BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Develop an
Electricity Integrated Resource Planning
Framework and to Coordinate and Refine Long-
Term Procurement Planning Requirements.    Rulemaking 16-02-007

(Filed February 11, 2016)

CALPINE ENERGY SOLUTIONS, LLC 2018 INTEGRATED RESOURCE PLAN
PUBLIC VERSION

Greg Bass
Director, Western Regulatory Affairs
Calpine Energy Solutions, LLC
401 West A Street, Suite 500
San Diego, CA 92101
Tel: (619) 684-8199
Email: Greg.Bass@calpinesolutions.com

August 1, 2018
PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

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Pursuant to Decision 18-02-018, Calpine Energy Solutions, LLC (“Calpine Solutions”) submits its 2018 Integrated Resource Plan (“IRP”). The public version of Calpine Solutions’ 2018 IRP has removed in its entirety confidential Appendix A Confidential Worksheets. In accordance with instructions from the Commission Docket Office, the confidential version of Calpine Solutions’ 2018 IRP was tendered under seal in digital format.

Dated: August 1, 2018

Respectfully submitted,

/s/
Greg Bass
Director, Western Regulatory Affairs
Calpine Energy Solutions, LLC
401 West A Street, Suite 500
San Diego, CA 92101
Tel: (619) 684-8199
Email: Greg.Bass@calpinesolutions.com
OFFICER VERIFICATION FORM

I am an officer of the reporting corporation herein, and am authorized to make this verification on its behalf. The statements in the foregoing document are true of my own knowledge, except as to matters which are therein stated on information or belief, and as to those matters I believe them to be true.
I declare under penalty of perjury that the foregoing is true and correct.

Executed on __July 31st, 2018__ at ______ San Diego _________, California___.

(Date) (Name of city) (State)

Drake Welch, Vice President Customer Care
CALPINE ENERGY SOLUTIONS, LLC

2018 INTEGRATED RESOURCE PLAN

August 1, 2018
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1. Executive Summary

Calpine Energy Solutions, LLC (Calpine Solutions) is an Electricity Service Provider (ESP) registered with the California Public Utilities Commission (Commission) with ESP #1364. Calpine Solutions has been actively serving commercial, industrial and institutional customers since California restructured its wholesale and retail energy markets in 1998, albeit under different names as corporate ownership of Calpine Solutions has changed over time. Calpine Solutions does not serve residential customers.

Calpine Solutions analyzed two energy portfolios as part of its integrated resource plan (IRP): a conforming portfolio of generation resources assuming forecasted 2019 demand levels and the default system load shape as ordered by the Commission and an alternative, preferred portfolio of generation resources constructed assuming 2019 demand levels and Calpine Solutions’ customers historical load shape. These portfolios are similar in many ways. Each portfolio has the same:

- Amount of annual wholesale demand
- Renewable energy targets based on the current renewable portfolio standard (RPS) requirements
- Total supply-side renewable energy in the portfolio, except in year 2030 when additional greenhouse gas (GHG) free energy—assumed to be procured from RPS portfolio content category one (PCC 1) renewable resources—is added to meet GHG emissions targets
- RPS PCC 1 renewable resource mix of existing wind and solar based on 2018 procurement
- Additions of new lithium ion batteries based on a load ratio share from that added in the reference system portfolio

The portfolios differ in two key respects:

- The conforming portfolio includes a forecast of customer-owned behind-the-meter solar generation based on defaults embedded in the Commission-approved GHG calculator spreadsheet. The alternative portfolio assumes the same load shape over time, essentially including no new customer solar.
- Due to the different load shapes between the two portfolios, the total renewable energy added to each portfolio in 2030 to meet the Commission-approved GHG emission benchmark is different for each portfolio, with the conforming portfolio requiring significantly more GHG-free energy (22% of wholesale energy demand) than the alternative portfolio (6% of wholesale energy demand). This result indicates that when Calpine Solutions uses its customer historical load shape, achieving GHG emissions targets with wind and solar energy resources is more effective than when using the conforming portfolio system load shape.

Given the divergent results between the two portfolios, Calpine Solutions concludes that the conforming portfolio may not have the optimal mix of resources to achieve the GHG emissions benchmark for Calpine Solutions. California has added a significant amount of customer behind-the-meter solar generation to date; continuing to add solar generation provides a diminishing GHG emission reduction return. Calpine Solutions will continue to monitor its customer load shape over time, and if it changes,

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1 Calpine Solutions provides a summary of its current RA portfolio, but does not speculate as to what resources will meet future RA requirements.
Calpine Solutions will consider diversifying renewable energy purchases away from solar generation to
other renewable energy technologies in order to better meet the GHG emissions target.

