



California Public Utilities Commission

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Guide to CPUC's Load Impact Protocols (LIP) Process

Version 4.0

Table of Contents

A.	Introduction and Purpose of This Guide.....	1
B.	Background.....	2
C.	Best Practices for LIP Filings.....	6
D.	Filing Schedule for LIP Reports	15
E.	Quarterly Testing Requirements.....	17
F.	Process for Updating DR Resource QC During RA Compliance Year.....	19
G.	Resource Adequacy Year-Ahead Net-Qualifying Capacity (NQC) Filings	21
H.	Using Templates	22

Tables

Table 1: Schedule for Obtaining DR QC Through the LIP Review Process.....	15
Table 2: Schedule for Submitting Bi-Annual Updates for Qualifying Capacity	20
Table 3: Sample Table Generator	23

A. Introduction and Purpose of This Guide

The Guide to the California Public Utilities Commission's (CPUC's) Load Impact Protocols (LIPs) Process (Guide) is a compilation of the Energy Division's interpretation of the CPUC's Decisions in Resource Adequacy (RA) and Demand Response proceedings. This Guide is intended to serve as a convenient reference point for Demand Response Providers (DRPs) and Load Serving Entities (LSEs) interested in seeking Resource Adequacy (RA)-eligible Qualifying Capacity (QC) for their Demand Response (DR) resources.

A key step in the determination of RA-eligible QC of DR resources is a review by Energy Division, in collaboration with California Energy Commission staff, of applicable CPUC policies and the LIP data to establish the load impact levels that could be counted for reliability. RA is one of the most important responsibilities of the CPUC, as it is the cornerstone program to ensure reliable electricity service to California ratepayers. The RA rules set by the CPUC and the California Independent System Operator only function if it is demonstrated that resources with assigned capacity values are, in fact, able to perform. Pursuant to Decision 08-04-050,¹ the CPUC delegated authority to Energy Division to establish the DR capacity that can be counted on with confidence for RA.

This Guide is updated periodically to reflect current Decisions and requirements. Although the Guide is organized for quick reference, the filing party is encouraged to review the Guide *and* the actual Load Impact Protocols in their entirety to become familiar with the requirements. To the extent that this Guide may be incomplete or may not address a particular issue, the reader is encouraged to consult the related CPUC Decisions.

This Guide is now being revised as version 4.0 with updates for the 24-hour slice-of-day methodology for RA-year 2025. The updates incorporate the changes made in D.23-06-029 and the 2023 discovery of relevant language from D.10-06-036. D.10-06-036 eliminated some of the LIP requirements, however some of the data is essential to enable independent review and verification of the LIP filings. As such, ED staff requests that the necessary data still be included in the LIP report filings.

Inquiries related to the Load Impact Protocols, applicable DR policies, or this Guide can be directed to Andrew.Magie@cpuc.ca.gov, Rebekah.Daniel@cpuc.ca.gov, and LoadImpactProtocolsInfo@cpuc.ca.gov.

¹ D.08-04-050, Protocol 27, 10.4 at 148-149: "Joint Staff (CPUC and CEC) is responsible to resolve any disputes that arise related to evaluation plans or evaluation results. For example, if a party disagrees with a chosen baseline method for evaluation of a particular program, the Joint Staff should have the authority to decide how to resolve it. Elevating these types of technical disputes to the Commission will be too time-consuming and these technical disputes do not need formal venues such as advice letters for resolution."

B. Background

The Load Impact Protocols (LIPs) and the LIP filing requirements to estimate ex-ante Qualifying Capacity (QC) and establish RA-eligible QC for DR resources were adopted by [D.08-04-050](#),² which prescribe a set of guidelines for estimating the load impact (or load change) resulting from DR activities. These guidelines established a consistent method for measuring program performance across DR resources on ex-post basis and for forecasting anticipated performance (or available capacity) on ex-ante basis. Additionally, the resulting capacity estimates are used to analyze the cost-effectiveness of DR programs managed by the IOUs and for other CPUC activities such as the RA framework and long-term integrated resource planning.

The LIPs define the minimum data outputs needed to understand the impact of a DR resource and statistical measures to assist in determining the accuracy of these impact estimates. The LIPs allow flexibility on the part of the load impact evaluators to choose methodologies which are both feasible for and suitable to the type of DR activity or program being analyzed. The protocols allow the evaluators to define any additional purposes and needs of a particular evaluation beyond the minimum required data. To the extent appropriate, the protocols provide direction and guidance on what methods might be appropriate in different situations and raise issues that evaluators should consider when choosing their methods.

The LIP filing requirements were subsequently modified by [D.10-04-006](#),³ which required parties to submit all LIP-associated filings to the Energy Division and to serve them to parties of the specified service list, instead of filing to the proceeding. It also established the IOU Executive Summary and Summary Tables filing requirements.⁴

After two years of LIP filings, [D.10-06-036](#) modified several protocols, including eliminating the requirements for uncertainty adjusted impact percentiles to be presented in the ex post or ex ante tables, 1-in-10 weather scenario, typical event day, average weekday, et al.⁵

As directed by [D.14-03-026](#), DR resources bid into the CAISO's wholesale market are considered supply-side DR resources (SSDR). These resources can be

² "Decision Adopting Protocols for Estimating Demand Response Load Impacts," in R.07-01-041. The Load Impact Protocols themselves can be found in the D.08-04-050 Attachment A here: https://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/81979.PDF.

³ "Decision Modifying Demand Response Load Impact Report Annual Filing Requirements," in R.07-01-041.

⁴ D.10-04-006, Appendix 1.

⁵ D.10-06-036, Appendix B.

counted for RA and receive RA capacity payments, accompanied by a Must-Offer Obligation.

In [D.16-06-045](#), the CPUC granted a temporary exemption from the LIPs for all market-integrated DR resources that were being bid into the market by third-party DRPs for the 2017-2019 RA compliance years. During that period, contract capacity was used in lieu of LIPs, to establish RA-eligible QC values for the above resources.

In [D.19-06-026](#),⁶ the CPUC recognized the expiration of this exemption and noted that LIPs were once again required for determination of QC values for all market-integrated DR resources, whether third-party DRP-, IOU-, or LSE-managed, except for DR resources participating in the Demand Response Auction Mechanism (DRAM) pilot in 2020-2023, where an alternative capacity counting method is in place.⁷

In the Fall of 2019, the Energy Division initiated a LIP process for third-party DRPs, in addition to the IOUs, to obtain RA-eligible QC values for their DR resources through LIP filings beginning in 2020. Based on comments from parties, the Energy Division released an updated LIP schedule and requirements on January 3, 2020.

