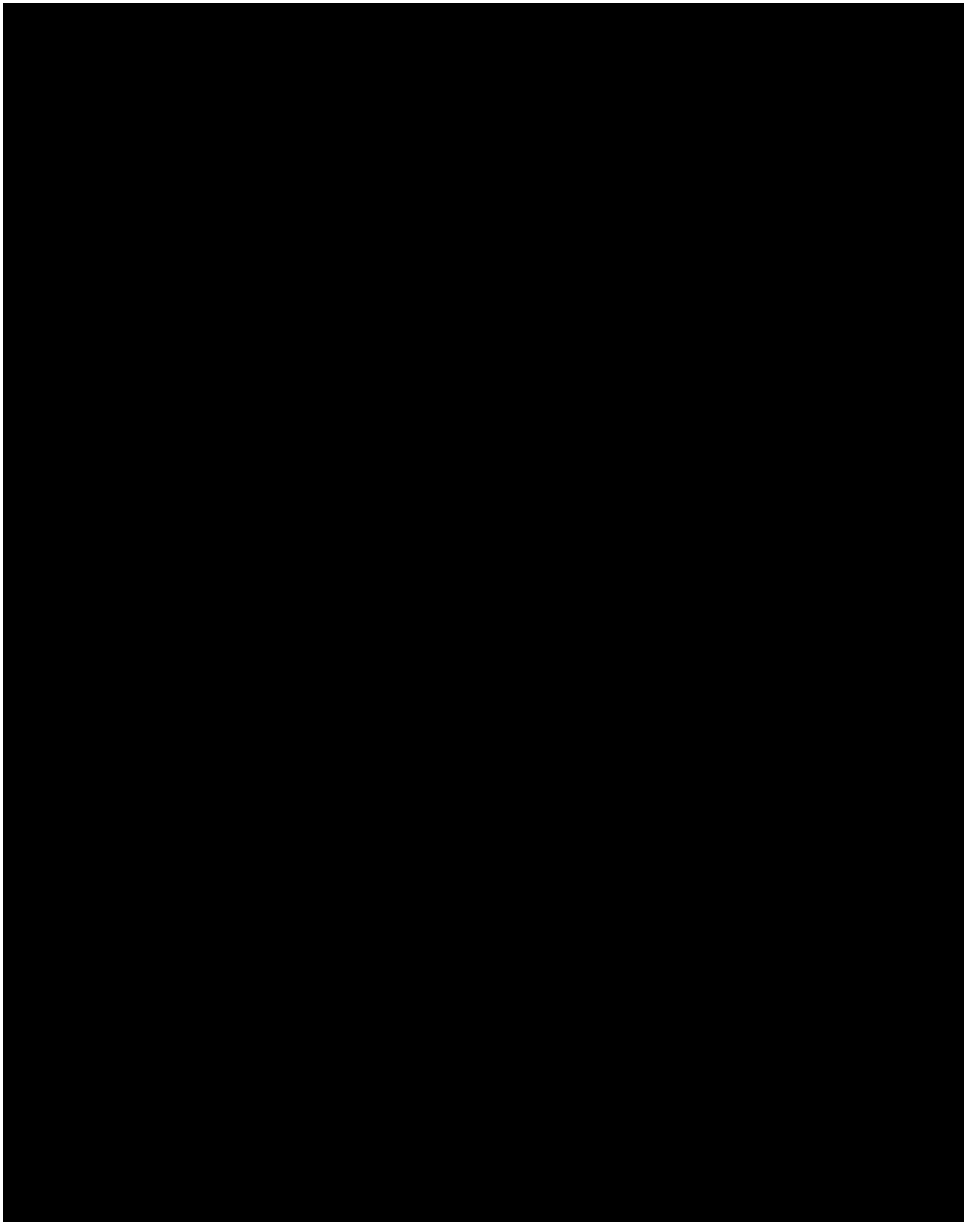
C.2

[REDACTED]



