

Greenhouse Gas and Criteria Pollutant Accounting Methodology for use in Load-Serving Entity Portfolio Development in 2020 Integrated Resource Plans

Introduction

Staff has developed a Clean System Power (CSP) calculator tool for Load Serving Entities (LSEs) to use in estimating the GHG and criteria pollutant emissions of their portfolios.

This document contains instructions for using the spreadsheet calculator tool. All LSEs filing Standard Plans as part of the IRP process are required to demonstrate use of the CSP method and calculator tool in accounting for emissions in their portfolios. LSEs are also free to use other tools to inform or supplement this accounting method. Importantly, the calculator is not intended to be used as an after-the-fact compliance tool, but rather to provide LSEs a simple and uniform way of estimating the emissions associated with their IRP portfolios.

The core function of the CSP tool is to assign emissions associated with the CAISO system's dispatchable thermal generation and unspecified imports ("system power") to LSEs based on how each LSE plans to rely on CAISO system power to meet its load on an hourly basis. The tool also calculates emissions from other generation sources that can be attributed to an LSE's resource portfolio. The CSP methodology enables the CPUC to address three critical needs for the IRP process: (1) to evaluate the expected 2030 GHG emissions associated with individual LSE plans and resource portfolios on a fair and consistent basis; (2) to compare each LSE's expected 2030 GHG emissions against its CPUC-assigned benchmark; and (3) to compare expected 2030 LSE emissions in aggregate against the Reference System Plan to meet the 2030 GHG planning target for the electric sector at least cost. To aid planning, the CSP tool also provides emissions estimates for years before 2030.

Note that neither emissions from, nor demand met by, Behind-the-Meter Combined Heat and Power (BTM CHP) resources are included in the CSP tool. While individual LSEs are not required to plan to reduce BTM CHP emissions, these emissions nevertheless count towards the electric sector emissions total. Commission staff plans to account for BTM CHP emissions when calculating electric sector emissions of the aggregated LSE portfolios during the development of the Preferred System Plan.

When calculating emissions in the CSP tool, LSEs should achieve GHG emissions results that are slightly below their official GHG benchmarks to leave room in the system for BTM CHP emissions that will be added during the portfolio aggregation process. The CSP tool tab titled "Benchmarks Net BTM CHP" contains the LSE-specific benchmarks that LSEs should use for planning when using the CSP tool.

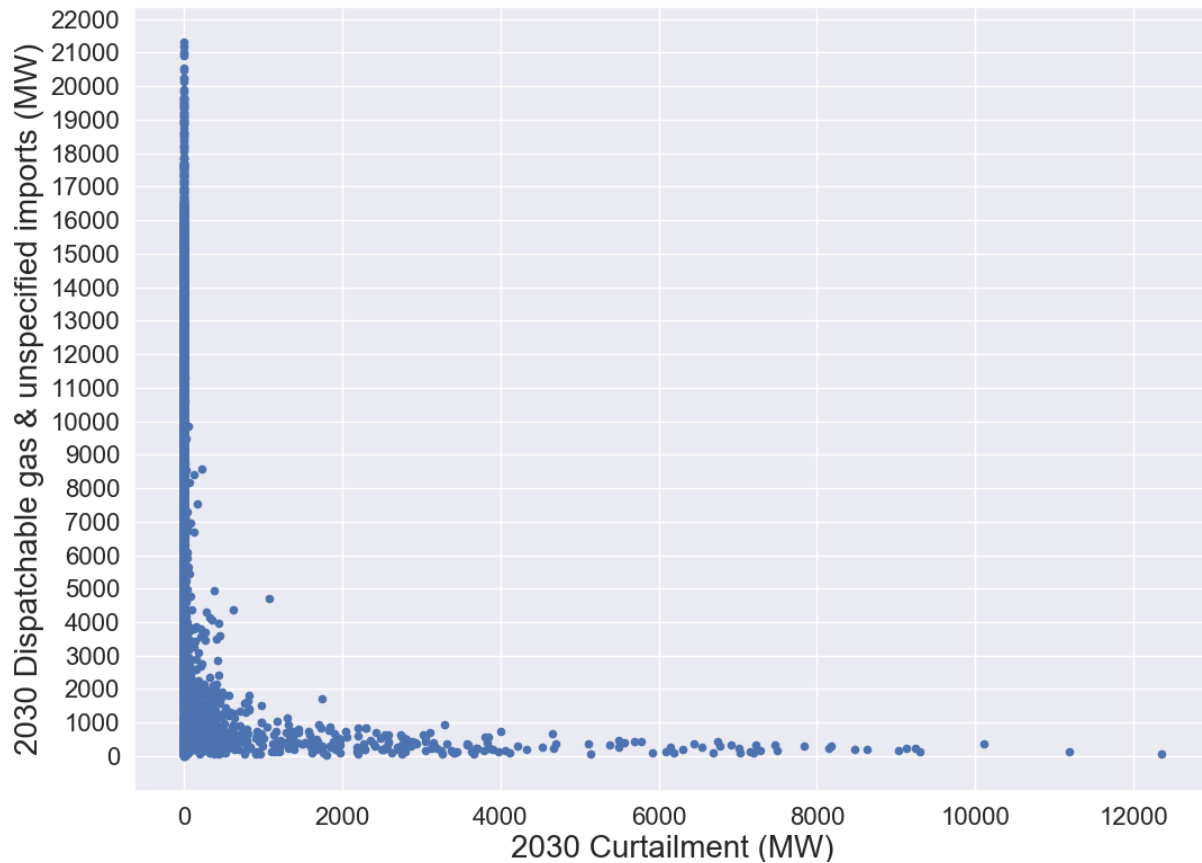
Conceptual steps taken by the Clean System Power tool to calculate LSE-specific emissions