Calpine Solutions also commits to the following:

- Meeting all Commission promulgated Resource Adequacy (RA) requirements including local RA
  and any future multi-year RA requirements
- Procuring adequate renewable energy and renewable energy credits (RECs) from contracts of ten
  years or greater duration (long-term) in order to meet Senate Bill 350 (DeLeon) requirements and
  Commission promulgated RPS rules
- Reporting on RPS long-term contracting results in its next IRP
- Considering the impact to disadvantaged communities in its decision process prior to procuring
  energy directly from non-renewable energy resources responsible for local air pollution should
  any such unforeseen need arise

2. Study Design

a. Objectives

Calpine Solutions procures energy and RA on behalf of direct access customers throughout
California. The objectives for its IRP are to:

- Analyze a conforming portfolio of generation resources assuming forecasted 2019 load levels
  and the default system load shape as ordered by the Commission;
- Analyze an alternative, preferred portfolio of generation resources constructed assuming 2019
  load levels and Calpine Solutions’ customers historical load shape;
- Estimate GHG emissions for the two portfolios using the Commission approved, clean net
  short method; and
- Show the preferred portfolio meets all requirements of Public Utility Code Section
  454.52(a)(1).

b. Methodology

i. Modeling Tool(s)

Calpine Solutions relied exclusively on Microsoft Excel software for all calculations in support
of its IRP. It created a spreadsheet model to create the resource portfolios and estimate non-
GHG emissions. It then relied on the Commission’s GHG calculator spreadsheet tool to
estimate GHG emissions. It did not conduct any production cost modeling or portfolio
optimization studies. The internal spreadsheet model and GHG calculator results are attached to
this IRP.
ii. Modeling Approach

Renewable Resources

Each portfolio includes the current contracts for RPS PCC 1\textsuperscript{2} renewable resources Calpine Solutions has procured to serve its retail customers. Almost all of these RPS contracts are short-term, that is less than three years in duration. Thus, of all the years modeled (2018, 2022, 2026, and 2030) only 2018 reflects actual contracts. Future years reflect the same mix of renewable resource technology types as procured for 2018. The level of RPS PCC 1 energy and RECs in each portfolio is the minimum needed to satisfy RPS requirements and for year 2030, the additional GHG emission target. Additional RPS PCC 2 and RPS PCC 3 RECs\textsuperscript{3} are added as required to meet the applicable annual RPS percentage targets.

Additional Resources

Currently, Calpine Solutions procures unspecified system power to meet customer energy demand above that met with RPS PCC 1 renewable resources. This is forecasted to continue through year 2030 for both portfolios. Each portfolio also includes Calpine Solutions’ load ratio share of new lithium ion battery capacity in the Commission’s reference system portfolio with “some updating to reflect the latest IEPR assumptions.”\textsuperscript{4} Specifically, Calpine Solutions relied upon the RESOLVE inputs and outputs from the 2017 IEPR Update model run.\textsuperscript{5} The load ratio share is calculated as Calpine Solutions’ forecasted load divided by total CAISO system load.

As with all ESPs, Calpine Solutions is mandated by the Commission to contract for energy storage capacity equivalent to one percent (1\%) of its Year 2020 peak demand per the Commission’s directive following passage of AB 2514.\textsuperscript{6} However, ESPs also receive a storage procurement credit for a portion of energy storage procured by investor owned utilities (IOUs) done for reliability purposes. As of the date of the 2018 IRP, Calpine Solutions estimates it needs to directly contract for 2 MW of additional storage capacity due to these credits. The load ratio share allocation of battery capacity adds more than 2 MW of battery capacity to the Calpine Solutions’ portfolio by 2030, and thus should also meet this requirement, though the actual timing of the contracts and resource installation may differ.

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\textsuperscript{2} Commission D.11-12-052.

\textsuperscript{3} Commission D.11-12-052.

\textsuperscript{4} Commission D.18-02-018, pg. 80.

\textsuperscript{5} The RESOLVE output summarized in D.18-02-018 differs from that in the updated run primarily because the updated load forecast is higher, thus increasing the amount of renewables added to the CAISO system, especially geothermal.

\textsuperscript{6} Commission D.13-10-040, pg. 2.
Calpine Solutions relied upon the Commission-approved GHG calculator spreadsheet tool to estimate GHG emissions from each portfolio using the clean net short method. Of all renewable energy resource contracts, only RPS PCC 1 resources are considered GHG-free by the Commission. The amount of capacity for each RPS PCC 1 resource type entered into the “Capacity Inputs” section of the spreadsheet produces the energy generation included in a given energy portfolio. It may differ from actual capacity of contracted resources if the assumed capacity factor in the spreadsheet is different from the actual capacity factor of the resource. The load ratio share of new lithium ion battery capacity from RESOLVE is also included.

