Greenhouse Gas and Criteria Pollutant Accounting Methodology for use in Load-Serving Entity Portfolio Development in 2022 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 for 2024, 2026, 2030, and 2035.

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 to account for emissions of 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 calculator 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, including combined heat and power (CHP) and coal, as well as criteria pollutant emissions from biogas and biomass. The CSP methodology enables the CPUC to address four critical needs for the IRP process: (1) to evaluate the expected GHG emissions associated with individual LSE plans and resource portfolios on a fair and consistent basis; (2) to compare each LSE's expected GHG emissions against its CPUC-assigned benchmarks; (3) to evaluate the expected criteria pollutant emissions associated with individual LSE plans and resource portfolios on a fair and consistent basis; and (4) to compare expected LSE emissions in aggregate against the 2021 Preferred System Plan Portfolio as updated by IRP staff with more recent inputs and posted on the IRP website (2021 PSP Portfolio with updates) to meet the GHG planning target for the electric sector at least cost.[1]

Note that neither emissions from, nor demand met by, Behind-the-Meter Combined Heat and Power (BTM CHP) resources are included in the CSP calculator. 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. Commission-approved LSE GHG benchmarks apply to an LSE's supply-side emissions; BTM CHP emissions have already been subtracted from the LSE GHG benchmarks.

Two separate CSP calculators will be developed by CPUC staff, and both must be filled out by LSEs. The two calculators will have identical functionality and appearance but will contain

[1] 2021 PSP Portfolio with updates can be found at: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2022-irp-cycle-events-and-materials/lse-filing-requirement-resolve-results.pdf

different input data for the different resource portfolios associated with the 30 MMT and 25 MMT 2035 GHG targets.

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

The steps of the CSP method are as follow

1. The LSE enters their assigned annual managed sales and BTM photovoltaic (BTM PV) forecasts that have been approved through a 2022 ALJ Ruling finalizing load forecasts and GHG benchmarks.

2. The managed sales 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 (AAEE)
   c. Electric vehicles
   d. Building electrification (AAFS)
   e. BTM photovoltaics (set by ALJ ruling as noted in step 1)
   f. BTM storage

3. The annual demand forecast is translated into an hourly demand shape for each hour of the year for each demand component, resulting in a 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 modeled in the CSP calculator.

4. A portion of the LSE's demand is met with a load-ratio share of the system-wide in front of the meter (IFM) CHP generation. Emissions from this CHP generation are attributed to the LSE.

5. Using the Resource Data Template (RDT), the LSE builds a projected portfolio of its owned or contracted resources, which includes both online and planned resources. The portfolio can, and for most LSEs should, change over time from the first year (2024) to the last year (2035) that is included in the CSP calculator. After filling out the RDT, the LSE should copy the numeric values from CSP output tab from the RDT directly into the Supply Inputs tab of the CSP workbook using the "paste values" option in Excel. 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.
   g. This portfolio includes:
      i. RPS-eligible delivered 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. Shed demand response (load shedding at peak)
vii. Standalone battery storage
viii. Pumped hydro storage
ix. Hybrid or paired solar and battery resources
x. Generation with a defined hourly profile that:
   1. Does not fit into one of the categories above, and
   2. Does not produce GHG emissions
xi. Standalone storage with a defined hourly profile that does not fit into one of the categories above

h. The portfolio excludes:
   i. Dispatchable gas resources (combined cycle, combustion turbine, etc.)
   ii. Unspecified imports
   iii. Gas-fired combined heat and power

The resource capacity data that is passed from the RDT to the CSP calculator has different units based on resource type:

- Installed capacity for shed demand response, pumped hydro, and custom profile storage
- Installed discharge depth for standalone batteries
- Annual energy for all other resources

Conversion of RDT inputs to the appropriate CSP units is performed automatically in the RDT; LSEs do not need to perform this calculation.

6. For each resource type in the projected portfolio, the resource capacity data from the RDT is used to produce a production profile for each hour for the modeled years. Storage resources can both increase demand (charging) or decrease demand (discharging). The CSP calculator converts all supply resources from the RDT to installed capacity before multiplying by an hourly capacity factor.