The steps of the CSP method are as follows:

1. The LSE enters their assigned annual managed sales forecast from the California Energy Commission's Integrated Energy Policy Report (IEPR), or a different sales forecast that has been approved through an ALJ Ruling finalizing load forecasts and GHG benchmarks.
2. The IEPR demand forecast is broken into components on an annual basis. The individual demand modifier components are:
 - a. Baseline electricity consumption, net of BTM CHP
 - b. Energy efficiency
 - c. Electrification
 - i. Electric vehicles
 - ii. Building electrification
 - iii. Other electrification
 - d. BTM photovoltaics
3. The annual load forecast is translated into an hourly demand shape for each hour of the year for each demand component, resulting in an 8760 demand profile that reflects the LSE's expected total energy to serve load (demand at the utility-scale generator bus-bar) on an hourly basis for all future years.
4. A portion of the LSE's demand is met with a load-ratio share of the system-wide non-dispatchable CHP generation. Emissions from this CHP generation are attributed to the LSE.
5. The LSE builds a projected portfolio of its owned or contracted resources, which includes both online and planned resource. The portfolio can, and for most LSEs should, change over time from present day to 2030. Each resource type can be specified in MW of capacity or GWh of annual energy. Resources count towards an LSE's portfolio only if their power output is delivered to (1) a California Balancing Authority area, if RPS-eligible, or (2) the CAISO system if the resource is not RPS-eligible.
 - a. This portfolio includes:
 - i. RPS-eligible resources (whether within CAISO or a dedicated import; includes RPS Bucket 1 and any other RPS-eligible resources that meet the criteria to qualify as RPS Bucket 1 except for the contract execution date of the resource);
 - ii. Large hydro within CAISO;
 - iii. Dedicated imports of Pacific Northwest hydro (under control of an Asset Controlling Supplier);
 - iv. Nuclear (whether within CAISO or a dedicated import);
 - v. Coal (dedicated import);
 - vi. Demand response (load shedding at peak);
 - vii. Storage resources – pumped hydro, 2-hour batteries, and 4-hour batteries; and
 - viii. Generation with a defined hourly profile that:

1. Does not fit into one of the categories above, and
 2. Does not produce GHG emissions
- b. The portfolio excludes:
 - i. Dispatchable gas resources (CCGT, CT, etc.);
 - ii. Unspecified imports; and
 - iii. Gas-fired combined heat and power.
6. For each resource type in the projected portfolio, the installed capacity or annual energy is multiplied by an hourly production shape to produce a production profile for each hour for the modeled years. Storage resources can both increase demand (charging) or decrease demand (discharging).
7. The hourly production from each resource type in the projected portfolio is added to the hourly production profile of CHP, resulting in the total supply from all resources except for system power.
8. The hourly production from all resources in the previous step is subtracted from the hourly demand profile, resulting in an hourly MW value (referred to in the tool as “Net purchases, before curtailment and exports”) for each hour that represents the amount of power available from the LSE’s portfolio relative to the LSE’s demand in that hour. Positive values indicate that the LSE is relying on system power – dispatchable gas within CAISO and unspecified imports – to serve part of its demand. Negative values indicate that the LSE has excess power that can be supplied power to the system. Note that “Net purchases, before curtailment and exports” is similar, but not identical to the previous IRP cycle’s “Clean Net Short” hourly profile. The main difference is that specified coal imports and gas-fired CHP generation are included in “Net purchases, before curtailment and exports” but were not included in the Clean Net Short in the last cycle.
9. As shown in the figure below, SERVM dispatch patterns include a significant number of hours with simultaneous renewable curtailment *and* gas generation and/or unspecified imports during the same hour.