Resource Adequacy

RA is procured separately from energy. Calpine Solutions’ procurement of 2018 RA is complete and summarized here in Section 3 of the IRP. Very limited amounts of RA for future years have also been procured at the time of the preparation of the 2018 IRP and these quantities are reported in the baseline data template. Calpine Solutions has chosen not to speculate as to what resources will provide RA beyond its existing RA contracts. Calpine Solutions is committed to meeting all RA requirements as promulgated by the Commission, including any future multi-year RA requirements. In addition, Calpine Solutions, and all ESPs, also receive a RA allocation for a portion of RA procured by the IOUs done for reliability purposes when the cost of the procurement is borne by all customers; this allocation of RA is part of the Cost Allocation Method (CAM).

NOx and PM2.5 Emissions

Calpine Solutions estimated NOx and PM2.5 emissions from the gas generation in each portfolio. See Table 4 in the following section for a list of the assumed emissions rates by resource type. The amount of gas generation was estimated for each portfolio based on a load ratio share of gas generation within the CAISO system mix as reported in the RESOLVE model output. Since the total annual load is the same for both portfolios, the estimated NOx and PM2.5 emissions are also the same.

Assumptions

Load Forecast

Per direction by Commission Staff, and due to the 2017 IERP forecast producing non-substantive results, Calpine Solutions used the 2019 forecasted energy demand as provided in

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8 Refer to Section 5a of the IRP for further details.
9 CAISO system mix refers to all resources contracted to meet CAISO demand. All gas resources contracted to meet CAISO demand are located within the CAISO footprint.
the California Energy Commission, *Demand Forecast Data Request for 2019*. Calpine Solutions has also adopted the load profile embedded in the GHG calculator tool. This is required for conforming portfolios per the directive in the OIR in R.16-02-007 filed May 25, 2018, which states, “[f]or Conforming Portfolios, LSEs are still required to use their individual assigned load forecast for IRP, as well as the default load profile from RESOLVE, which is pre-loaded in the [clean net short] calculator, in order to ensure comparability across LSE filings. The default load profile from RESOLVE is associated with the CAISO’s underlying transmission area.”\(^{10}\)

For the alternative, preferred portfolio, Calpine Solutions also uses the 2019 forecast energy demand as provided in the California Energy Commission, *Demand Forecast Data Request for 2019*, grossed up for actual losses and extended to year 2030, assuming zero load growth or decline. Calpine Solutions also used the 2016 actual load shape\(^ {11}\) as a proxy for the forecasted load shape. Since the actual load shape is also net of any customer behind-the-meter solar as well as energy efficiency and would include building electrification and electric vehicle load, these items were not forecasted separately.

The table below summarizes the annual load forecast used in each portfolio and shows the calculated load ratio share used to allocate CAISO system battery capacity to Calpine Solutions.

Table 1. Calpine Solutions annual load forecast (GWh) and calculated load ratio share.

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2022</th>
<th>2026</th>
<th>2030</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calpine Solutions’ Total Managed Net Energy for Load</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2019 forecast for RA</td>
</tr>
<tr>
<td>CAISO Total Managed Net Energy for Load</td>
<td>225,889</td>
<td>224,124</td>
<td>221,928</td>
<td>218,478</td>
<td></td>
</tr>
<tr>
<td>Load Ratio Share</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following table shows the default assumptions used to construct the load shape for the conforming portfolio based on the inputs in the GHG calculator tool. The input retail sales numbers are lower than actual retail sales because Calpine Solutions’ average historical transmission and distribution losses (4.5%) are lower than system average losses input into the workbook (7.3%). This difference in loss factors is due to the customer base served by Calpine Solutions. Large commercial and industrial customers, by-and-large, take power deliveries at higher voltages than residential customers and therefore incur less distribution losses. The

\(^{10}\) Pg. 15.

\(^{11}\) Since 2016 was a leap year, leap day was removed for purposes of creating a normalized hourly load shape for non-leap years.
amount of retail load shown in the table below is the level of load that will return the 2019 forecast of wholesale load (\(\text{\ldots}\)) once grossed up by system losses.

Table 2. Calpine Solutions load assumptions used for conforming portfolio. Numbers are in GWh.