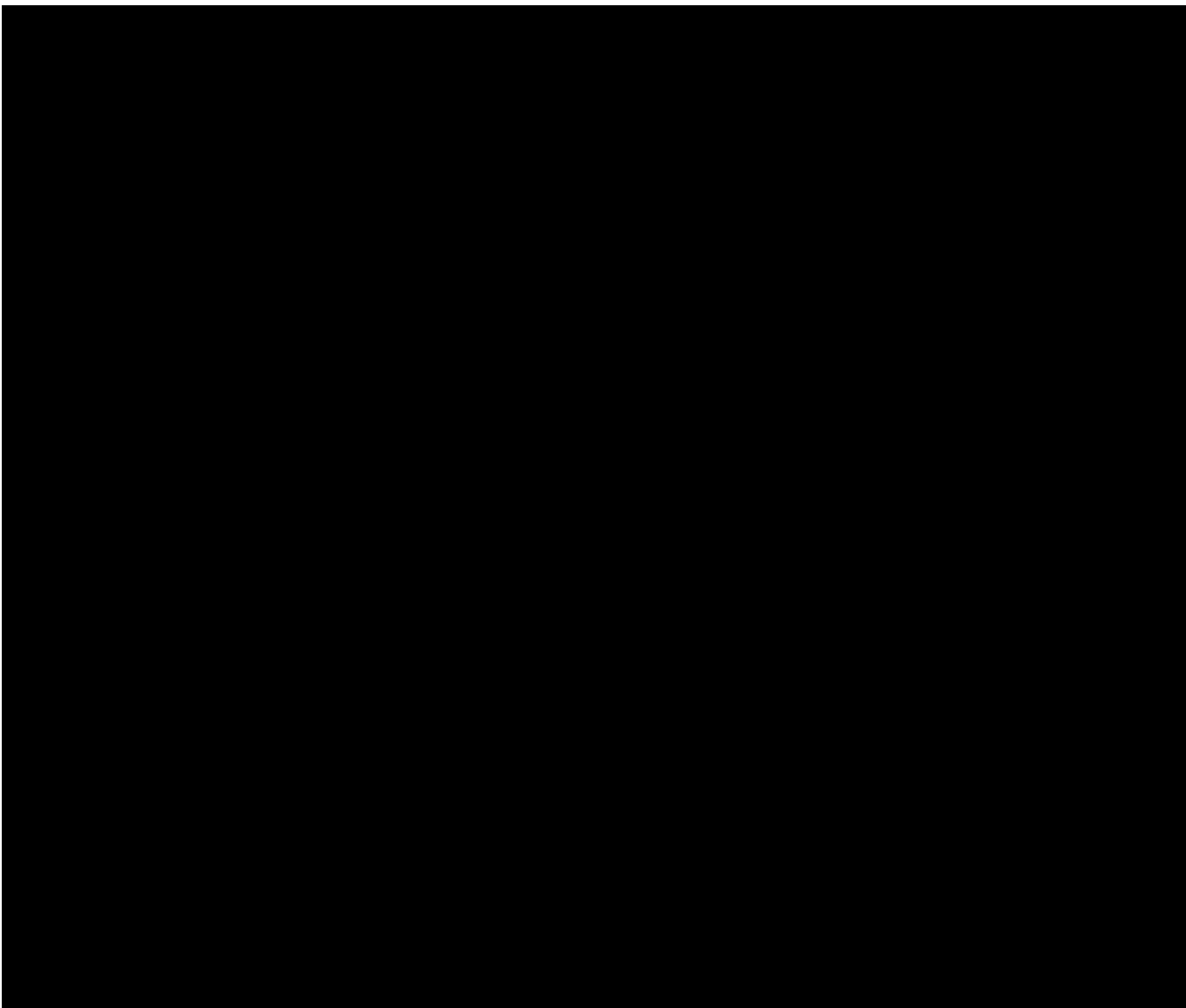
C.3



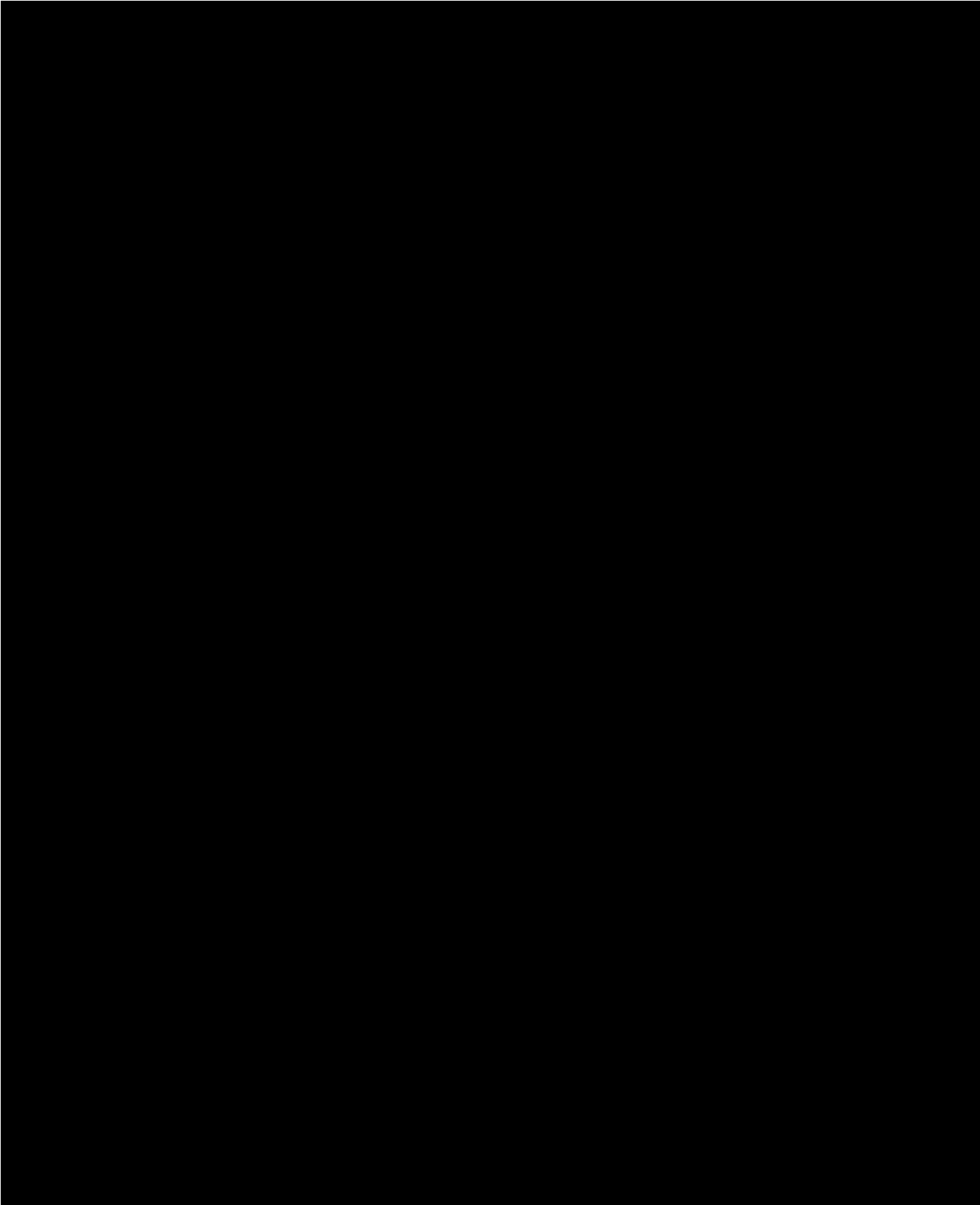


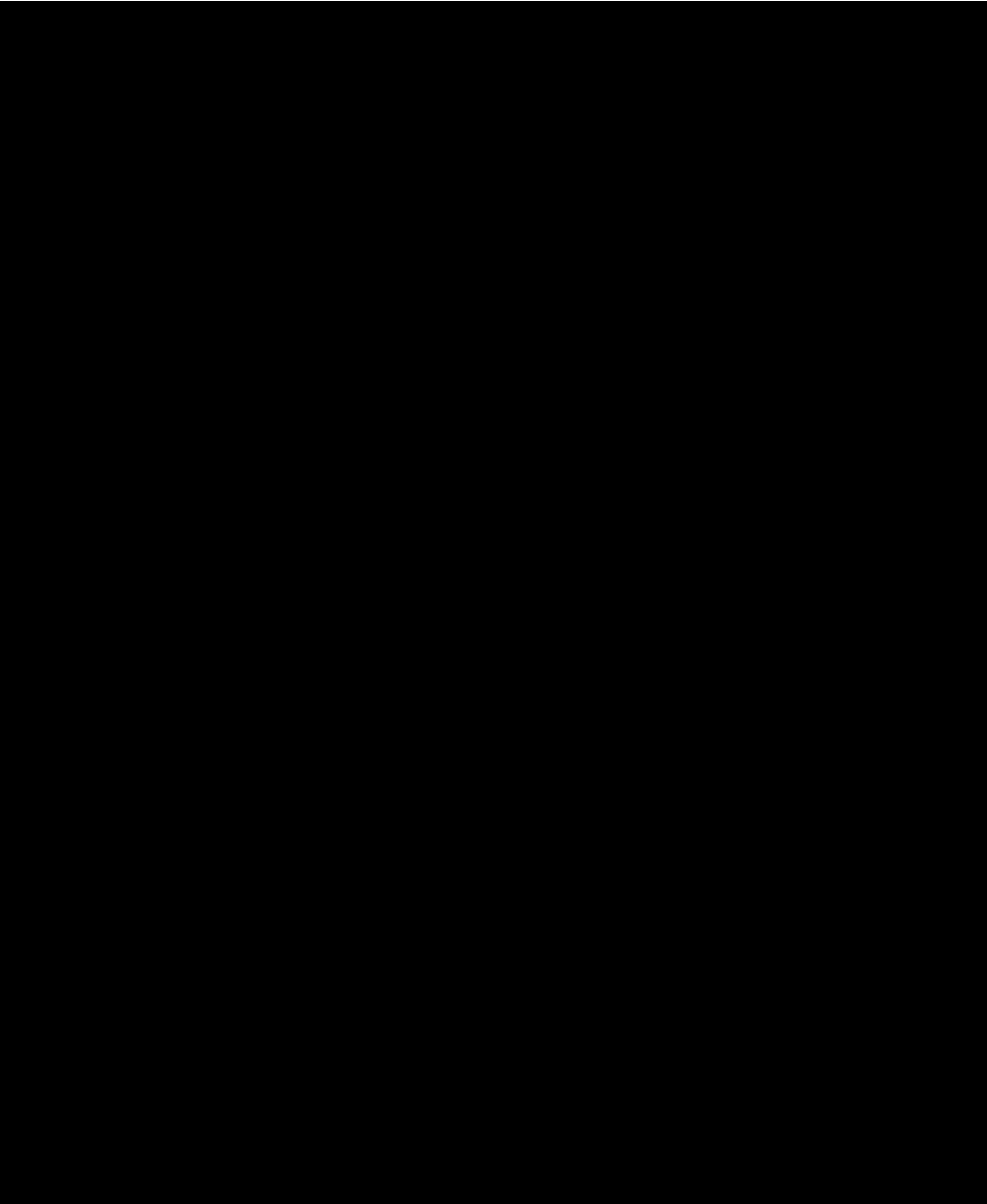
Appendix D: CAISO Settlement Issues

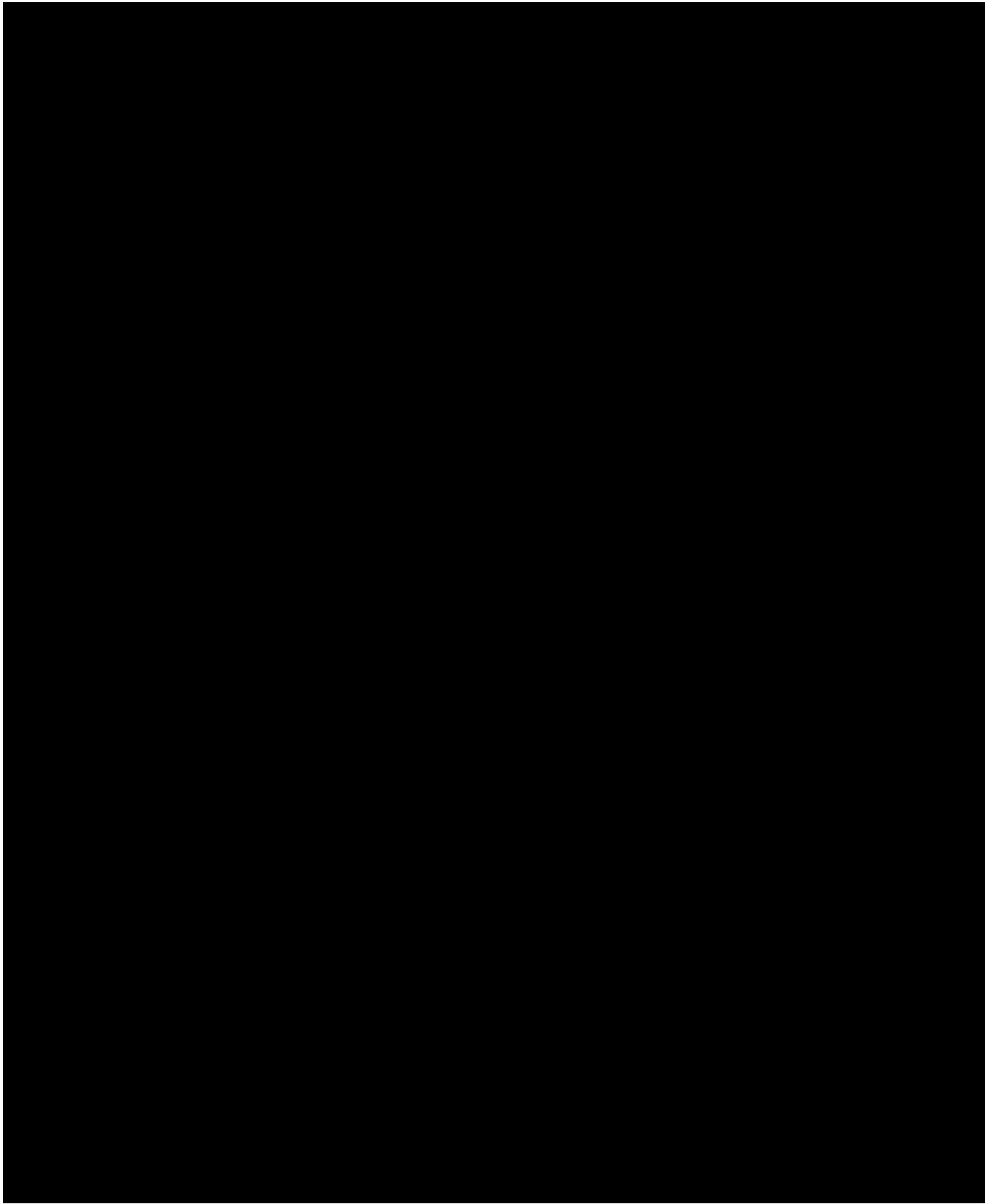
Table 7 below includes events where the CAISO did not pay for any performance in the 55B statement. Olivine started tracking the clawbacks in June 2015. Most of these are due to failure to process DRS data, but there are also several events that did not get entered in DRS. Some of these events also have performance different from what was calculated in DRS, due to differing baselines from a combination of missing events and improper holiday treatment. The 9M to CAISO reflects the 9M settlement in response to disputes submitted to Olivine. A negative value indicates that Olivine received payments relating to the dispute. The 9M values are broken out by day, but not by resource. The “clawback amount” is the dollar value charged to Olivine in the 55B statement. The performance is the total load reduction divided by the total award quantity. The adjusted dollar value is the clawback amount multiplied by the percent performance.