On February 2, 2020, the Energy Division clarified that, for any current or future LSE solicitations for market-integrated DR capacity, the LIPs for the DR resources being bid into the solicitation need not be completed prior to the solicitations. However, after the solicitation, all contracted RA capacity on the year ahead and month ahead CPUC RA filings must be supported by the Energy Division-approved QC values established for the contracted year (N) via a completed LIP process in the prior year (N-1).

In [D.20-06-031](#),⁸ the CPUC adopted a process to update the QC of market-integrated DR resources up to two times a year to reflect changes in customer enrollments *during* the RA compliance year, provided that the requested changes vary by more than 20 percent, or 10 MW, whichever is greater.

D.20-06-031 also established testing and dispatch requirements for “all third-party DR resources procured by non-IOU LSEs.” These resources “must demonstrate response over a four-hour period on a quarterly basis.”⁹

⁶ “Decision Adopting Local Capacity Obligations for 2020-2022,” in R.17-09-020.

⁷ D.19-06-26 at 41-42.

⁸ “Decision Adopting Local Capacity Obligations for 2021-2023, Adopting Flexible Capacity Obligations for 2021, and Refining the Resource Adequacy Program,” in R.19-11-009.

⁹ D.20-06-031, 3.5.1.1 Discussion, at 40.

D.20-06-031 also directed a re-formation of the Supply Side Working Group (SSWG) to “(1) define the details of the biannual process; (2) further study the LIPs and potential enhancements to improve the accuracy, transparency, and applicability of the methodology; and (3) re-evaluate the QC update threshold (20 percent, 10 MWs) for potential future updates.”¹⁰ The Decision directed the SSWG to submit its recommendation for items (2) and (3) into Track 4 of R.19-11-009.

For item (1), the Energy Division and the California Efficiency and Demand Management Council (CEDMC) each submitted a proposal on the bi-annual QC update process on October 15, 2020. On October 19, 2020, Energy Division held a SSWG meeting, after which the CEDMC submitted a revised proposal on October 19, 2020.

On February 10, 2021, the Energy Division released the final process and schedule for the QC update process for filing year 2021 as part of this Guide (version 1.0). The Guide was subsequently updated on May 7, 2021. Later, version 2.0 was issued December 20, 2021.

In [D.21-06-029](#), the CPUC requested the California Energy Commission (CEC) “to develop recommendations for a comprehensive and consistent measurement and verification (M&V) strategy, including a new qualifying capacity (QC) counting methodology for demand response (DR) resources addressing ex post and ex ante load impacts for implementation as early as practicable.”

The CEC was also “requested to launch a stakeholder working group process in the 2021 Integrated Energy Policy Report (IEPR) and make actionable recommendations... no later than March 18, 2022.”¹¹ In July 2021 the CEC opened [Docket 21-DR-01](#) in response to the above request, to work on a new methodology.¹² The CEC Working Group, called the CEC Supply-Side Demand Response (SSDR) QC Working Group, released its report in Dec 2022.¹³ The CEC report was presented to the RA proceeding in February 2022. The report indicated that there was insufficient time to develop a permanent QC methodology for the 2023 RA year. The Commission acknowledged the report findings and found insufficient record to adopt a DR QC counting proposal for the 2023 RA year.

The Commission determined that the CEC Working Group should continue to develop long-term recommendations, consistent with the adopted Reform Track

¹⁰ OP 16 at 93-94, “Decision Adopting Local Capacity Obligations for 2021-2023, Adopting Flexible Capacity Obligations for 2021, and Refining the Resource Adequacy Program,” in D.20-06-031.

¹¹ D.20-06-029, OP 11, at 77. Seven issues were identified to be discussed in the stakeholder working group. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M389/K603/389603561.PDF>.

¹² CEC Docket 21-DR-01.

¹³ D.23-06-029, at 80.

Lyon, Erik, Tom Flynn, and Daniel Hills-Bunnell. (2022) “Qualifying Capacity of Supply Side Demand Response Working Group Final Report.” Publication #CEC-200-2022-001-F. Download the CEC WG report here: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=248493&DocumentContentId=82959>

framework, and those recommendations should focus on the 2025 RA year and beyond.¹⁴

The CEC restarted the Working Group and submitted its report in February 2023 including several proposals and CEC's recommendation. The Commission declined to adopt any of the new proposals and maintained the LIPs as the supply-side DR QC methodology while authorizing Energy Division to lead a Working Group, with support from CEC Staff, and submit a joint proposal in the RA proceeding for an incentive-based supply-side DR QC methodology in December 2024.¹⁵ Working Group held meetings in 2023 and CEC and CPUC staff are currently evaluating the QC proposal with test and historical data.

In [D.22-06-050](#), the CPUC clarified the quarterly testing report requirements and moved the RA measurement hours during the months of March and April from 4-9 PM to 5-10 PM. May was reclassified by CAISO as a spring month instead of summer, also moving its RA measurements hours from 4-9 PM to 5-10 PM.¹⁶ In addition, the CPUC established that RA Compliance Year 2024 (FY 2023) would be considered a "test year" for the 24-hour slice-of-day framework.

[D.22-08-039](#) found it reasonable to use the existing LIP methodology for the 2024 RA test year. However, the CPUC recognized that LSEs would need further guidance on how to utilize the LIP outputs under the 24-hour slice-of-day framework, and parties were directed to submit proposals in Workstream 2 of R.21-10-002.¹⁷ This process resulted in [D.23-04-010](#), which made updates to the DR RA counting methodology under the 24-hour slice-of-day framework for the 2024 RA test year.

[D.23-06-029](#) authorized two parallel working groups (WGs) led by Energy Division staff. The first would take over the work started in the CEC SDR QC WG to refine elements in the CEC's incentive-based supply-side DR QC proposal by December 2024.¹⁹ The second WG would propose how to simplify the load impact protocols using a stakeholder process²⁰ by January 19, 2024.²¹ Both WGs were scoped into R.23-10-011, the new RA proceeding.²²

¹⁴ D.22-06-050

¹⁵ D.23-06-029

¹⁶ D.23-06-029, OP 5, at 136.

¹⁷ D.22-08-039, OP 2-3, at 15.

¹⁹ D.23-06-029, OP 23, at 143-144.

More information about the SDR QC WG can be found here: <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/demand-response-workshops>. Or email David.Oliver@cpuc.ca.gov.

²⁰ D.23-06-029, COL 17, at 134.