<table>
<thead>
<tr>
<th>Assigned Load Forecast for IRP (i.e., Managed Retail Sales Forecast)</th>
<th>2018</th>
<th>2022</th>
<th>2026</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Demand Inputs (based on sales-weighted share of total from IEPR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline net energy for load (no BTM PV, EV, electrification, energy efficiency)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Vehicle Load - Home Charging Only</td>
<td>34</td>
<td>87</td>
<td>141</td>
<td>181</td>
</tr>
<tr>
<td>Electric Vehicle Load - Home + Work Charging</td>
<td>2</td>
<td>14</td>
<td>40</td>
<td>77</td>
</tr>
<tr>
<td>Other Electrification</td>
<td>2</td>
<td>6</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>(-48)</td>
<td>(-233)</td>
<td>(-447)</td>
<td>(-647)</td>
</tr>
<tr>
<td>BTM PV</td>
<td>(-272)</td>
<td>(-445)</td>
<td>(-615)</td>
<td>(-772)</td>
</tr>
</tbody>
</table>

**GHG Emissions Benchmark**

Calpine Solutions adopted the Commission-approved GHG emissions benchmarks for direct access customers in each California IOU service territory. To translate these benchmarks into an appropriate benchmark for Calpine Solutions specifically, we use a load ratio share allocation, as directed by the Commission,\(^\text{12}\) and as shown in the table below. Load ratio share is calculated separately for each service territory. Both portfolios have the same annual load forecast and hence the same GHG emissions benchmark.

Table 3. Calculation of Calpine Solutions’ 2030 GHG emissions benchmark for both portfolios.

<table>
<thead>
<tr>
<th></th>
<th>PG&amp;E</th>
<th>SCE</th>
<th>SDG&amp;E</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Direct Access Load (GWh)</td>
<td>10,263</td>
<td>12,525</td>
<td>3,840</td>
<td>26,627</td>
</tr>
<tr>
<td>Calpine Solutions’ Load (GWh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Ratio Share</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Direct Access GHG Emissions Benchmark (MMT)</td>
<td>1.691</td>
<td>2.035</td>
<td>0.740</td>
<td></td>
</tr>
<tr>
<td>Calpine Solutions GHG Emissions Benchmark (MMT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The California Air Resources Board (CARB) recently published its GHG planning target ranges for ESPs. Calpine Solutions’ target range is between \(\text{\ldots}\) and \(\text{\ldots}\) of CO\(_2\).

\(^{12}\) Commission D.18-02-018, pg. 124.
This is above the target of calculated using the Commission methodology as shown in Table 3.

**NO\textsubscript{x} and PM2.5 Emissions Factors**

The Commission’s proposed reference system portfolio post processing spreadsheet provides NO\textsubscript{x} and PM2.5 emissions rates for each gas generation type modeled in RESOLVE. Calpine Solutions uses these rates to estimate the emissions from its resource portfolios. They are summarized in the table below.

<table>
<thead>
<tr>
<th>NO\textsubscript{x} Emissions Rate (lb/MWh)</th>
<th>PM2.5 Emissions Rate (lb/MMBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Cycle Gas Turbine</td>
<td>0.07</td>
</tr>
<tr>
<td>Gas Turbine Peaker 1</td>
<td>0.099</td>
</tr>
<tr>
<td>Gas Turbine Peaker 2</td>
<td>0.279</td>
</tr>
<tr>
<td>Steam Turbine</td>
<td>0.15</td>
</tr>
<tr>
<td>Reciprocating Engine</td>
<td>0.5</td>
</tr>
</tbody>
</table>

3. **Study Results**

**a. Portfolio Results**

Here we describe the results of the IRP analysis. Calpine Solutions has modeled two portfolios:

- Conforming Portfolio: Reflects 2019 forecasted demand and the system load shape as embedded in the GHG calculator tool.
- Alternative/Preferred Portfolio: Reflects 2019 forecasted demand using a historical hourly load shape for Calpine Solutions.

**b. Preferred and Conforming Portfolios**

**Conforming Portfolio Results**

The figure below shows the conforming portfolio by resource type on an energy basis. This includes RPS PCC 1 wind and solar resources as well as customer behind-the-meter solar generation based on default assumptions. All demand growth is almost entirely attributable to the rise in customer behind-the-meter solar, meaning that based on the default load shape, demand before consideration of

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customer behind-the-meter solar rises such that with the growing amount of customer behind-the-meter solar is subtracted from the demand forecast, Calpine Solutions’ demand will be flat at [GWh] as shown in Table 1 (with some added battery losses, which are very small).