SERVVM Renewable Curtailment and Gas Generation and/or Unspecified Imports in 2030 in the 46 MMT Case



There are a variety of factors that may cause simultaneous curtailment of renewable generation and production from dispatchable gas generation/unspecified imports, including transmission constraints within CAISO, minimum uptime and downtime constraints on thermal resources, reserve requirements, ramp rate limitations, etc. Consequently, it is likely to be difficult to displace the remaining thermal generation in many of these hours. The hourly emissions factor calculation, outlined in a subsequent section, produces an emissions factor that represents the average emissions per MWh of system power. As long as at least one CAISO dispatchable gas generator is producing power, or at least 1 MWh of power is imported from an unspecified source in an hour, the calculated emissions factor will fall in the range of typically observed CAISO system power emissions factors (~ 0.4 tCO₂/MWh). This is true even if the magnitude of the system power is small (perhaps a few hundred MWs), and even if there is curtailment somewhere on the system. Applying this emissions factor to hours in which there is significant curtailment is inappropriate because this would allow an LSE to displace emissions from system power during hours when there is little to no system power that could be displaced. Consequently, the net purchases value that is used to calculate emissions is adjusted during hours when 1) renewable curtailment was observed in the SERVVM production cost simulation or 2) the CSP tool, when populated with the CAISO-

wide Reference System portfolio, suggests that system power is not on the margin. To ensure that all system-level emissions are accounted for across LSE portfolios, the MW level of dispatchable gas + unspecified imports during these hours is added back to the LSE's net purchases on a load-ratio share basis, resulting in a "net system power" value representing the power supplied by the system (or sent back to the system from if negative) in hours when CAISO dispatchable gas and/or unspecified imports are on the margin.

10. The net system power is multiplied by the system emissions intensity on an hourly basis, yielding total emissions associated with using system power for that LSE for every hour of the year. Four separate emissions profiles (CO₂/GHG, SO₂, NO_x, PM_{2.5}) are multiplied by the net system power value in each hour, resulting in separate values for hourly emissions for each of the four emissions types calculated in the Clean System Power tool. When an LSE has an oversupply of power (a negative net system power), it may receive credit for avoiding system power at the system emissions intensity during that hour. The credit applies only at the hourly level, as emissions are calculated for each hour independently of other hours.
11. Emissions from coal, supply-side CHP, biomass, and biogas are calculated in a similar manner using the hourly production profiles developed above.
12. Hourly emissions from the previous two steps are summed over the course of a year to yield resource-specific subtotals. The subtotals are then added together, resulting in the total emissions for each year for each type of emissions. Criteria pollutant emissions (SO₂, NO_x, PM_{2.5}) from specified imports of coal generation are calculated for informational purposes but are not included in the total emissions because these emissions occur outside of California.

Hourly emissions factors used in the CSP tool

The CSP Calculator is a tool that automates calculation of the net system power attributable to each LSE. It contains emissions intensities for system power that represent the average of only dispatchable thermal and unspecified imports on the CAISO system. The Net System Power emissions intensities are calculated in this manner because they are designed to quantify the emissions associated with consuming system power during hours when an LSE does not have enough GHG-free power to serve its own hourly load, while also assuming that CAISO system operations reflect a proportionate achievement of a statewide GHG target for the electric sector by 2030. Consequently, system power hourly emissions intensities are not directly comparable to other analyses that quantify the average emissions intensities of all generation (and imports and exports), both emitting and GHG-free. The CSP calculator also quantifies emissions "credits" that LSEs may receive by supplying more power to the system than is necessary to cover their own load.

Average emissions factors, as opposed to marginal, are used in the tool. Marginal emissions factors may be more appropriate when assessing the emissions impact of new investments or incremental demand (e.g., estimating emissions reductions from power plants that would turn down to accommodate additional renewable generation). The decision to use average rather than marginal emissions factors for system power reflects the underlying goal of the CSP method: to attribute system-wide emissions to multiple LSEs in a consistent manner, so that the aggregation of their portfolio emissions will be comparable to those of the system. One benefit of using average emissions factors is that multiplying an average emissions factor by a given level of demand will sum to the total emissions for that level of demand. In California, where there is a single dominant dispatchable fuel (natural gas), marginal emissions factors will tend to overestimate aggregate emissions because the marginal generator tends to be less efficient than generators further down in the stack of dispatchable resources.