7. The hourly production from each resource type in the projected portfolio is added to the hourly production profile of IFM 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 to the system.

SERVM dispatch patterns can include hours with simultaneous renewable curtailment *and* gas generation and/or unspecified imports during the same hour. 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 (~0.4-0.8 tCO_2/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 renewable curtailment is observed in the SERVM production cost simulation. To ensure that all system-level emissions are accounted for across LSE portfolios, the MW level of dispatchable gas + unspecified imports is added back to the LSE's net purchases on a load-ratio share basis during hours where there is a meaningful level of curtailment (>100 MW) in SERVM. The result of the above calculations is the hourly "net system power," which represents 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.

9. 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 (CO_2, SO_2, NO_x, and PM2.5) are multiplied by the net system power value in each hour, resulting in separate values for hourly emissions for each of the four emission types calculated in the Clean System Power tool. When an LSE has an oversupply of power (a negative net system power), it receives credit for avoiding system power at the system power emissions intensity during that hour. The credit applies only at the hourly level, as emissions are calculated for each hour independently of other hours.

10. Emissions from coal, IFM CHP, biomass, and biogas are calculated in a similar manner using the hourly production profiles developed above.

11. 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 (SO_2, NO_x, PM2.5) 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.

12. For the purpose of calculating an LSE's percentage of RPS-eligible delivered renewable and GHG-free generation, excess generation that is not used to serve an LSE's load is divided between exports and curtailment. Exported generation contributes to an LSE's RPS-eligible delivered renewable and GHG-free generation; curtailed generation does not. All excess generation is assumed to be exported up to the LSE's load-ratio share of hourly SERVM exports; any excess generation past this level of exports is curtailed.

13. The CSP calculator also calculates "Zero Emissions Power From System," which represents system power that is used to cover a portion of an LSE's load during periods of system-wide curtailment.

Hourly emissions factors used in the CSP calculator

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. 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 factors (metric tons/MWh) of generation on the CAISO system associated with the 2021 PSP Portfolios with updates are calculated for a subset of study years (2024, 2026, 2030, and 2035) on an hourly basis. The process outlined below is performed twice, once for the 30 MMT CSP calculator and once for the 25 MMT CSP calculator.

Hourly, unit-level generation profiles from the SERVM production cost model maintained by CPUC staff are the basis for the hourly generation profiles. SERVM dispatch values originate from simulations of the 2021 PSP Portfolios with updates; the SERVM runs for the CSP calculator represent the 2021 PSP Portfolios with updates directly and have not been tuned to a 0.1 loss-of-load expectation. SERVM simulates many years of historical conditions in each production cost model run – dispatch data corresponding to only the weather year 2009 is used for the Clean System Power tool. 2009 is chosen because annual load, peak load, wind output, and solar output values for this year are close to the average value across all SERVM-modeled weather years. To ensure data quality, fuel consumption is adjusted to be within the bounds of minimum and maximum efficiency in a small number of hours.

Emissions intensity values for GHG and criteria pollutants (NO_x, PM2.5, and SO_2) 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 tCO_2/MWh. The level of unspecified imports is calculated by first reducing total SERVM imports by 11.9 TWh/yr of asset controlling supplier hydro imports from the Pacific Northwest. The 11.9 TWh/yr value is based on historical asset controlling supplier imports and is consistent with RESOLVE assumptions. After hydro imports have been removed from the total SERVM imports, specified imports of geothermal, solar, and wind resources are subtracted from SERVM's hourly import profile to arrive at the final profile for unspecified imports.

Neither emissions nor power production from IFM CHP resources are included in the calculation of system power emissions factor. IFM CHP emissions factors are calculated separately because CHP is treated differently than system power in the tool. IFM CHP emissions factors are reported on a net basis by subtracting out emissions from fuel used to produce useful thermal output[2]. The goal is to capture emissions associated with electricity production (the "power" portion of combined heat and power), 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. NO_x 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.