The dramatic drop in Calpine Solutions’ reliance on system power in year 2030 is attributable to the added RPS PCC 1 energy resources needed to bring the year 2030 conforming portfolio GHG emissions under the Commission’s GHG emissions benchmark of [MTM]. (See Table 3.) To achieve this target level, Calpine Solutions is forecasting the need to procure additional GHG-free energy, assumed in this analysis to be RPS PCC 1 energy, in an amount that equals 22% of Calpine Solutions’ wholesale energy demand (approximately [MTM]) Without the incremental addition of GHG-free energy in excess of year 2030 RPS procurement obligation percentages, year 2030 GHG emissions would otherwise have been 0.979 MMT.

Figure 1. Calpine Solutions conforming portfolio energy by resource type.

Figure 1 above only reports RPS PCC 1 procurement as this procurement, by definition, provides energy to the CAISO system. In addition to RPS PCC 1 procurement, Calpine Solutions will also procure additional RPS RECs from RPS categories two and three (PCC 2 and PCC 3) to meet the Commission’s RPS percentage obligations. The figure below shows this graphically. Per current legislation, RPS PCC 3 resources can only meet at most 10% of Calpine Solutions RPS obligation and RPS PCC 1 must be at least 75% of Calpine Solutions RPS requirements. Calpine Solutions procures the maximum allowed RPS PCC 3 RECs and minimum amount of RPS PCC 1 resources in order to manage overall RPS compliance costs, purchasing the remaining RPS compliance percentage obligation with RPS PCC 2 RECs. As the figure shows, Calpine Solutions assumes its RPS portfolio will have the same percentages by product content category except in year 2030. In that year with the added GHG-free energy procurement needed to meet the GHG emissions target, total RPS PCC 1
procurement will exceed the total RPS percentage requirement, negating the need for any RPS PCC 2 or RPS PCC 3 procurement.

Figure 2. Calpine Solutions conforming portfolio of RECs needed to meet RPS requirement.

Wind and solar energy shown in the charts above are assumed to be procured from existing generation resources and reflects Calpine Solutions current renewable energy portfolio technology mix. Calpine Solutions will always seek RPS procurement of the most economic resource technology mix. Therefore, actual procurement of RPS renewable resources will differ from the mix of existing wind and solar resources shown here, depending on RPS resource economics and RPS resource commercial availability. Calpine Solutions will provide updated estimates of its forecasted renewable energy portfolio technology mix in future IRPs to be filed with the Commission.

The conforming portfolio also includes a load ratio share of new battery storage on the CAISO system as selected by RESOLVE. The amount of new batteries is summarized in the table below. Assumed battery losses reflect those per the dispatch in the GHG calculator spreadsheet.

### Table 5. New battery storage additions.

<table>
<thead>
<tr>
<th>New Li Ion Battery Storage (MW)</th>
<th>2018</th>
<th>2022</th>
<th>2026</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>45</td>
</tr>
</tbody>
</table>

The table below is an excerpt from the GHG calculator tool dashboard, showing GHG emissions attributed to Calpine Solutions under the clean net short methodology. The table also shows some emissions reductions due to hydroelectric imports from the Pacific Northwest (NW) region. This was automatically built into the GHG calculator tool. Calpine Solutions has not done any independent analysis of whether the NW hydroelectric emissions offsets are reasonable. As discussed above, RPS PCC 1 resources were added above the minimum percentage level required for RPS compliance in
order to bring the GHG emissions under the Commission’s 2030 GHG benchmark. Calpine Solutions will monitor its ability to meet state GHG goals and procure GHG-free energy as necessary.

Table 6. Calpine Solutions conforming/preferred portfolio GHG emissions.

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Unit</th>
<th>2018</th>
<th>2022</th>
<th>2026</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Net Short</td>
<td>MMtCO2/yr.</td>
<td>1.4</td>
<td>1.2</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Owned or contracted non-dispatchable GHG-emitting resources</td>
<td>MMtCO2/yr.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Emissions offset for NW hydroelectric imports</td>
<td>MMtCO2/yr.</td>
<td>(0.1)</td>
<td>(0.1)</td>
<td>(0.1)</td>
<td>(0.1)</td>
</tr>
<tr>
<td>Total</td>
<td>MMtCO2/yr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since the CARB GHG emissions benchmark range is higher than that calculated from the Commission’s GHG targets for direct access demand, Calpine Solutions’ conforming portfolio will be below the minimum GHG emissions range as set by CARB for Calpine Solutions. The GHG emissions result of ____, predicted when no incremental RPS PCC 1 procurement is added to the year 2030 conforming portfolio, falls within the CARB GHG emissions benchmark range for Calpine Solutions. This result indicates that no additional incremental procurement of GHG-free energy above the 2030 RPS percentage obligation is required in order to meet the CARB target.