Calculation description:

The average emissions factor (metric tons/MWh) of generation on the CAISO system associated with the Reference System Plan Portfolio is calculated for a subset of study years (2020, 2022, 2026, and 2030) on an hourly basis.

Hourly, unit-level generation profiles from the SERVIM production cost model maintained by CPUC staff are the basis for the hourly generation profiles. SERVIM dispatch values originate from a simulation of the Reference System Plan portfolio. SERVIM simulates many years of historical conditions in each production cost model run – dispatch data corresponding to only the weather year 2007 is used for the Clean System Power tool. To ensure data quality, fuel consumption is adjusted to be within the bounds of its minimum and maximum efficiency in a small number of hours.

Emissions intensity values for GHG and criteria pollutants (NO_x, PM_{2.5}, and SO₂) are calculated on an hourly basis for system power (dispatchable gas + unspecified imports), coal, CHP, biogas, and biomass. Hourly emissions factors for each generator class are calculated as the sum of emissions from all generators within that generator class, divided by the sum of generation.

GHG emissions are calculated based on the amount of fuel consumed in each hour and the GHG content of that fuel. For biogas and biomass, GHG emissions are zero based on current CARB accounting rules. In each hour, the GHG emissions factors for system power are a weighted average across CAISO dispatchable gas generation and unspecified imports. GHG emissions factors for system power include unspecified imports at the CARB deemed unspecified import rate of 0.428 tCO₂/MWh. Neither emissions nor power production from non-dispatchable combined heat and power (CHP) are included in the calculation of system power emissions factor.

CHP emissions factors are calculated separately because CHP is treated differently than system power in the tool. CHP emissions factors are reported on a net basis by subtracting out

emissions from fuel used to produce useful thermal output.¹ The goal is to capture emissions associated with electricity production (the “power” portion of CHP), but not from heat used outside of electricity production (the “heat” portion).

Criteria pollutant emissions for each unit are calculated based on available factors – metric tons of emissions per (1) MWh of generation, or (2) MMBtu of fuel. NOx emissions include different factors for start and normal operations. Criteria pollutant emissions factors for system power do not include any emissions associated with unspecified imports – these emissions factors are calculated using only emissions from in-CAISO dispatchable gas resources. The criteria pollutant hourly emissions intensity values for biomass and biogas are adjusted using minimum and maximum emission intensity cutoffs.

For the purposes of the net system power calculation, it is unlikely that LSEs would be able to displace significant amounts of GHG-intensive power during hours that experience curtailment. Consequently, as described in item #9 of the Conceptual Steps section above, if the SERVM simulation experienced renewable curtailment in an hour, the LSE’s net system power value is adjusted to reflect curtailment conditions.

Changes from the Clean Net Short calculator spreadsheet tool used in the 2017-8 IRP cycle

The primary differences between the Clean System Power and the Clean Net Short calculator tool used in the 2017-8 IRP cycle are summarized below.

1. **Criteria air pollutants:** Emissions intensity values for criteria pollutants (NOx, PM2.5, and SO₂) are calculated on an hourly basis for system power (dispatchable gas + unspecified imports), coal, supply-side CHP, biogas, and biomass in an LSE’s resource portfolio.
2. **Energy Only contracts:** LSEs can enter the annual GWh expected from Energy Only contracts for any resource type in their portfolio and the tool will calculate the implied capacity using resource-specific capacity factors.
3. **Asset-Controlling Supplier (ACS) resources:** LSEs can claim carbon-free energy from contracts with hydro-dominated ACS resources using RESOLVE dedicated dispatch numbers to characterize Northwest hydro hourly dispatch.
4. **CHP emissions:** Emissions from supply-side CHP generation are attributed to LSEs based on their load-weighted share.
5. **Load-modifier toggle:** LSEs can choose a percentage of their baseline load that is commercial and industrial (C&I), and can enter a custom C&I load shape if desired. The tool will rescale the LSE’s baseline load shape proportionally based on the percentage of C&I load specified.

¹ CARB (2016) “California’s 2000-2014 Greenhouse Gas Emission Inventory,” page 9. Available at: https://ww3.arb.ca.gov/cc/inventory/doc/methods_00-14/ghg_inventory_00-14_technical_support_document.pdf.