Changes from the Clean System Power calculator used in the 2019-20 IRP cycle

The primary differences between the Clean System Power Calculator in the 2022-2023 IRP cycle and that of the 2019-2020 cycle are summarized below.

1. Increased interaction with the Resource Data Template. LSEs should copy the CSP output from the Resource Data Template as the input for their supply portfolio. LSEs do not need to input additional information on supply resources into the CSP calculator unless their portfolio includes renewable, GHG-free, or storage resources with a custom profile, in which case they need to add the profile of those resources to the Supply Inputs tab.
2. Updated years calculated by the tool. The 2020 CSP calculator included 2020, 2022, 2026, and 2030; the 2022 CSP calculator includes 2024, 2026, 2030, and 2035.
3. Calculation of RPS-eligible delivered renewable and GHG-free percentage of retail sales by year.
4. The custom GHG-free profile option is split into three separate profiles: Storage, RPS, and non-renewable GHG-free.
5. A 2009 modeled weather year as opposed to a 2007 modeled weather year.
6. Updated demand profiles.
7. Addition of a hybrid/paired solar-battery supply resource option.
8. Wind and solar profiles sourced from the Energy Division's SERVM model rather than RESOLVE.
9. Quality checks available in the Supply and Demand inputs tabs that flag major errors.
10. Separation of curtailment and exports.
11. LSEs must entire their assigned annual BTM PV forecasts as well as their managed sales forecasts.

[2] 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.

Layout of the Clean System Power Tool

The CSP Calculator is an Excel tool created to help LSEs calculate emissions associated with their resource portfolio. It calculates the LSE's annual emissions for a subset of the modeling years used in IRP modeling: 2024, 2026, 2030, and 2035.

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 copy information on their supply-side resource portfolio from the RDT using the "paste values" option in Excel. In addition, this worksheet contains an input table that LSEs must fill with 8760 resource generation profiles out if they have included custom storage, renewable, or GHG-free resources in their portfolio. The only part of the supply inputs tab that does not directly come from RDT is the custom profile section.
3. **Demand Inputs**: This worksheet is where LSEs enter information on their annual demand 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. **LSE Demand Forecasts**: This worksheet contains data on electricity deliveries to end users approved in 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 Benchmarks:** This worksheet contains a calculator that the ESPs must use to calculate their individual 2030 and 2035 GHG benchmarks. This worksheet does not affect any other aspects of the tool.
7. **GHG Benchmarks:** This a list of LSE-specific benchmarks approved in an ALJ Ruling finalizing load forecasts and GHG benchmarks. This worksheet should be used by LSEs when developing their portfolios to look up the maximum GHG emissions that their portfolio should achieve.
8. **Supply Demand 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. It also divides energy that is not used to serve an LSE's load between curtailment and exports.
9. **Supply Calcs:** This worksheet adds up power production and storage dispatch from resources in the LSE's portfolio.

10. **Emission Calcs**: This worksheet combines power production information on the *Supply Calcs* and *Supply Demand Balance Calcs* worksheets with emissions factors from the *Emissions Profiles* worksheet to calculate hourly emissions by resource type.
11. **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 profile used in the *Supply Demand Balance Calcs* worksheet.
12. **IEPR CAISO Load Modifiers**: This worksheet contains data from the IEPR and is used to divide an LSE's managed retail sales forecast into more detailed demand components.
13. **Demand Profiles**: This worksheet contains the hourly, normalized load shapes that are applied to the LSE's annual load forecast for each of the modeled years. It contains shapes for the following demand categories: baseline, commercial and industrial, electric vehicles, building electrification, energy efficiency, BTM PV, and BTM storage.
14. **Resource Profiles**: This worksheet contains hourly production profiles for various generation resources. Storage and hybrid/paired solar-battery resource profiles are also included on this worksheet.
15. **Emission Profiles**: This worksheet contains hourly emissions profiles for GHG and criteria pollutant emissions for system power, coal, IFM CHP, biomass, and biogas resources.
16. **Renewable Profiles**: This worksheet contains hourly renewable profiles for standalone solar and wind resources. Profiles in this worksheet are based on the production potential profiles (i.e. pre-curtailment) used as inputs to the SERVM model. All profiles correspond to weather conditions from the year 2009 and are not shifted for daylight savings time (are in standard time throughout the year). The four resource profiles for new solar and wind (Solar New PG&E, Solar New SCE SDG&E, Wind New PG&E, and Wind New SCE SDG&E reflect the capacity-weighted average of candidate resource profiles selected for the 2021 PSP Portfolio with updates in the year 2030.
17. **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 2021 PSP Portfolio with updates.