**Preferred Portfolio Results**

The figure below shows the preferred portfolio by resource type on an energy basis. The alternative portfolio differs from the conforming portfolio in two ways. First, no customer behind-the-meter solar is separately forecasted. Therefore, the figure shows no customer solar generation. However, a number of Calpine Solutions’ customers own solar, but Calpine Solutions does not collect usage data on how much solar its customers generate. The ____ of demand forecasted for 2019 is net of customer behind-the-meter solar. The alternative portfolio demand forecast also assumes no growth in customer behind-the-meter solar and how that would affect Calpine Solutions’ load shape, which was developed from Calpine Solutions’ historical customer usage data.

Second, the amount of total RPS PCC 1 procurement in the alternative portfolio in year 2030 is less than the conforming portfolio indicated needed to be procured. This disparate result in the need for additional incremental GHG free energy between the two portfolios is entirely driven by the GHG calculator’s load shape. In the preferred portfolio, Calpine Solutions used its historical load shape, which is driven by the class of customer Calpine Solutions serves: commercial, industrial and institutional customers. These classes of customers tend to have flatter demand shapes and their peak demand is non-coincident to the CAISO peak demand. Thus, we conclude that Calpine Solutions using its customer historical load shape is more favorable to achieving GHG emissions targets with wind and solar energy resources than the conforming portfolio system load shape indicates.
Figure 3. Calpine Solutions preferred portfolio energy by resource type.

The figure below shows Calpine Solutions preferred portfolio of RECs for meeting RPS requirements. It is identical to Figure 2 for the conforming portfolio except in year 2030. In that year, Calpine Solutions estimates it will need to procure less additional RPS PCC 1 energy than the conforming portfolio results indicate because of its commercial and industrial customer-driven load shape. It then assumes that purchases of RPS PCC 2 RECs are reduced by the amount of additional RPS PCC 1 procurement, such that the amount of total RECs and energy purchased meets but does not exceed the RPS portfolio balancing requirements.¹⁴

¹⁴ Commission D.12-06-038.
As with the conforming portfolio, wind and solar energy shown in the charts above is assumed to be provided from existing resources. Actual procurement of renewable resources may differ from the mix of existing wind and solar resources shown here, depending on resource economics and availability.

The preferred portfolio also includes the same battery storage additions as the conforming portfolio, as summarized in Table 5.

The table below is an excerpt from the GHG calculator tool dashboard, showing GHG emissions attributed to Calpine Solutions under the clean net short methodology. As discussed above, RPS PCC 1 procurement was added above the minimum percentage level required for RPS compliance in order to bring the GHG emissions under the Commission’s 2030 GHG benchmark. In other years, the preferred portfolio shows lower emissions than the conforming portfolio indicates because of Calpine Solutions commercial and industrial customer-driven load shape.

Table 7. Calpine Solutions conforming/preferred portfolio GHG emissions.

<table>
<thead>
<tr>
<th>Emissions</th>
<th>Unit</th>
<th>2018</th>
<th>2022</th>
<th>2026</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Net Short</td>
<td>MMtCO2/yr</td>
<td>1.4</td>
<td>1.2</td>
<td>1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Owned or contracted non-dispatchable GHG-emitting resources</td>
<td>MMtCO2/yr</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Emissions offset for NW hydroelectric imports</td>
<td>MMtCO2/yr</td>
<td>(0.1)</td>
<td>(0.1)</td>
<td>(0.1)</td>
<td>(0.1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>MMtCO2/yr</strong></td>
<td><strong>[ ]</strong></td>
<td><strong>[ ]</strong></td>
<td><strong>[ ]</strong></td>
<td><strong>[ ]</strong></td>
</tr>
</tbody>
</table>

Since the CARB GHG emissions benchmark range is higher than that calculated from the Commission’s GHG targets for direct access demand, the preferred portfolio should meet this benchmark as well. The level of estimated GHG emissions prior to adding the RPS PCC 1
procurement beyond the minimum RPS percentage requirements (0.833 MMT) is also under the CARB emissions target range.

**Resource Adequacy Portfolio**

Calpine Solutions’ current portfolio of RA by resource type is shown below. Specific resources supplying the RA are listed in the baseline resource data template. The portion labeled unspecified derives from firm Liquidated Damages energy imports that are not tied to any specific in-state resource. Calpine Solutions has chosen not to speculate about what resources will be used to supply future RA and thus has not prepared separate portfolios of future RA resources.