For more information about the LIP Simplification WG, please email Andrew.Magie@cpuc.ca.gov and LoadImpactProtocolsInfo@cpuc.ca.gov.

²¹ [Order Instituting Rulemaking R.23-10-011](#), at 6.

²² [Order Instituting Rulemaking R.23-10-011](#), preliminary scoping issue 6, at 5.

C. Best Practices for LIP Filings

Procedural

1. Follow all filing deadlines, content requirements, and reporting templates as directed in [Protocols 26 and 27](#).
2. The evaluation protocols for all DR resources are defined in the LIPs. Alternative methods to calculate LIPs are outside the scope of this document. Proposals for alternative methods should be filed in the relevant proceeding to obtain CPUC approval.
3. Consistent with reporting requirements established in Ordering Paragraph (OP) 4 of [D.08-04-050](#), parties must submit their LIP-associated filings to the Energy Division and serve the files to the relevant service lists and to the Demand Response Measurement Committee (DRMEC).²³ Filings containing confidential information²⁴ can be served to the [Energy Division's KiteWorks Secure File Transfer Protocol \(SFTP\)](#) website by emailing them to LoadImpactProtocolsInfo@cpuc.ca.gov.

Data Requirements

1. Meeting the minimum data and analysis requirements is a pre-requisite for establishing confidence in the LIP Final Report:
 - a. Follow the LIP guidance on how to control for uncertainty that may result from the estimation methods and/or underlying variables when conducting evaluations (for example, appropriate sample sizes, sampling strategy, etc.).²⁵
 - b. Understand that the goal of impact estimation is to establish a causal relationship between the DR resource and the load impact.

²³ The service lists are R. 21-10-002, A. 17-01-012, and the DR and RA proceedings current to the LIP filing year (RA: R. 23-10-011. DR: A. 22-05-002, et al.). The e-mail for the DRMEC is drmec@calmac.org. The emails for Energy Division are Andrew.Magie@cpuc.ca.gov, Rebekah.Daniel@cpuc.ca.gov, and LoadImpactProtocolsInfo@cpuc.ca.gov.

²⁴ Including materials that contain proprietary, market-sensitive information.

²⁵ Protocol 5, Section 4.1.2: "The mean change in energy use per year shall be reported for the average across all participants and for the sum of all participants on a DR resource option for each year over which the evaluation is conducted."

And Protocol 6: "Estimates shall be provided for the 10th, 30th, 50th, 70th and 90th percentiles of the change in energy use in each hour, day and year, as described in Protocols 4 and 5, for each day-type and level of aggregation described in Protocol 8."

- c. When creating a control group is not possible, utilize probability distributions associated with key drivers of the resource and reasonable assumptions, as prescribed by the LIPs.²⁶
2. All ex-post measurements or ex-ante projections of DR resource capacity or energy must be reported as measured at the premise meter level and exclude any adjustments for loss factors or Planning Reserve Margin (PRM).
3. Ex-ante and ex-post table generators must provide a breakdown for each hour according to each Local Capacity Area (LCA) matched to sub-Load Aggregation Points (sub-LAPs) at both the program and portfolio levels.
 - a. For ex ante, this is only required for August of each year if the DRP/IOU is not asking for local RA.²⁷
 - b. For ex post, each day on which an event was called, average across all participants notified on each event day, and the total of all participants notified on each event day. Because this data is still essential to build out regression models for ex ante, ED requests it still be communicated in the table generators despite D.10-06-036.²⁸
4. Ex-ante table generators must provide projections under both CAISO and utility 1-in-2 weather conditions.²⁹ CAISO and utility 1-in-10 weather conditions are not required.³⁰
5. All ex-post and ex-ante tables must include a separate tab containing the raw data inputs that inform the table generators.
6. At minimum for consistency, all data referenced and analysis discussed within the LIP narrative must be based on IOU 1-in-2 weather conditions, portfolio level impacts, and medium enrollment scenario (if multiple growth scenarios are presented). Optionally, additional data/analysis based on other scenarios could be included if desired.
7. In the ex-ante section of the LIP report (as well as the table below), the customers (meters) who are expected to provide the ex-ante projected capacity (associated with the DR program for which the RA-eligible QC is

²⁶ Protocol 16, Section 6.1: "For regression based methods, the following statistics and information shall be reported: (1) Adjusted R-squared or, if R-squared is not provided for the estimation procedure, the log-likelihood of the model, (2) Total observations, number of cross-sectional units and number of time periods, (3) Coefficients for each of the parameters of the model, (4) Standard errors for each of the parameter estimates, (5) The variance-covariance matrix for the parameters, (6) The tests conducted and the specific corrections conducted, if any, to ensure robust standard errors, (7) How the evaluation assessed the accuracy and stability of the coefficient(s) that represent the load impact."

²⁷ D.10-06-036, Appendix B, at 22.

"In order for DR programs to receive local capacity credit for RA, the load impact must be broken down by local areas. However, this breakdown is not required for all months – it is only required for August."

²⁸ D.10-06-036, Appendix B, at 19.

²⁹ Per Protocol 22, Section 6.1

³⁰ D.10-06-036, Appendix B, at 20 & 21.

"Protocol 22 requires the use of 1-in-2 weather year for the monthly system peak day. The 1-in-10 weather year... for each month are not needed for QC calculation."

being requested) in a specific month must be distinct from and incremental to the customers counted by the DR Provider for any other DR program commitments (such as, DRAM, IOU CBP/BIP, other DR procurement contracts) in the same month. In other words, the ex-ante projection must represent any ONE of the following categories (but not blend multiple categories):³¹

- a. DRAM (Demand Response Auction Mechanism)
 - b. IOU CBP (Capacity Bidding Program)
 - c. IOU BIP (Base Interruptible Program)
 - d. IOU API (Agricultural-Pumping Interruptible)
 - e. Other IOU procurement contracts for supply-side DR as RA
 - f. Non-IOU LSE procurement contracts for supply-side DR as RA
8. Only 3 years are required to be projected in ex ante for RA QC. E.g., Filing Year 2024 would only need to project program years 2025-2027.³²
 9. The narrative should include a table with the monthly ex-ante values under IOU 1-in-2 worst day weather scenario for the 12 months of the RA compliance year.
 10. Typical event day and average event day per month are not required to be calculated in ex ante.³³

Executive Summary Requirements (Third Party DRP requirements)

1. The following summary information must be included within the first page of the Executive Summary of the LIP report (please include additional rows for each local area and repeat the table as needed if the report data is separated for different or program types – such as, battery vs. HVAC):