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 and BTM PV forecasts**: Input the LSE's annual managed sales and BTM PV forecasts for each of the modeling years in the "Managed Retail Sales Forecast (assigned to LSE)" and "Behind-The-Meter Photovoltaics (BTM PV) Forecast (assigned to LSE)" rows of the *Demand*

Inputs worksheet. The LSE must enter its IRP-assigned values and therefore should refer to the *LSE Demand Forecasts* worksheet for LSE-specific managed retail sales forecast values. Populating the Managed Retail Sales Forecast and BTM PV rows 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 baseline demand, energy efficiency, electric vehicles, 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 retailed sales and BTM PV forecasts even if they plan to use custom levels of demand in their Alternative Portfolios. Assigned managed retail sales are used to apportion non-dispatchable gas and IFM 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 2009 and should remain in standard time throughout the year (i.e. no daylight savings shift)
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 (1) demand from electrification of buildings that is incremental to that embedded in the IEPR baseline

demand or (2) electric vehicles because these components are 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. The Resource Data Template aggregates LSEs portfolios into the CSP format; LSEs should directly paste the RDT data into CSP calculator using the "paste values" option in Excel.

   Users may want to refer to information presented in the "Information Only" section of the Supply Inputs worksheet, which depicts their portfolio in 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.

   Information on each resource type in the CSP is provided below:

   a. **RPS-eligible delivered 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. For standalone wind and solar resources, users can choose between an aggregated representation of existing resources, or new (candidate) resources located in CAISO. Offshore and out-of-state wind resource types are also available. In addition to other supply-side solar resources, a distributed solar option is available for LSEs who would like to include distributed solar resources that are in front of the meter.
   b. **Hybrid or paired solar and battery:** LSEs may represent hybrid or paired solar-battery resources in the CSP calculator using output shapes from an aggregate of hybrid and paired resource dispatch in the SERVM model. Here "paired" resources refer to generation and storage resources that share the same grid interconnection and "hybrid" resources refer to a subset of paired resources that have constraints which require storage to charge from the paired generation resource rather than the grid. Recognizing that there are a range of possible hybrid and paired configurations, if the hybrid/paired profile in the CSP calculator does not adequately represent an LSE's expected hybrid or paired resource output, LSEs can use the custom renewable profile functionality described below as an alternate way to include hybrid or paired resource generation.

c. **Large Hydro in CAISO**: Energy 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 as Large Hydro. Large hydro production is given an hourly production profile using SERVM model outputs.
d. **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.
e. **Nuclear**: Nuclear generation either balanced directly by CAISO (Diablo Canyon) or directly imported into the CAISO system (likely Palo Verde) should be included here.
f. **Coal**: Represents owned or contracted generation from dedicated coal imports. The CSP calculator does not include coal dispatch data for 2026 and beyond due to expected expiration of Intermountain Power Plant coal contacts.
g. **Shed Demand Response (DR)**: MW capacity of load shedding demand response programs. Given the infrequent dispatch of this resource, the RDT specifies MW capacity for shed DR (as opposed to GWh for most other resources).
h. **Storage**: The LSE's owned or contracted storage capacity over time for two stand-alone storage options – pumped hydro and batteries. The tool will use this capacity in conjunction with normalized storage dispatch profiles from the SERVM model to determine 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 CEC's IEPR demand forecast should be included here. Battery capacity data passed from the RDT to the CSP is MWh of nameplate energy capacity. Representing batteries in this manner allows the CSP to represent different battery durations. The SERVM profile for batteries was created using the output from 4-hour duration batteries; the CSP calculator converts battery MWh from the RDT into a 4-hour battery equivalent. For example, a 100 MW 4-hr battery and a 200 MW 2-hour battery would have the same charge/discharge profile in the CSP calculator.