**Figure 5. Calpine Solutions’ 2018 RA portfolio by resource type.**

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i. **Local Air Pollutant Minimization**

Calpine Solutions exclusively serves nonresidential commercial, industrial and institutional customers in all three IOU service territories, excluding a small number of incidental residential accounts that are financially associated with a large commercial or institutional customer, such as university dormitories. Calpine Solutions compared the zip codes associated with the disadvantaged communities as defined in Commission D. 18-02-018 to the service accounts that Calpine Solutions currently serves. Calpine Solutions does not track service account by census tract. Comparing by zip code may overstate the number of
service accounts in disadvantaged communities because there isn’t a one-to-one
relationship between the census tract boundary and the zip code boundary with the zip code
boundary being a larger area. Calpine Solutions serves approximately 8,000 service
accounts out of approximately 17,000 total service accounts between the three IOU service
territories in disadvantaged communities. Intuitively this makes sense; the industrial
sections of California tend to have higher local pollution than exclusively residential
neighborhoods and since Calpine Solutions only serves nonresidential commercial,
industrial and institutional customers, these business customers are more likely to be
located in industrial sections of California.

The table below summarizes expected NOx and PM2.5 emissions from gas-fired generation
within each portfolio. Calpine Solutions does not directly contract with any fossil-fired
generation to meet its energy needs, and has no plans to in the future. All gas generation in
each portfolio is from CAISO system power. The emissions are estimated based on a load
ratio share allocation of system gas generation. Since the total load for each portfolio is the
same, the emissions estimates are the same. The different load profile for the different
portfolios could impact these emissions as it does GHG emissions, but Calpine Solutions
has not attempted to estimate the impact.

As the tables show, emissions intensity falls between 2018 and 2022 and then increases in
2026, largely due the retirement of Diablo Canyon nuclear plant in 2025. It then levels off
in years thereafter.

<table>
<thead>
<tr>
<th></th>
<th>NOx</th>
<th>PM2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2018</td>
<td>2022</td>
</tr>
<tr>
<td>Total Emissions (tons)</td>
<td>45.6</td>
<td>35.2</td>
</tr>
<tr>
<td>Total Generation (GWh)&lt;sup&gt;15&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Emissions Rate (t/GWh)</td>
<td>0.010</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Calpine Solutions has no specific information on how these emissions impact
disadvantaged communities. Because the gas generation represents a slice of the entire
CAISO system, these emissions should be spread over all gas generation in the system.
Although Calpine Solutions has no plans to contract for energy from specific gas
generation in the future, if for some reason there is a need to procure energy from these
types of non-renewable generation resources, Calpine Solutions will consider the impact to
disadvantaged communities in its decision process.

**ii. Cost and Rate Analysis**

As an ESP, Calpine Solutions operates in a competitive market with customers free to
choose among a host of ESPs and these customers demand the products and services that

<sup>15</sup> Excludes customer solar and includes battery losses from new lithium batteries.
best meet their needs. Thus, maintaining competitive pricing is critical to maintaining satisfied customers. Calpine Solutions notes that the Commission has a more limited scope of oversight over ESPs. ESPs are not regulated as “public utilities;” the Commission does not regulate retail transactions by ESPs or establish rates for ESP products or services, nor does the Commission directly oversee the procurement activities of ESPs undertaken in order to serve an ESP’s retail transactions which includes cost quantification information. However, in order to be responsive to the Commission and the IRP process, costs for energy, RPS and RA procurement to meet Calpine Solutions’ retail sales in California have been approximately $1 billion per year.

c. Deviations from Current Resource Plans

Not Applicable. Calpine Solutions has not filed any other resource plans.

d. Local Needs Analysis

Calpine Solutions procures local RA to meet its share of local RA requirement in the IOU territories it serves. Current RA procurement by resource type is summarized in Figure 5. Calpine Solutions has not prepared a specific portfolio of future RA resources. Calpine Solutions is committed to meeting all future RA requirements, including local RA requirements.

4. Action Plan

a. Proposed Activities

Calpine Solutions constantly reviews its market positions to optimize its portfolio of all electricity products. Calpine Solutions is evaluating the most appropriate commercial means of responding to the prescriptive requirement of the IRP which will include significant changes to the required quantities of long-term contracting.

With the passage of Senate Bill 350 (DeLeon) in 2015, starting in the year 2021, Calpine Solutions is required to have at least 65% of its RPS procurement obtained from contracts of ten years or greater duration. Calpine Solutions plans to meet this RPS requirement and is in commercial negotiations with a number of renewable generation developers and marketers. In Calpine Solutions’ next IRP, to be filed with the Commission in 2020, Calpine Solutions expects to report a significant increase in both procurement quantity and length of term of its renewables portfolio.