6. **Hourly (8760) emissions factors:** The CPUC’s SERVVM model is used as the basis for most hourly demand profiles, resource dispatch profiles, and emissions factors. The 2017-8 CNS calculator included month-hour average dispatch and emissions profiles from the RESOLVE model.
7. **System power during curtailment:** The tool has been updated to allocate a load-ratio share of system power to each LSE during hours when system power is not on the margin, for example during renewable curtailment events.
8. **New candidate resources:** LSEs can enter 4-hour or 2-hour battery storage, shed DR, out-of-state wind, and offshore wind to their supply-side resource portfolios.
9. **Generic CA Solar and Wind resources:** LSEs may select generic CA solar and/or wind resources after 2026. The hourly profiles and capacity factors of these generic resources reflect weighted averages based on the selected capacity in the Reference System Plan.

Layout of the Clean System Power Tool

The CSP Calculator is an Excel tool created to help LSEs calculate their emissions using the CSP method. It calculates the LSE’s annual emissions for a subset of the modeling years used in IRP modeling: 2020, 2022, 2026, and 2030.

Users should only modify two worksheets in the excel workbook: the *Supply Inputs* and *Demand Inputs* worksheets. As described below, the workbook contains many other worksheets that hold input data and perform calculations. The Excel spreadsheet consists of the following worksheets:

1. **Cover + Data Sources:** This worksheet contains information regarding key data sources, a description of the workbook’s color-coding scheme, and notes.
2. **Supply Inputs:** This worksheet is where LSEs enter information on their supply-side resource portfolio. This worksheet also contains information on the Reference System Plan portfolio that LSEs may want to use as a point of reference when developing their portfolios. In addition, this worksheet contains an optional input table that LSEs may fill out with custom 8760 shapes for GHG-free power.
3. **Demand Inputs:** This worksheet is where LSEs enter information on their annual demand forecasts from the IEPR, or a different sales forecast that has been approved through an ALJ Ruling finalizing load forecasts and GHG benchmarks. On this worksheet LSEs can also enter custom demand inputs for various load components if desired.
4. **Results:** Annual emissions results and aggregated generation and load information are presented on this worksheet.
5. **IEPR Form 1.1c:** This worksheet contains data from the IEPR as modified by an ALJ Ruling finalizing load forecasts and GHG benchmarks. As described below, this worksheet can be used to look up an LSE’s managed retail sales forecast. This worksheet is a read-only worksheet that the user should not change.

6. **ESP GHG Benchmark:** This worksheet contains a calculator that the ESPs must use to calculate their individual 2030 GHG benchmarks. This worksheet does not affect any other aspects of the tool.
7. **Benchmarks Net BTM CHP:** This is a list of LSE-specific benchmarks with the BTM CHP emissions backed out. This worksheet should be used by LSEs when developing their portfolios to look up the maximum GHG emissions that their portfolio should achieve.
8. **Load Resource Balance Calcs:** This worksheet starts with hourly demand at the generator bus bar and calculates an hourly MW profile for dispatchable gas + unspecified imports attributable to an LSE's load by subtracting power production from various resource types from the LSE's load profile.
9. **Emission Calcs:** This worksheet uses power production information on the *Load Resource Balance Calcs* worksheet and emissions factors from the Emissions Profiles worksheet to calculate hourly emissions by resource type.
10. **Demand Calcs:** This worksheet combines annual demand forecast information from the *Demand Inputs* worksheet with normalized hourly demand profiles from the *Demand Profiles* worksheet to create the hourly demand profiles used in the *Load Resource Balance Calcs* worksheet.
11. **IEPR CAISO Load Modifiers:** This worksheet contains data from the IEPR and is used to calculate detailed demand inputs given an LSE's managed retail sales forecast.
12. **Demand Profiles:** This worksheet contains the hourly, normalized load shape that is applied to the LSE's annual load forecast for each of the modeled years. It also contains shapes for electric vehicle loads, electrification loads, energy efficiency, and BTM PV.
13. **Supply Resource Profiles:** This worksheet contains hourly production profiles for various resource types. Storage resource profiles are also included on this worksheet.
14. **Emissions Profiles:** This worksheet contains hourly emissions profiles for GHG and criteria pollutant emissions for system power, coal, supply-side CHP, biomass, and biogas resources.
15. **Renewable Profiles:** This worksheet contains hourly renewable profiles for solar and wind resources. Profiles in this worksheet are based on the production profiles used as inputs to the RESOLVE model. All profiles correspond to weather conditions from the year 2007, but are normalized to the multi-year average capacity factor of each resource. Generic CA solar and CA wind profiles (meant only to be used post-2026) reflect the capacity weighted average of CA candidate profiles selected for the RSP Decision.
16. **Hydro Specified Imports Profile:** This worksheet contains month-hour average values for specified hydro imports from the Pacific Northwest to CAISO. Values are derived from RESOLVE dispatch of specified hydro imports from the Reference System Plan portfolio.