Ex-Ante Projections for Qualifying Capacity (Insert Year Here) Under 1-in-2 Utility Weather Conditions						
As of August	Scenario #1		Scenario #2		Scenario #...	
Local or System Capacity Allocation	Number of Customers (meters)	MWs	Number of Customers (meters)	MWs	Number of Customers (meters)	MWs
(If local, state the utility name; if system, state the TAC area ³⁴)						

³¹ "Distinct from and incremental to" ex ante capacity is known as "program ex ante" as opposed to "portfolio ex ante"
³² D.19-02-022, OP 8. "A minimum three-year forward duration shall be the required duration adopted for the multi-year local resource adequacy program."
³³ D.10-06-036, Appendix B, at 20 & 21.
 "typical event day, or an average weekday for each month are not needed for QC calculation."
³⁴ [Transmission Access Charge](#) area

2. In case of LIP reports for DR resources contracted with non-IOU LSEs, the executive summary must include a section with a summary of key program attributes of DR contracts with non-IOU LSEs related to resource availability (# of hours in a day/month/year, min/max limits on number of dispatches/events, consecutive days, days of the week), performance obligations, energy and capacity invoicing and payment terms, and penalties for under performance or not meeting commitments.

3. Third-party DRPs should include the following information in the report's executive summary, as well as in a separate tab in the ex-ante table generator (*MWs should exclude any adders or adjustments*):

	DRP (below) = Third-party DRP ³⁵	2020	2021	2022	2023	2024	2025
1	Total August capacity awarded to DRP by the IOUs under DRAM						
2	Total August DRAM capacity shown by the DRP on month-ahead supply plans					N/A	N/A
3	Total August customer (meter) enrollment (related to #2 above) estimated by the DRP in the month-ahead supply plans					N/A	N/A
4	How much of the August DRAM capacity in #2 above was invoiced by the DRP as Demonstrated Capacity (%)					N/A	N/A
5	Total August customer (meter) enrollment (related to #4 above) estimated by the DRP in the year-ahead supply plans (submitted in October of the prior year)						N/A
6	Total August DR capacity contracted by the DPR with non-IOU LSEs						
7	Total August capacity (related to #6 above) shown by the DRP on month-ahead supply plans***						N/A
8	Total August customer (meter) enrollment (related to #6 above) estimated by the DRP in month-ahead supply plans***						N/A
9	Total August capacity nominated (or to be nominated) by the DRP into the IOU CBP						
10	Total August capacity enrolled (or to be enrolled) by the DRP into IOU BIP						

³⁵ As a reminder, the non-IOU LSE MW must be incremental for all other commitments per Executive Summary Requirements point #2.

11	Total DR August capacity contracted by the DRP under other IOU procurement programs (as of April of the filing year)						
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***for 2024, report April supply plan

Analysis

1. The Protocols require a forecast exercise using the relevant Utility's 1-in-2 and 1-in-10 weather scenarios. To obtain these scenarios, please contact the following:
 - PG&E: Neil Yazma (NXYR@pge.com).
 - SCE: Nery Navarro (nerly.navarro@sce.com), Yi "Louie" Liu (yi.liu@sce.com), and Jake J. Hoffman (Jake.1.Hoffman@SCE.com).
 - SDG&E: Leslie Willoughby (leslie.willoughby@sdge.com) and Lizzette Garcia-Rodriguez (lgarcia-rodriquez@sdge.com).
2. A reference load measured at the premise level should attempt to establish a causal relationship between a load reduction and the dispatch of a DR event.³⁶
3. If estimates are needed for scenarios that differ from those that have already occurred, refer to the guidance on alternative methods and explain them.³⁷
4. Current (2024 and beyond) "measurement hours" are 4-9 PM in all months except March-May, which are 5-10 PM.³⁸
5. 24-Hour Slice-of-Day Requirements: A four consecutive hour dispatch is required in ex ante within Availability Assessment Hours (AAH) on the "worst day"³⁹ of each month unless the DR resource is required by contract or tariff to be capable of dispatching for more than four hours (if more than four, ex ante must include all of AAH).⁴⁰
 - a. The value of DR resources will vary by hour based on the resources' capabilities, and the LSE will show DR availability in the same hours that were used in ex ante LIP filing.⁴¹
 - b. Snapback effects must be included in the ex-ante LIP filings but will not be reflected in RA capacity counting.⁴²

³⁶ For example, an energy dispatch from a storage device could be responding to time-of-use management, instead of a DR event. Alternately, a premise's load may increase, which would reduce the portion of the load measured from the storage device. In either case, direct metering would not be able to establish causality.

³⁷ Protocol 16, Section 6.1

³⁸ D.23-06-029, OP 5.

CPUC's RA "Measurement Hours" were modified to align with CAISO's "Availability Assessment Hours."

³⁹ Per D.22-06-050, Appendix A, at 1: "The "worst day" is defined as the day of the month that contains the hour with the highest coincident peak load forecast."

⁴⁰ D.23-04-010, OP 11.

⁴¹ D.23-04-010, OP 11.

⁴² D.23-04-010, OP 11.

6. Distribution Loss Factor (DLF) adder will be retained and used during the 2024 RA test year and beyond.⁴³
7. The Transmission Loss Factor (TLF) and PRM adders were eliminated starting in the 2024 RA compliance year.⁴⁴

New DR Resources

1. If submitting a study on new DR resources, the filing party may reference the available data that best approximates the anticipated performance of the new resources, either published data or the historical performance of similar resources operated by the filing party.⁴⁵
2. When proposing new market integrated DR resources, a preferred practice is for the DRP to conduct pilots or participate in a Utility program as an aggregator to establish market dispatch history that is specific to California.
3. Day matching and regression methods are preferred over engineering analysis, especially if there is sufficient ex post data. “[E]ngineering analysis is much less useful for estimating the impacts associated with most DR resources because impacts are driven much more by consumer behavior than by technology implementation.”⁴⁶

Data Quality Considerations

1. If no data exists, follow the guidelines on how to turn unobservable characteristics into observable ones.⁴⁷
2. When sufficient data from the DR resource for the LIP filing doesn’t exist, considerations as to whether alternative data planned to be use are “reasonable.”
 - a. California data should be used unless all other options are exhausted.
 - b. Only like-for-like comparisons should be made. E.g., a resource previously performing under a BIP tariff is unlikely to have the same performance in a CBP-like program.

⁴³ D.23-04-010, OP 12.