   LSEs may utilize the Storage Resource Custom Profile option if they determine that one or many of their standalone storage resources differ enough from the pumped storage or batteries options above to require representation via an LSE-entered custom 8760 charge/discharge profile. Only one custom storage resource profile is allowed in each year; if LSEs plan to represent multiple resources under this category, they should add together the individual production profiles of each resource to create an aggregate 8760 shape representing the output of all resources they have chosen to represent as a custom profile resource. When possible, LSEs should use 2009 weather conditions when developing custom resource profiles.

i. **Custom Renewable and GHG-free resources**: LSEs are also permitted the option of adding two custom 8760 energy production profiles in the *Supply Inputs* worksheet. There are two separate profile options: one for RPS-eligible delivered energy and another for GHG-free non-RPS energy. The two profiles are used in the same way in the CSP calculations, with the exception that GHG-free non-RPS energy will not be counted towards the RPS-eligible delivered renewable percentage calculation in the Results tab. When possible, LSEs should use 2009 weather conditions when developing custom energy production profiles. The RDT will aggregate the GWh of generation that LSE plans to represent via custom renewable and GHG-free profiles; this total must match the sum of hourly energy production in each year. Only one custom renewable profile and one custom GHG-free profile is allowed in each year; if LSEs plan to represent multiple resources under each of these categories, they should add together the individual production profiles of each resource to create an aggregate 8760 shape representing the output of all resources they have chosen to represent with custom profiles.

    i. One possible use of the custom renewable 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. Similarly, LSEs could use the GHG-free resource profile to represent a large hydro contract with a unique output profile.

    ii. Another possible use of the custom renewable profile is to represent hybrid or paired solar and battery resources. LSEs should only use this option if they determine that the CSP's hybrid/paired resource does not accurately represent their resource(s). To represent a hybrid or paired resource with a custom 8760 profile, LSEs should develop an output profile for the resource outside the CSP calculator and enter the result into the tool in the Custom Hourly profiles section of the Supply Inputs tab. Note that the CSP calculator contains both solar generation profiles and storage dispatch profiles that could be used to create a custom hybrid generation shape.

3. **Investigate results**: Results are shown in the *Results* worksheet. Results include values for annual demand, power production, total emissions by source and by year, average emissions intensity, percent renewable generation, and percent GHG-free generation.

   The percent RPS-eligible delivered renewable generation metric shown in the CSP *Results* worksheet is not directly comparable to an LSE's renewable generation that would be used to comply with the state's RPS requirement because the CSP calculator quantifies renewable generation that is directly delivered to California. Generation from PCC2 and PCC3 renewables are not included in the CSP calculator's renewable generation percentage but are eligible for RPS requirement compliance; the CSP calculator does not contain information on PCC2 and PCC3 RECs.

4. **Explore alternative assumptions** (optional): Adjust inputs in the *Demand Inputs* and *Supply Inputs* worksheets to explore different resource and demand scenarios. As most inputs on the *Supply Inputs* worksheet originate from the RDT, if an LSE would like to change their supply portfolio, they should edit the RDT and copy the results into the CSP.

ESP GHG Emissions Benchmarks

The CSP Calculator contains a tool for ESPs to calculate their individual 2030 and 2035 GHG Emissions Benchmarks.

Because the IEPR does not include load forecasts for individual ESPs, the GHG Emissions Benchmarks are 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 Benchmarks based on its 2030 and 2035 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 calculator, which was developed based on ESP-submitted IRP and resource adequacy forecasts, 2021 recorded loads, and direct access service request data..