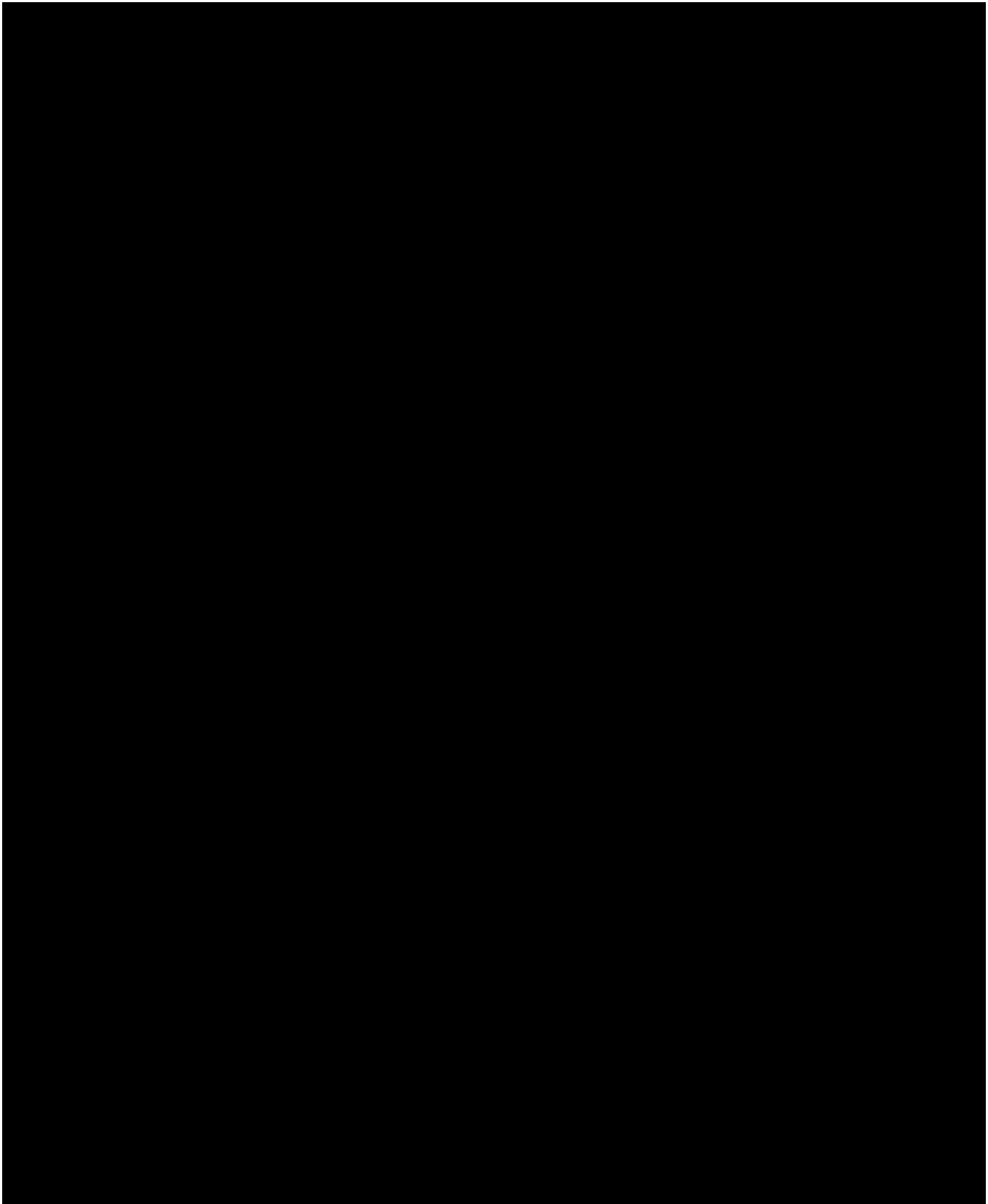


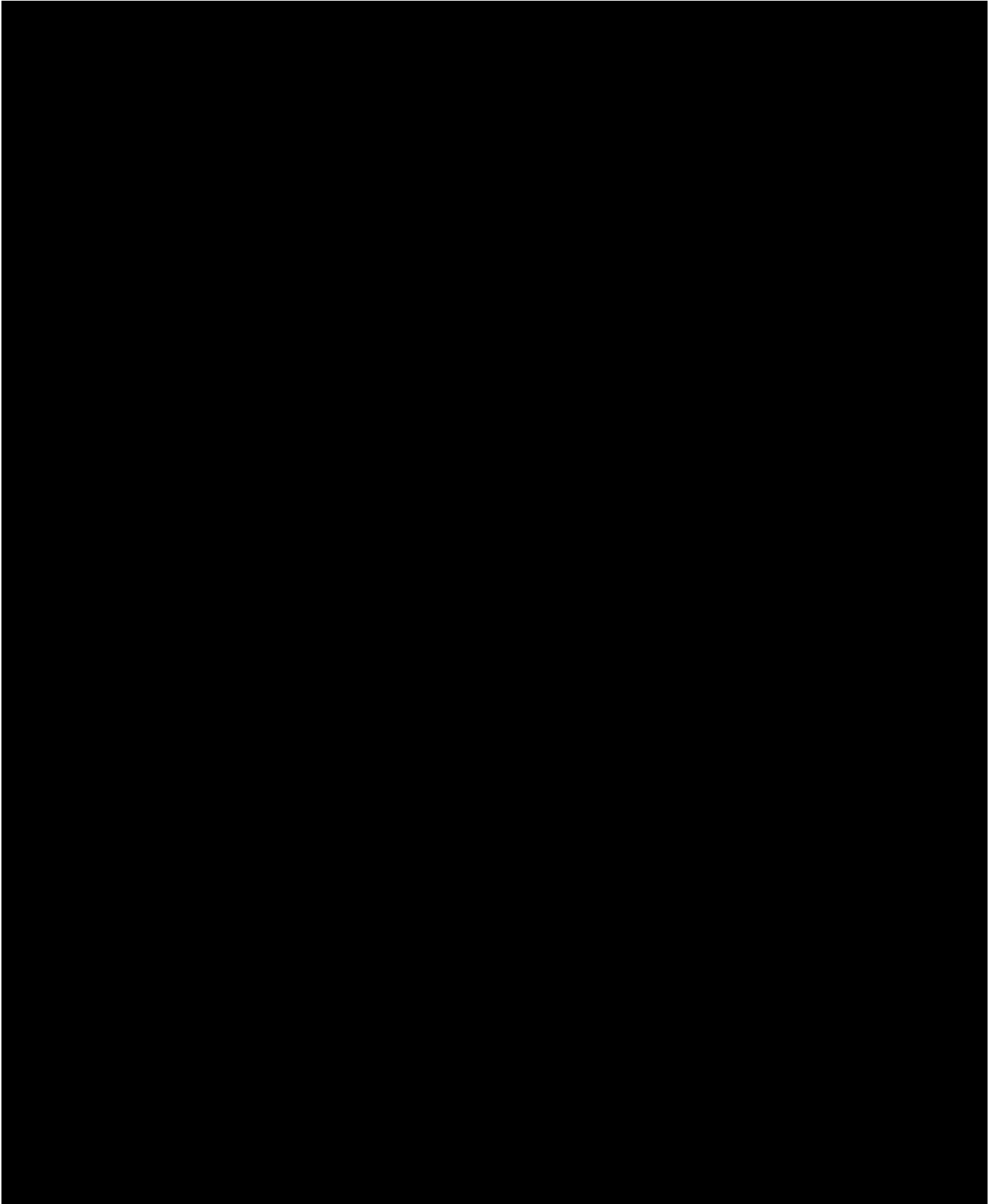
¹⁵ Merged cells indicate that this was not reconciled against individual resources.