⁴⁴ D.23-06-029, OP 27: “The Transmission Loss Factor adder and the Planning Reserve Margin adder for demand response resources are removed beginning with the 2024 Resource Adequacy compliance year and for the 2024 slice-of-day test year.”

⁴⁵ Protocol 17, Section 6.1: “Whenever possible, ex ante estimates of DR impacts should be informed by ex post empirical evidence from existing or prior DR resource options. Evidence from resource options and customer segments most relevant to the ex ante conditions being modeled should be used, regardless of whether they come from the host utility or some other utility. If ex post estimates or models are not used as the basis for ex ante estimation, an explanation as to why this is the case shall be provided.”

⁴⁶ Protocols 10-11, Section 4.2.2, at 77.

⁴⁷ Protocol 16, Section 6.2.2.

3. If, per the evaluator's determination, the existing data is not sufficient, document the differences and explain why the estimation was not possible.⁴⁸
4. Ideally, to establish confidence in a DR resource's ability to meet the minimum RA requirements: 1) the ex-post data should include evidence of load impacts sustained over multi-hour events, multiple times per year, under different conditions, including performance over RA measurement hours and three consecutive days, with 2) ex-ante data that includes fatigue considerations.
5. In building the ex-ante regression model from the ex-post data, a weighted regression model should be used which weights events with much larger sample sizes and smaller confidence intervals over events with small sample sizes.
6. Ideally, a performance track record of DR resources should be developed through the LIP reports over the years, so that subsequent LIP filings can more accurately project future performance.
 - a. When possible, the report should discuss how discrepancies between prior ex-ante forecast submitted two years ago and last year's actual performance reported in the current filing are being addressed to increase confidence in the latest ex-ante projection in the current filing.
 - b. When the current resource portfolio is substantially different (such as, enrollment, end use load type, total capacity achieved) from that assumed in the prior ex-ante projection, the current LIP filing should explain these differences.

Third-Party DRP Contract and Market Participation

1. DRPs may enter into a contract with an LSE that is not subject to the Central Procurement Framework⁴⁹ for three years of Local Resource Adequacy based on the Qualifying Capacity (QC) assigned to them for the first year.⁵⁰
2. Consistent with the Energy Division Guidance on applying LIPs to [IRP Solicitations](#) released on February 18, 2020, LIPs for the DR resources being bid into the solicitation need not be completed prior to the solicitations. However, subsequent to the solicitation, all contracted RA capacity on the year ahead and month ahead CPUC RA filings must be supported by Energy Division-approved QC values established for the contracted year (N) via a completed LIP process in the prior year (N-1).

⁴⁸ Protocol 17, Section 6.1.

⁴⁹ D.20-06-002 in R.17-09-020, "Decision on Central Procurement of the Resource Adequacy Program."

⁵⁰ The three-year forward Year Ahead local Resource Adequacy requirement was adopted in [D.19-02-022](#). This capacity is granted in the first year is based on the DRP's LIP Final Report filing on April 1, 2020.

Parties offering DR resources into current and future solicitations are advised to complete their LIPs in anticipation of any future solicitations of interest.

3. While the Energy Division is providing the above guidance, it is each DRP's responsibility to ensure that its potential countersigners or partners are aware of potential risks associated with the outcome of the LIP process.

During the RA compliance year, a DRP must not shift resources required to meet DRAM and IOU program commitments to meet non-LSE capacity commitments.

Third-Party DRP Public Vs. Confidential Information

The LIP Simplification WG has asserted there is an unequal playing field between third-party DRPs, as there could be different interpretations of the below requirement established in D.20-06-031.

"The Load Impact Protocol (LIP) reports and qualifying capacity values from a demand response provider's LIP results shall be posted publicly to the maximum extent allowable, while protecting customer privacy and market sensitive information of demand response providers by adhering to the Commission's existing confidentiality policies,"⁵¹

To create a standard reporting of information across providers Commission staff clarifies that the following information shall be made publicly available:⁵²

1. Current customer base: both by industry and load type for ex post

The following information can be redacted from the public report:⁵³

1. Customer forecast scenarios and concomitant rationale
2. All existing confidential information from previous CPUC and California State Decisions and Laws.

CPUC Rule 1.1

In terms of various compliance obligations of LIP report filers and DR providers, the following points are notable:

- In the creation and submission of the LIP report, the CPUC expects filers to follow Title 20, Division 1, Chapter 1: Rules of Practice and Procedure, Article 1, Rule 1.1: "Any person who signs a pleading or brief, enters an appearance, offers testimony at a hearing, or transacts business with the Commission, by such act represents that he or she is authorized to do so and agrees to comply with the laws of this State; to maintain the respect

⁵¹ D.20-06-031, OP 17, at 95.

⁵² These clarifications by ED staff do not supersede any previous confidentiality decisions and state laws, including but not limited to Civ. Code §§ 1798 et seq.; Govt. Code § 6254; Public Util. Code § 8380; D.14-05-016; D.04-08-055; D.06-12-029; Civ. Code §§3426, et seq.; Govt. Code §§ 6254, et seq., e.g., 6254(e), 6254(k), 6254.15; Govt. Code § 6276.44; Evid. Code §1060; D.11-01-036; Civ. Code §§ 1798 et seq.; Govt. Code § 6254; 42 U.S.C. § 1320d-6; General Order (G.O.) 77- M; Govt. Code §§ 6254(k), 6254.15; D.11-01-036; and Govt. Code § 6255(a).

⁵³ Confidential information can be accessed by Joint Staff (CPUC—both ED and Public Advocates—and CEC Staff)

due to the Commission, members of the Commission and its Administrative Law Judges; and never to mislead the Commission or its staff by an artifice or false statement of fact or law.” <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/administrative-law-judge-division/documents/rules-of-practice-and-procedure-may-2021.pdf>

- When utilizing the RA-eligible QC (and the associated enrollment basis) determined through the LIP process for supply plans and CAISO market participation, DR providers are expected to follow CAISO Rules of Conduct 37.3.1.1: “Market Participants must submit Bids for Energy, RUC Capacity and Ancillary Services and Submissions to Self-Provide an Ancillary Service from resources that are reasonably expected to be available and capable of performing at the levels specified in the Bid, and to remain available and capable of so performing based on all information that is known to the Market Participant or should have been known to the Market Participant at the time of submission.” <https://www.caiso.com/Documents/Section37-Rules-of-Conduct-asof-Jan1-2021.pdf>

D. Filing Schedule for LIP Reports

Beginning in 2022, all filing deadlines are the same for IOUs and third-party DRPs.