Instructions for Using the LSE Clean System Power Tool

To use the tool effectively, a user would generally take the following steps:

1. **Define demand level and profile:**

- a. **Annual managed sales forecast:** Input the LSE's annual managed sales load forecast for each of the modeling years in the "Managed Retail Sales Forecast (assigned to LSE)" row of the *Demand Inputs* worksheet. The LSE must enter its IRP-assigned annual load forecast. LSEs should refer to the *IEPR Form 1.1c* worksheet for LSE-specific managed retail sales forecast values. Populating the Managed Retail Sales Forecast row will automatically populate the "Calculated Demand" section of the *Demand Inputs* worksheet, which breaks the managed sales forecast into many components by assuming that the LSE has a sales-weighted share of specific components of the IEPR demand forecast, such as the level of BTM PV, energy efficiency, etc. Each of these demand components receive a distinct hourly shape in the CSP tool. For Alternative Portfolios, LSEs may choose to use different annual levels of load modifiers provided that they provide a detailed explanation as to how their alternate load modifier assumptions were developed in the Narrative Template. This is done by selecting "Yes" under the "Use Custom" column and entering in demand values in the Custom Demand Inputs section. Custom demand inputs must be grossed up for T&D losses before they are entered. Note that LSEs must enter their assigned managed retail sales forecast even if they plan to use custom levels of demand in their Alternative Portfolios because assigned managed retail sales are used to apportion non-dispatchable gas and supply-side CHP generation to LSE portfolios.
- b. **Custom hourly forecast (optional):** Users can specify custom 8760 demand profiles for each component of the demand forecast on the "Custom Hourly Load Profiles" section of the *Demand Inputs* worksheet provided the total annual energy volumes remain consistent with the forecast in section 1a above and the LSE provides a detailed explanation as to how their load shape was developed in the Narrative Template. This option is appropriate for LSEs that know the hourly shape of their demand components. Custom hourly shapes are applied to the annual demand forecasts in the *Demand Inputs* worksheet. The same custom demand profile shape is applied to all years. The hourly SERVM model simulations that are used to populate data throughout the calculator use the convention that all future years start on a Monday. When entering custom hourly demand forecasts users should strive to maintain this convention whenever possible. Also, if possible, custom hourly demand forecasts should be based on weather conditions from 2007.
- c. **Custom Commercial and Industrial (C&I) fraction of baseline demand (optional):** Users can specify a percentage of their baseline demand that comes from C&I loads in each year provided the total annual energy volumes remain consistent with the forecast in section 1a above and the LSE provides a detailed

explanation as to how their load shape was developed in the Narrative Template. Users should toggle the “Use Custom?” toggle to “Yes” to enable the custom C&I percentage. This percentage should not include demand from light duty electric vehicles in the C&I sectors because EV demand is handled elsewhere in the tool. A C&I baseline hourly demand shape will be applied to the C&I percentage, and the remaining baseline demand will receive a non-C&I hourly demand shape. If a custom C&I percentage is not entered, the default percentage will be used.

2. **Define owned or contracted supply-side resource portfolio:** On the *Supply Inputs* worksheet, input the LSE’s resource portfolio for each of the modeling years. Resources should only be added here if their power output is delivered to (1) a California Balancing Authority area, if RPS-eligible, or (2) the CAISO system if the resource is not RPS-eligible. LSEs will need to aggregate individual generators and contracts into the resource types shown on the *Supply Inputs* worksheet of the excel tool.
 - a. Users have the option to enter resource capacity in either annual GWh or MW of owned/contracted capacity. Users can switch between the two options using the drop-down menu in the MW/GWh column of the *Supply Inputs* worksheet. Storage and demand response resource capacity must be specified in units of MW – the annual GWh option is not available for these resources.
 - b. The following resource types are available to the user:
 - i. **RPS-eligible renewable resources:** Supply-side solar, wind, geothermal, biomass, biogas, small hydro resources. RPS PCC 1 and any other RPS-eligible resources that meet the criteria to qualify as RPS PCC 1 except for the contract execution date should be entered – RPS PCC 2 and 3 should not be included. Resources modeled in the RESOLVE model are provided as possible resources from which the user can choose. For wind and solar resources, users can choose between an aggregated representation of existing resources, or new (candidate) resources. Wind and solar candidate resources within CAISO are broadly grouped into different resource areas representing different transmission constraint zones defined by CAISO – a more detailed description of the resource areas is included in the Notes section for each resource. Wind and solar resources that (1) are expected to be located within the CAISO and (2) have an online date after 2026 may be entered under the ‘Generic_CA_Wind’ and ‘Generic_CA_Solar’ resources when a more granular level of detail is unknown. These are meant to be used only post-2026 (year 2030 in the CSP).
 - ii. **Large Hydro in CAISO:** Enter the owned/contracted capacity (MW) or annual energy (GWh) from large hydro resources. The division between “large” and “small” hydro should be consistent with RPS eligibility – any hydroelectric generation that is balanced by CAISO, does not currently count towards RPS requirements, and is not imported from the Pacific Northwest should be entered in the Large Hydro category. Large hydro