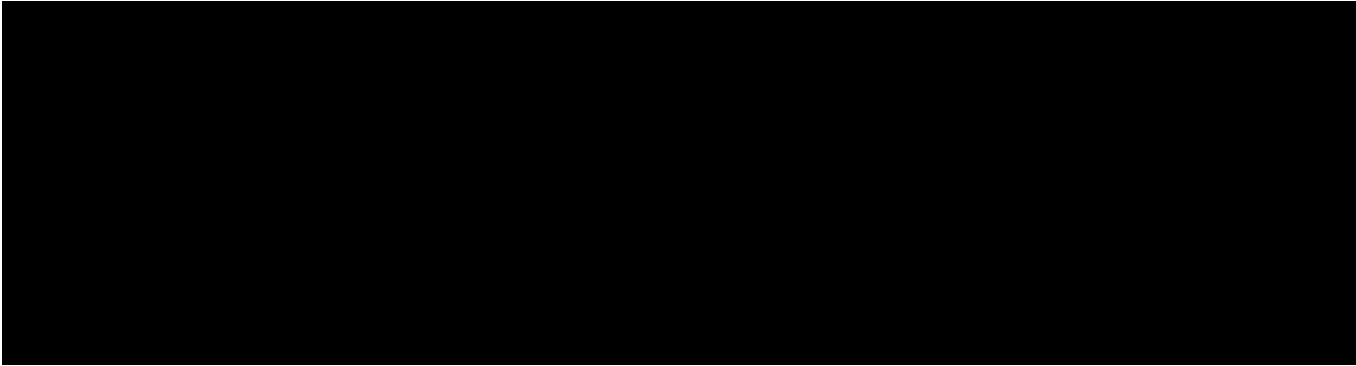


Table 8 includes partial clawbacks only. The clawback amount is multiplied by the performance and the percentage clawback to get to the adjusted dollar value.

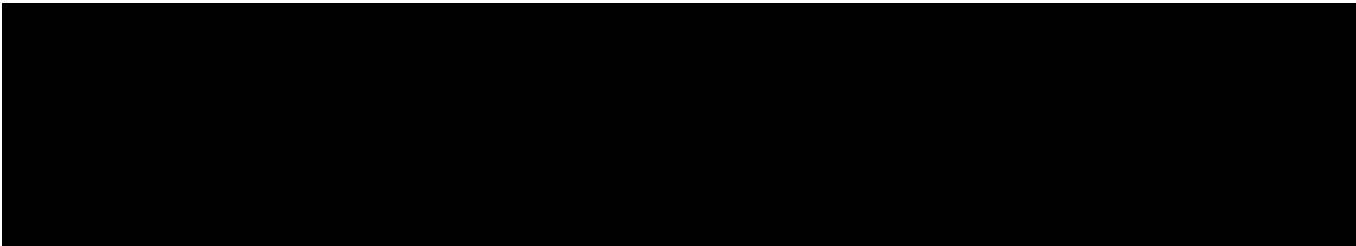


Table 8: Partial 55B Clawbacks

Table 9 includes partial clawbacks where the CAISO properly processed DRS results, but due to the reasons listed in column 3, did not end up with the correct baseline. The adjusted value is the clawback amount multiplied by the difference between the event performance and DRS performance. It is negative when the CAISO's calculated event performance is greater than Olivine's calculated performance.