Table 1: Schedule for Obtaining DR QC Through the LIP Review Process

Filing Requirement (Third-Party DRPs and/or LSEs ⁵⁴)	Deadline for Filing Year 2024+ (RA Year 2025+) ⁵⁵
1. Draft Evaluation Plan distribution to service lists ⁵⁶ and to the DRMEC ^{57,58}	October 30, 2023 – January 2, 2024
a. Stakeholders and DRMEC comment on Draft Evaluation Plan via service lists	15 days after submission of Item 1.
b. Filing Party publishes a summary of comments from the DRMEC and stakeholders, and how they are addressed. ⁵⁹	No date requirement.
2. Draft LIP Report due to service lists, filing to include item 1b ⁶⁰	March 8, 2024
a. Stakeholders, parties, and DRMEC comment on draft LIP Report via service lists	March 22, 2024
3. Final LIP Report due (including responses to comments ⁶¹) via service lists	April 1, 2024
a. Host IOU LIP Report workshop	First week of May 2024
b. Host DRP and SCE LCR LIP Report Workshop	1-2 weeks after first workshop
4. Energy Division DR Section begins review of LIP filings	May 2024
5. Initial RA requirements assigned to Load Serving Entities (LSEs)	June 2024

⁵⁴ Load Serving Entities including Investor-Owned Utilities (IOUs).

⁵⁵ CPUC Rule 1.15: "When a statute or Commission decision, rule, order, or ruling sets a time limit... including the last day. If the last day falls on a Saturday, Sunday, holiday or other day when the Commission offices are closed, the time limit is extended to include the first day thereafter."

⁵⁶ R.21-10-002, A.17-01-012, and the DR and RA proceedings current to the LIP filing year (RA: R.23-10-011. DR: A.22-05-002, et al.).

⁵⁷ The email address for the Demand Response Measurement and Evaluation Committee is drmec@calmac.org.

⁵⁸ Protocol 27, Section 10.1.

⁵⁹ The party filing the evaluation plan is responsible for publishing a small summary of comments received and how or if they were incorporated into the final evaluation plan for each load impact study. The final evaluation plan will be made available to Joint Staff and parties upon request. (LIP 27, Section 10.1.3, at 147.)

⁶⁰ Protocol 27, Section 10.2.

⁶¹ Protocol 27, Section 10.3.

6. Energy Division DR Section finalizes DR QC assignments	September 2024
7. Energy Division RA section assigns final RA requirements to LSEs	
8. Third-Party DRPs submit names of capacity buyers and associated MWs to Energy Division RA and DR Sections	October 2024
9. LSEs submit RA Year-Ahead compliance filing for the 24-hour slice-of-day framework to the Energy Division RA and DR Sections	October 31, 2024

E. Quarterly Testing Requirements

All DR resources must abide by the testing requirements set in [D.14-06-050](#). These testing results should be included in the ex-post data that is used to make ex-ante projections.⁶³ In D.23-06-029, the Commission more explicitly tied the quarterly testing results to the annual RA QC awards.⁶⁴

Beginning with 2021, [D.20-06-031](#) established specific testing requirements for third-party DR resources procured by all non-IOU LSEs.⁶⁵ [D.22-06-050](#) expanded the applicability of the testing requirements to third-party DR resources procured by all LSEs (IOU and Non-IOU) in addition to other clarifications starting in RA year 2023.⁶⁶

The testing requirements do not apply to:

- (1) third-party DR resources procured via investor-owned utility (IOU) programs, such as the Capacity Bidding Program and Base Interruptible Program,
- (2) or contracted by an IOU under Commission-approved contracts prior to June 23, 2022; and
- (3) third-party DR resources in the Demand Response Auction Mechanism pilot.

The testing requirements for all other third-party DR resources procured by all LSEs include:

1. "The DR resource must dispatch for four consecutive hours during the Resource Adequacy (RA) measurement hours in every quarter of the delivery year."⁶⁷

⁶³ Per D.20-06-031, at 38: "All test results would be provided to the Commission and be used to determine QC values."

⁶⁴ Per D.23-06-029, OP 32: "Beginning with the capacity awards granted through the LIP process for the 2024 Resource Adequacy compliance year, test performance failures will be considered when making capacity awards to non-investor-owned utility demand response (DR) resources procured by third-party DR providers under the Load Impact Protocols (LIPs). Derates will be applied so that they correspond to performance during test events for the most recently available quarterly test results at the time of the award for the relevant quarter. The average performance results of each quarter will inform the capacity awarded through the LIPs for the respective sub-load aggregation point."

⁶⁵ Per D.22-06-050, OP 12 (testing requirements) and 13 (submitting results of test).

OP 12(a): "The DR resource must dispatch for four consecutive hours during the Resource Adequacy measurement hours in every quarter of the delivery year."

OP 12(b): "The test must be done at the resource ID level and all resources within the same sub-Load Aggregation Point must be dispatched concurrently. If qualifying capacity values vary by month, within each quarter, the test shall be done in the month with the highest qualifying capacity for each sub-Load Aggregation Point."

OP 13(a): "The scheduling coordinator shall submit the test results to the DR buyer, DR provider, Energy Division, and the California Independent System Operator by the end of the quarter following the quarter in which the test dispatch occurs."

OP 13(b): "Third-party DR providers shall submit the test results in their Load Impact Protocol analysis and reports submitted to the Commission."

⁶⁶ Per D.22-06-050, OP 12: "The testing requirements do not apply to: (1) third-party DR resources procured via investor-owned utility (IOU) programs, such as the Capacity Bidding Program and Base Interruptible Program, or contracted by an IOU under Commission-approved contracts prior to the effective date of this decision; and (2) third-party DR resources in the 2023 Demand Response Auction Mechanism pilot."

⁶⁷ Per D.22-06-050, OP 12(a).