production is given an hourly production profile using SERVMM model outputs.

- iii. **Imported Hydro:** Dedicated imports from the Pacific Northwest from Asset Controlling Suppliers (predominantly hydro generation) are included in this category. Dispatch profiles for imported hydro from the Pacific Northwest come from month-hour average dispatch from the RESOLVE model.
 - iv. **Nuclear:** Users should enter any nuclear generation – either balanced directly by CAISO (Diablo Canyon) or directly imported into the CAISO system (likely Palo Verde).
 - v. **Coal:** Users should specify the owned or contracted capacity of dedicated coal imports.
 - vi. **Shed Demand Response (DR):** Users should enter the MW capacity of demand response programs. Given the infrequent dispatch of this resource, users cannot enter the capacity of this resource in GWh.
 - vii. **Storage:** Users should input the LSE's owned or contracted storage capacity (in MW) over time for three stand-alone storage options – pumped hydro, 2-hour battery, and 4-hour battery. The tool will use this capacity in conjunction with normalized storage dispatch profiles from the SERVMM model to determine the final storage dispatch in each hour. The normalized storage dispatch profiles vary by year. Any BTM storage resources that are incremental to BTM storage resources in the CPUC's IEPR demand forecast should be included here.
 - viii. **Custom GHG-free resource:** LSEs are also permitted the option of adding an energy production profile from custom GHG-free resources in the *Supply Inputs* worksheet. One possible use of the custom GHG-free resource functionality is to represent a wind resource with a production profile that is significantly different than any of the options on the *Supply Inputs* worksheet. Another possible use is to represent a contract for PCC 1 RECs that may include multiple types of resources that are either unknown in advance or that vary in type over time. Users should use 2007 weather conditions if possible.
- c. Users may want to refer to information presented in the “Information Only” sections of the *Supply Inputs* worksheet when creating their portfolios.
- i. The first Information Only section presents the Reference System Portfolio at the CAISO system level. While each LSE's portfolio represents a fraction of the CAISO system, it may be useful to explore the relative magnitudes of different supply-side resources during the portfolio creation process.
 - ii. The second Information Only section allows users to explore their portfolio in both units of MW of capacity *and* GWh of annual generation. The capacity factor assumed by the tool for each resource in each year is also shown.

3. **Investigate results:** Results are shown *Results* worksheet. Results include values for annual demand, power production, total emissions by source and by year, and average emissions intensity.
4. **Explore alternative assumptions** (optional): Adjust inputs in the *Demand Inputs* and *Supply Inputs* worksheets to explore different resource and demand scenarios.

ESP GHG Emissions Benchmark

The CSP Calculator contains a tool for ESPs to calculate their individual 2030 GHG Emissions Benchmarks.

Because the IEPR does not include load forecasts for individual ESPs, the GHG Emissions Benchmark is determined for all ESPs in aggregate within each IOU service territory, and these top-level values are made public. Each ESP is required to calculate its own confidential GHG Emissions Benchmark based on its 2030 load share within the host IOU's territory. For any ESP that serves load in more than one IOU service territory, that ESP should add up the separate GHG Emissions Benchmarks calculated based on its share of direct access load for each IOU service territory to result in a single benchmark.

Commission staff will confidentially communicate to each ESP its individual load forecast to be used within the tool, which will be developed based on the year-ahead load forecast that each ESP submits this year for RA purposes.