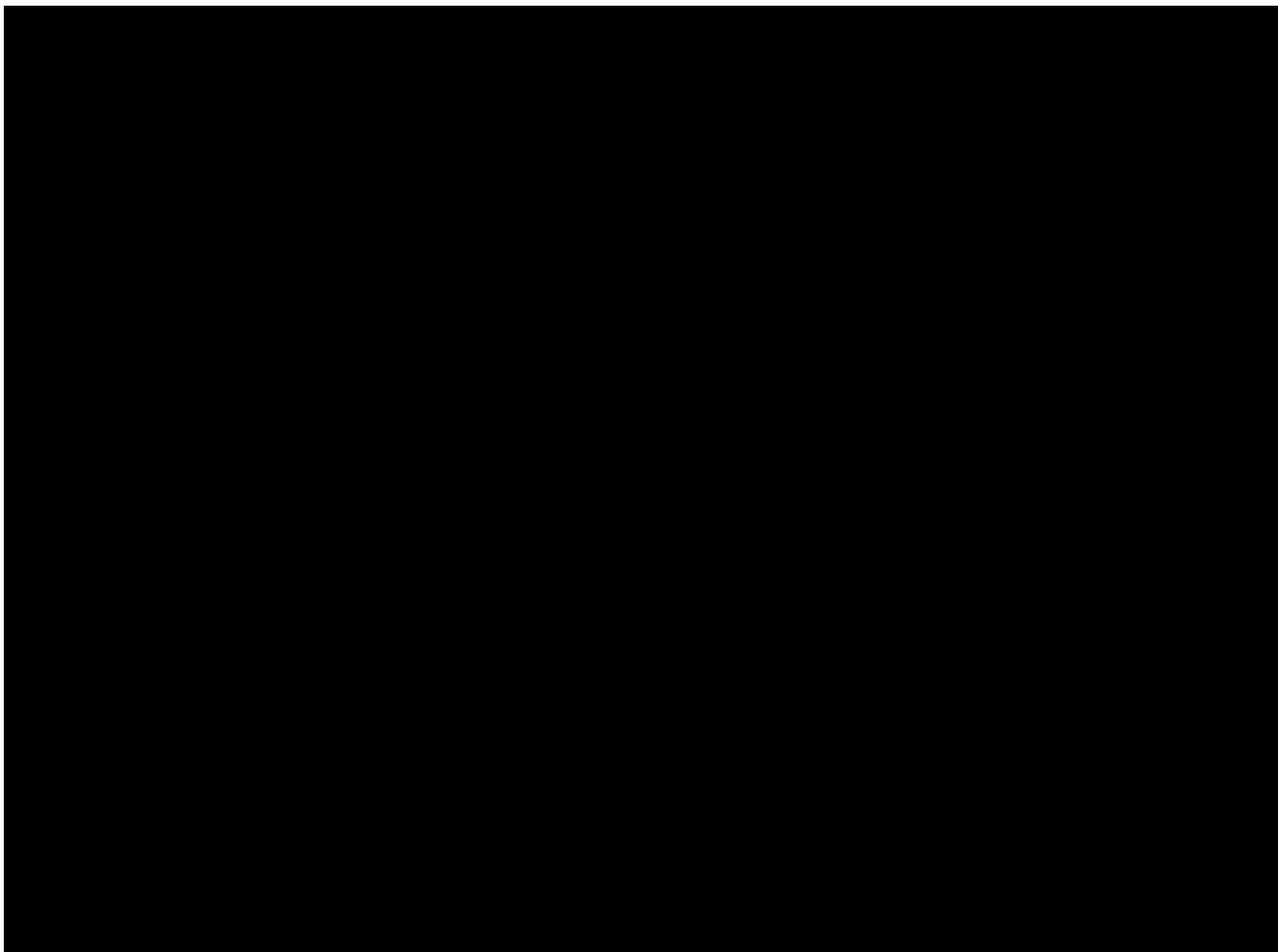
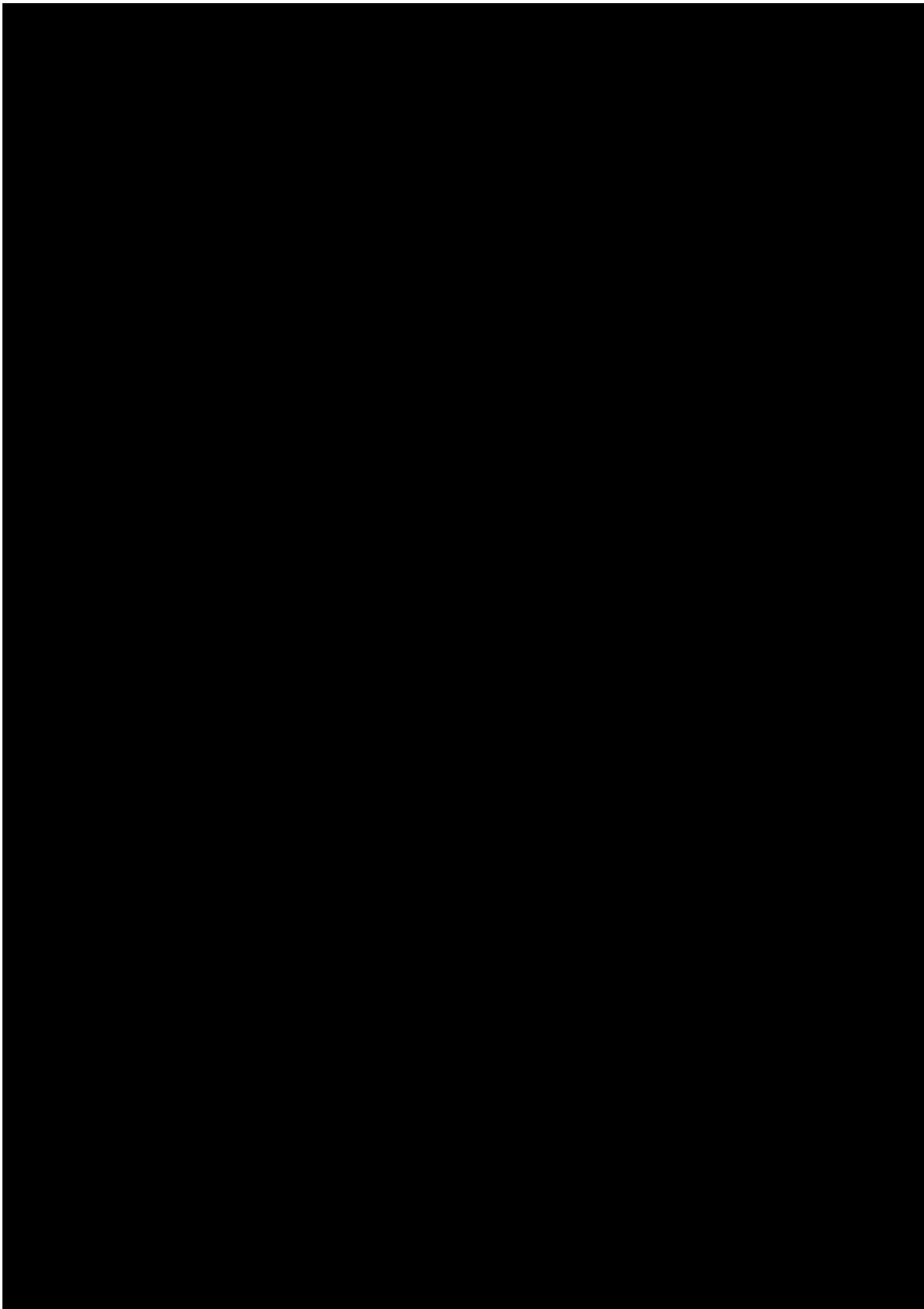