No significant change in RPS and RA procurement activity is expected in the near term under each portfolio, however Calpine Solutions will continue to analyze its customer load shape when considering the technology mix of resources that is most economic to serve its customers’ power needs and achieve GHG emission reduction targets.
b. Barrier Analysis

Calpine Solutions does not anticipate any significant barriers to procuring resources in line with the preferred portfolio. Given the current competitive cost of new renewable energy development, Calpine Solutions does not foresee the need for significant cost increases for its customers to meet the 2030 GHG emissions targets, despite the need to procure additional GHG-free energy above the RPS percentage requirements. Calpine Solutions will also closely monitor the cost of renewable technologies compared to reliance on system power. Should procuring additional renewable energy beyond RPS targets become more economic than relying on system power, it plans to pursue additional renewable energy procurement. It will also monitor developing technologies, especially battery storage, designed to further grid integration of intermittent renewable energy and procure such new resources as it becomes cost-effective for RA purposes.

Upon reflection of the results of the two portfolios, the conforming portfolio, though feasible, is not selecting the optimal mix of GHG-free renewable resources. California has added a significant amount of customer behind-the-meter solar generation to date; adding more solar generation provides a diminishing GHG emission reduction return. It appears that a more diversified renewable generation technology mix that addresses the conforming portfolio’s load shape and/or additional battery storage will likely be more effective in meeting GHG emission reduction targets if Calpine Solutions’ demand ultimately reflects the projected system shape as found in the conforming portfolio, rather than its current load shape as modeled in the preferred portfolio. Calpine Solutions will continue to monitor its customer load shape over time and will consider diversifying renewable energy purchases away from solar generation to other renewable energy technologies in order to better meet GHG targets if its load shape changes.

c. Proposed Commission Direction

Calpine Solutions has no requests from the Commission at this time.

5. Data

Calpine Solutions has completed the required resource templates for its conforming portfolio. These are attached to this IRP.

a. Baseline Resource Data Template

The baseline resource data templates are attached as “CONFIDENTIALData_CalpineSolutions_BaseRsrc_Conforming_20180801.xlsx” and “CONFIDENTIALData_CalpineSolutions_BaseRsrc_Preferred_20180801.xlsx.” Both files include all existing contracts, by resource type, by month. This includes RA and energy contracts. For contracts that do not specify a monthly energy output, the output is prorated by the number of days in the particular month based on an annual quantity.
It also includes generic information for expected future contracts with existing wind and solar resources as well as for system power. Generic data is also reported by resource type, by month.

b. New Resource Data Template

The new resource data template for both conforming and preferred are the same and is attached as “CONFIDENTIALData_CalpineSolutions_NewRsrc_All_20180801.xlsx” The only new resources reflected are the new battery resources shown in Table 5.

c. Other Data Reporting Guidelines

The workbooks Calpine Solutions created to create each portfolio and estimate non-GHG emissions are attached as “CONFIDENTIALSupporting_CalpineSolutions_Conforming_20180801.xlsx” and “CONFIDENTIALSupporting_CalpineSolutions_PREFERRED_20180801.xlsx.” GHG calculator spreadsheets for each portfolio are also attached as “CONFIDENTIAL GHG Calculator for IRP v1.4.5 Conforming Portfolio.xlsx” and “CONFIDENTIAL GHG Calculator for IRP v1.4.5 Preferred Portfolio.xlsx”.

6. Lessons Learned

Calpine Solutions, along with most ESPs, have a significantly different customer demand shape than the system load shape as offered in the conforming portfolio. Calpine Solutions surmises the conforming portfolio customer load shape is driven by residential energy consumption patterns. Therefore, when doing GHG emissions accounting with the system load shape, the results mischaracterize the important differences between the load serving entities that serve nonresidential exclusively and the load serving entities that also include a residential load shape in their customer mix. These differences will be further exacerbated as California continues its solar expansion. Since load shape is a significant input to the conforming portfolio, the Commission should consider recognizing that ESPs that serve nonresidential customers should have the option in the conforming portfolio of a load shape that more accurately reflects the nonresidential customers that they serve.
APPENDIX A

Confidential Worksheets

Baseline resource data templates:

CONFIDENTIALData_CalpineSolutions_BaseRsrc_Conforming_20180801.xlsx
CONFIDENTIALData_CalpineSolutions_BaseRsrc_Preferred_20180801.xlsx

New resource data template for both conforming and preferred:

CONFIDENTIALData_CalpineSolutions_NewRsrc_All_20180801.xlsx

Other data templates:

CONFIDENTIALSupporting_CalpineSolutions_Conforming_20180801.xlsx
CONFIDENTIALSupporting_CalpineSolutions_Preferred_20180801.xlsx
CONFIDENTIAL GHG Calculator for IRP v1.4.5 Conforming Portfolio.xlsx
CONFIDENTIAL GHG Calculator for IRP v1.4.5 Preferred Portfolio.xlsx