Notes

- While the CSP tool does not have a specific option that allows LSEs to simulate hybrid resources (storage + a supply resource, typically solar or gas), it is possible to represent hybrid solar + storage resources using one of the following methods:
 - Include battery and solar capacity separately and the tool will in-effect add the profiles together (without any dispatch constraints relating to the co-location of the resources), or
 - Use the user-defined custom GHG-free generation profile to model hybrid resource dispatch with a production shape that has been defined outside of the tool. If LSEs use this option, they should *not* enter capacity for the solar and battery resources in the "Capacity Inputs" section of the *Supply Inputs* worksheet - doing so would result in double counting of resource output. Note that the CSP tool contains both solar generation profiles and battery dispatch profiles that could be used to create a custom hybrid generation shape.
- For LSEs reporting Energy Only contracts that specify deliveries in PCC 1 renewable energy without specifying the nameplate capacity of the delivering resource(s), LSEs should enter the annual GWh for the resource(s) that it believes most closely matches the energy source or sources(s) for the contract in the *Supply Inputs* worksheet.

- Information on timeseries data: Hourly data in the Clean System Power tool is based on historical weather conditions from the year 2007. Variable renewable profiles are created using 2007 weather conditions at specific geographic locations. Demand profiles in the CPUC's SERVM dataset are based on underlying 2007 weather conditions, as well as a regression on many years of historical demand data. The SERVM demand profiles for all future years use the 1990 calendar, meaning the first day of the year is a Monday, and all holidays and weekends correspond to 1990 dates. Users of the Clean System Power tool should adhere to the following conventions when entering custom hourly 8760 profiles into the tool:
 - For renewable / GHG-free generation profiles, use 2007 weather conditions whenever possible.
 - For demand profiles, start on a Monday for all future years. If possible, also base weather conditions on the year 2007.
- The small hydro profile in the CSP tool has a lower capacity factor compared with RESOLVE. Because RESOLVE models small hydro as a flat profile, and SERVM models small and large hydro as one unit, a new profile was created for the purpose of hourly emissions. This was accomplished using historical small hydro generation in CAISO and CAISO contracted capacity. Those LSE's whose small hydro supply has a different capacity factor may choose to enter the energy supplied in GWh in the Supply Inputs tab rather than capacity using the toggle to the left of the input cells.
- When entering resources into the Supply Inputs tab of the CSP calculator, LSEs should only input resources for which they have procured or plan to procure directly.
 - LSEs should adjust their contracted capacity and quantity (MW or GWh) by any amount that they anticipate buying from or selling to another LSE. This is to help avoid having multiple LSEs count the same GHG-free resources toward achieving their individual 2030 GHG Benchmarks, and to ensure that the aggregation of all LSE portfolios amounts to 100% of all contracted or planned resources on the system. For example, if an LSE has a PCC-1 eligible energy-only contract for 100 GWh of wind energy, but anticipates it will sell 30 GWh from that project to another LSE, the selling LSE should only enter 70 GWh into the CSP calculator for the applicable planning years. If the planned sale and purchase is in an advanced stage, the counterparts should reflect each side of the transaction consistently with each other so the purchasing LSE (or group of LSEs, if applicable) enters the 30 GWh under sale so that the aggregated portfolio includes the full 100 GWh from that wind resource. Otherwise, the planned 70 GWh sale would be reflected by the seller. The future buyer may or may not be reflected in other LSEs' plans. In such instances, the LSE plan aggregation process would identify and seek to resolve issues associated with over or under "subscription" of existing resources.
 - Additionally, each LSE should input any eligible resources that are currently subject to the cost allocation mechanism (CAM). In estimating its share of

resources subject to the CAM, each LSE should refer to the most recent year-ahead CAM resource list available on the Commission's Resource Adequacy Compliance Materials webpage. The year-ahead CAM list reflects the contract start and end dates of Commission approved CAM resources. The list itemizes the resource adequacy capacity value by month for each IOU service territory. An LSE's proportional share is determined by its year-ahead share of the total coincident peak load for each IOU service territory, as assigned in the Commission's annual resource adequacy process. The LSE's proportional share of that resource is assumed static through the IRP planning horizon, but it will be updated each IRP cycle based on the current proportional share assignment from the Commission's annual resource adequacy process. LSEs should not make assumptions or predictions on what resources may be procured on behalf of all load and subject to the CAM in the future beyond what is already included in the most recent year-ahead CAM resource list.

- PCIA resources must be included in the IOU baseline of resources in the CSP tool, and other LSEs should not include PCIA resources in their baseline resources, unless otherwise directed by the Commission in the PCIA proceeding or another venue.
- If an LSE opted-out of its procurement obligation under D.19-11-016, or was not assigned a procurement obligation under D.19-11-016, and thus will have a certain amount of procurement occurring on their behalf, the LSE must enter an amount and type of resource(s) communicated to it by Energy Division staff. Staff will coordinate LSEs that are not self-procuring and IOUs procuring on their behalf to prevent double counting and to ensure that reported resources align with procurement that has already occurred or is consistent with the RSP.