2. The test must be done at the resource ID level and all resources within the same sub-Load Aggregation Point must be dispatched concurrently. If qualifying capacity values vary by month, within each quarter, the test shall be done in the month with the highest qualifying capacity for each sub-Load Aggregation Point.⁶⁸ When possible, ED staff recommends all resources within a DRP's portfolio to be dispatched concurrently, to provide stronger evidence of available capacity.
3. The testing requirement can be fulfilled either through a CAISO market dispatch or an out-of-market test with a preference for market dispatches.⁶⁹
4. Performance must be averaged over the four consecutive hours for each day.⁷¹
5. The third-party DRPs must include the performance results of the 4-hour dispatches in an hourly format in the LIP Reports submitted to the CPUC.⁷²
6. The Scheduling Coordinator (SC) must submit the performance result for the quarterly dispatch to the DR buyer, DR provider, Energy Division, and the CAISO by the end of the quarter following the quarter in which the dispatch occurs.⁷³
 - a. Please submit quarterly dispatch results and/or documentation of efforts to acquire the supporting data to Energy Division at LoadImpactProtocolsInfo@cpuc.ca.gov.
 - b. If awarded RA QC in a given year but not in every quarter, the SC is requested to email Energy Division by the end of the following quarter.
7. All DR resources belonging to a third party DRP for which results are not timely provided will be ineligible for RA showings until the complete results are submitted. If the DRP is unable to provide results by the appointed date due to inability to access the required meter data, they may submit documentation showing efforts to acquire the supporting data.⁷⁴
8. All quarterly dispatch reports should use the template available on the LIPs page [here](#).

⁶⁸ Per D.22-06-050, OP 12(b).

⁶⁹ Per D.20-06-031, at 40.

⁷¹ Per D.20-06-031, p.41.

⁷² Per D.22-06-050, OP 13(b).

⁷³ Per D.22-06-050, OP 13(a).

⁷⁴ Per D.20-06-031, p.41.

F. Process for Updating DR Resource QC During RA Compliance Year

Beginning with 2021, two opportunities are available *during* the RA compliance year to update the QC values for DR resources qualified through the LIP process in the previous year:⁷⁵

- April 1 (for delivery beginning in July of the RA compliance year)
- July 1 (for delivery beginning in September of the RA compliance year)

The update process is described below and summarized in Table 2.

For third-party DRPs:

1. An update filing during the RA compliance year is *required* when the current capacity of the DRP's DR resource portfolio falls below the threshold of 20% below or 10 MW less than the QC value of the resource portfolio assigned through the prior year LIP process.
2. An update filing is also *required* during the RA compliance year when:
 - a. The current capacity of the DRP's DR resource portfolio increases above the threshold of 20% or 10 MW greater than the assigned QC value, **and**
 - b. The DRP plans to sell the incremental capacity to an LSE during the same RA compliance year.
3. An update filing is *optional* when:⁷⁶
 - a. The current capacity of the DRP's DR resource portfolio increases above the threshold of 20% or 10 MW greater than the assigned QC value **and**
 - b. The DRP has no plans to sell the incremental capacity to an LSE during the same RA compliance year.

For IOUs:

4. An update filing is *optional* when:⁷⁷
 - a. The current capacity of the LSE's DR resource portfolio increases above the threshold of 20% or 10 MW greater than the assigned QC value **and**
 - b. The IOU has no plans to increase the RA allocation assigned to the DR resources in the RA compliance year.

⁷⁵ OP 15 D. 20-06-031: "The following clarifications to the Load Impact Protocol (LIP) process for third-party demand response (DR) resources are adopted: (a) Ex post and ex ante load impacts are required at the subLoad Aggregation Point level. (b) Mid-year updates are permitted to reflect changes in customer enrollment if the change is reasonably large. In the compliance year, on a biannual basis, Energy Division shall update qualifying capacity (QC) values based on the actual customer enrollment volume associated with that resource in the California Independent System Operator's Demand Response Registration System. LIP results will be updated if QC values vary by more than 20 percent, or 10 MW, whichever is greater."

⁷⁶ If a DRP decides not to file, the DRP must still notify ED staff and loadimpactprotocolsinfo@cpuc.ca.gov of their increased capacity.

⁷⁷ If an IOU decides not to file, the IOU must still notify ED staff and loadimpactprotocolsinfo@cpuc.ca.gov of their increased capacity.

For All DR Providers (IOUs and third-party DRPs):

5. An update filing must utilize the “QC Update” standardized template and include the following information:
 - a. Average per-customer ex-ante load impact for each sub-Load Aggregation Point (sub-LAP) from the last approved LIP results for the applicable RA delivery months.
 - b. Current customer enrollment in the CAISO Demand Response Registration System (DRRS) at the time of QC update request (in aggregate and by sub-LAP).
 - c. The ex-ante enrollment forecast from the last approved LIP results for the applicable RA delivery months.
 - d. Updated enrollment forecast, including all active and inactive locations as indicated by the CAISO DRRS.

6. The QC update request for the applicable RA delivery months shall be made as follows:
 - a. Updated QC (in RA month N) = Actual customer enrollment (from CAISO DRRS in month of request) + Projected enrollment growth (for RA month N, per the last approved LIP results)) x Average ex-ante load impact per customer (from the last approved LIP results).
 - b. Updated QC allocation aggregated by sub-Load Aggregation Point (sub-LAP) level, mapped to individual resource IDs.⁷⁸
 - c. Indicate the proportion by which the MW value has changed on a portfolio level.

7. Templates for bi-annual updates for qualifying capacity can be found on the LIPs webpage [here](#).

Table 2: Schedule for Submitting Bi-Annual Updates for Qualifying Capacity

Applicable to All IOUs and Third-Party DRPs	Updates for 2024 RA Year
1. Table of revised information as prescribed earlier, containing changes that meet either an increase or decrease of 20% or 10 MW of a portfolio's QC value.	April 1, 2024 (for delivery beginning in July 2024)
2. Table of revised information containing changes that meet either an increase or decrease of 20% or 10 MW of a portfolio's QC value since the filing in Item 1.	July 1, 2024 (for delivery beginning September 2024)

⁷⁸ Per D. 20-06-031 at 45. This information is used by CAISO to update its Customer Interface for Resource Adequacy (CIRA) system.

G. Resource Adequacy Year-Ahead Net-Qualifying Capacity (NQC) Filings

Once the Energy Division issues the RA-eligible QC of DR resources to filing parties, it will accompany these awards with requests for parties to complete several templates. As part of the process of finalizing the Resource Adequacy awards in the Year-Ahead timeframe, parties will be asked to complete several templates.

Year-Ahead Filings

Beginning with the 2023 transition year to a Slice-of-Day (SoD) framework,⁷⁹ parties with approved DR qualifying capacity are asked to provide the hourly breakdown of the MW value for each month of the year in which the party is providing DR resources. Specifically, parties are asked to provide the breakdown of the MW value for each hour under the Availability Assessment Hours (AAH):

- Where they are offering local resources, parties are asked to provide the total for the Local Capacity Area (LCA)
- Where parties are providing system resources, they are asked to provide the total for the Transmission Access Charge (TAC) area.
- The total MW value for all IOU TAC areas is not to exceed the monthly values as approved by the Energy Division.