Table 9: Incorrect Baseline Adjustments due to Missing Events

Table 10 includes a summary of incorrect event start times in the CAISO DRS.



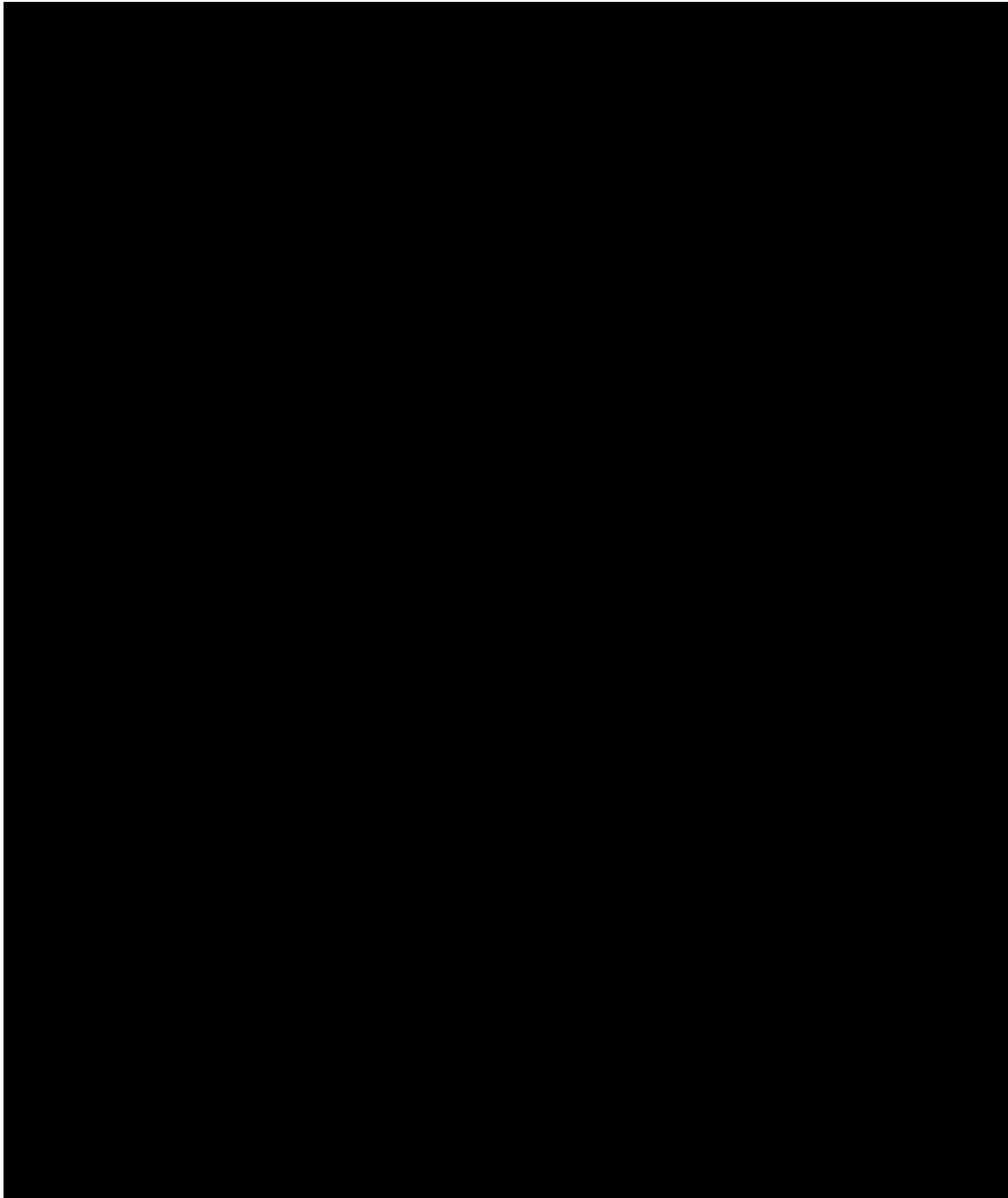


Table 10: Incorrect Event Start Times