For all files submitted to Energy Division, please indicate where information must be aggregated or redacted because it is confidential, proprietary, or market sensitive. Once submitted, the Energy Division staff will review these files for accuracy and consistency with parties' LIP Final Reports and Energy Division determinations of eligible QC. Once finalized, this information will be integrated into the Resource Adequacy and procurement planning processes.

Please consult the filing year's Demand Response Section of the Resource Adequacy Guide⁸⁰ to ensure that all filing requirements are being met.

Month-Ahead Filings

Once parties have undertaken the process in the Year-Ahead Filings, they must make monthly submissions to the Energy Division in order to be added to the CAISO NQC list. Detailed guidelines on this process can be found in the ["Instructions for Adding Demand Response Resource IDs to the Monthly NQC List"](#); the accompanying template can be found on the [Resource Adequacy page](#) of the Energy Division website, under the section titled, "2024 Demand Response Net Qualifying Capacity Filings for Demand Response Providers."

⁷⁹ [Appendix A, D.22-06-050](#)

⁸⁰ Section 15, [2024 Filing Guide for System, Local, and Flexible Resource Adequacy \(RA\) Compliance Filing](#), R.21-10-002, Issued September 28, 2023, at 42.

H. Using Templates

Protocol 26⁸¹ of the LIPs details the required content of the reports, while Protocols 4-25 describe the output requirements and formats. Table 9-1 contains a template for ex-post estimation; Table 9-2 displays a template for ex-ante estimates.⁸²

In Table 3 below we provide an example of a preferred table generator format for ex-post and ex-ante results. This format allows for more efficient review of report outputs. A few elements are important to note:

1. The primary "Results" tab displays the underlying data found in the Summary, Lists, Enrollment, and Data tabs.
2. Underlying data tabs that support the primary "Results" tab must be included in the filing.
3. While D.10-06-036⁸³ makes presenting the uncertainty adjusted impact percentiles optional in the table, they are still required to be calculated per Protocol 6, et al. ED still requests the uncertainty percentiles to be presented in Table 3 for both ex post and ex ante.
4. Pull-down menu options under each category shows several options:
 - Type of Results: Aggregate or average
 - Portfolio: Portfolio or Program Specific
 - Electric System: Relevant Utility or CAISO
 - Ex-ante projections should include an "all" or "CAISO" option
 - Day Type: Monthly System Peak Day, Typical Event Day, and Worst Day (if different than the Monthly System Peak Day).⁸⁴
 - Forecast Year: Begins with Resource Adequacy Year (N) and (N+X, where X is each year thereafter for three years [years 1-3]).
 - LCA: Relevant Local Capacity Areas for the relevant Utility
 - Sub-LAP: Sub-Load Aggregation Points for the relevant Utility
 - Month: Each month of the year

⁸¹ Per Protocol 26 at 42.

⁸² At 143 and 144, respectively.

⁸³ Appendix B, at 19 & 20.

⁸⁴ Per D.22-06-050, Appendix A, at 1: "The "worst day" is defined as the day of the month that contains the hour with the highest coincident peak load forecast." Worst day is required in ex ante projections per D.23-04-010, OP 11.

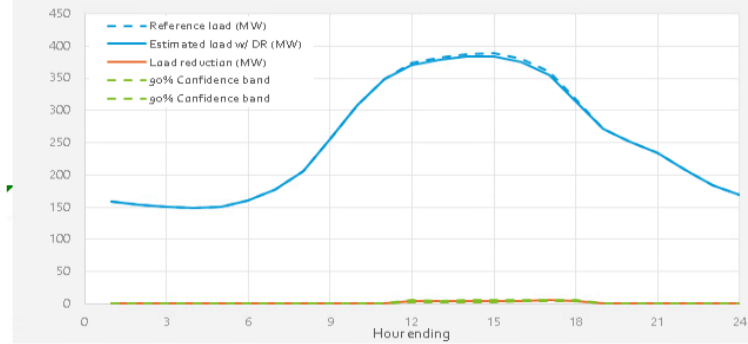
Table 3: Sample Table Generator

Table 1: Menu options

Type of results	Aggregate
Portfolio	Portfolio
Electric System	CAISO
Day Type	MONTHLY SYSTEM PEAK DAY
Weather Year	1-in-2
Forecast Year	2022
Month	August
Event Window	1 to 6 pm

Table 2: Event day information

Total enrolled accounts	97,630
Load reduction 1 to 6 pm (MW)	4.46
% Load reduction 1 to 6 pm	1.2%



Hour ending	Reference load (MW)	Estimated load w/	Load reduction	% Load reduction	Weighted temp (F)	Uncertainty adjusted in				Demand Side Analytics		
						5th	10th	30th	50th	DATA DRIVEN RESEARCH AND INSIGHTS		
1	159.14	159.14	0.00	0.0%	74.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	153.57	153.57	0.00	0.0%	73.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	149.72	149.72	0.00	0.0%	72.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	148.23	148.23	0.00	0.0%	72.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	150.30	150.30	0.00	0.0%	71.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	160.62	160.62	0.00	0.0%	71.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	177.20	177.20	0.00	0.0%	71.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	205.47	205.47	0.00	0.0%	72.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	255.38	255.38	0.00	0.0%	75.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	307.86	307.86	0.00	0.0%	80.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	348.61	348.61	0.00	0.0%	84.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	373.29	369.90	3.39	0.9%	86.6	4.86	4.54	3.86	3.39	2.92	2.23	1.91
13	381.26	377.99	3.27	0.9%	88.0	4.78	4.45	3.75	3.27	2.79	2.09	1.76
14	387.32	383.82	3.50	0.9%	88.4	5.03	4.70	3.99	3.50	3.02	2.31	1.97
15	388.45	384.19	4.26	1.1%	88.6	5.79	5.45	4.75	4.26	3.77	3.07	2.73
16	380.78	376.01	4.77	1.3%	88.4	6.27	5.94	5.25	4.77	4.30	3.61	3.28
17	360.10	355.06	5.04	1.4%	87.4	6.46	6.14	5.49	5.04	4.59	3.94	3.63
18	317.21	312.48	4.73	1.5%	86.0	5.98	5.70	5.13	4.73	4.33	3.76	3.48
19	271.15	271.15	0.00	0.0%	83.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	250.31	250.31	0.00	0.0%	81.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	234.09	234.09	0.00	0.0%	78.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	207.42	207.42	0.00	0.0%	76.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	183.06	183.06	0.00	0.0%	75.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	168.44	168.44	0.00	0.0%	74.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00