

California Air Resources Board

Quantification Methodology

California State Transportation Agency
Zero Emission Transit Capital Program

California Climate Investments



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List of Acronyms and Abbreviations

Acronym	Term
AB	Assembly Bill
AC	Alternating Current
AHSC	Affordable Housing and Sustainable Communities
CalSTA	California State Transportation Agency
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CEC	California Energy Commission
CNG	Compressed Natural Gas
DC	Direct Current
DCS	California Department of Community Services and Development
Diesel PM ₁₀	Diesel Particulate Matter with a diameter less than 10 micrometers
DME	Dimethyl Ether
ft ²	Square Feet
ft ³	Cubic Feet
GGRF	Greenhouse Gas Reduction Fund
GHG	Greenhouse Gas
kW	Kilowatt
kWh	kilowatt hours
lbs	Pounds
LCFPP	Low Carbon Fuel Production Program
LCTOP	Low Carbon Transit Operations Program
LIWP	Low Income Weatherization Program
LNG	Liquid Natural Gas
MTCO _{2e}	Metric Tons of Carbon Dioxide Equivalent
NO _x	Nitrous Oxide
PM _{2.5}	Particulate Matter with a diameter less than 2.5 micrometers
PTA	Public Transportation Account
PV	Photovoltaic
RNG	Renewable Natural Gas
ROG	Reactive Organic Gas
RTPA	Regional Transportation Planning Agency
SB	Senate Bill
SGC	Strategic Growth Council
TIRCP	Transit and Intercity Rail Capital Program
VMT	Vehicle Miles Traveled
ZETCP	Zero-Emission Transit Capital Program

Preface

SB 125 (Chapter 54, Statutes of 2023) set aside a distribution of \$4 billion in General Fund through the Transit and Intercity Rail Capital Program (TIRCP) on a population-based formula to Regional Transportation Planning Agencies (RTPAs). The bill also established the \$1.1 billion Zero-Emission Transit Capital Program (ZETCP, or Program) to be allocated to RTPAs on a population-based formula and another formula based on revenues to fund zero-emission transit equipment and operations.

Of the \$1.1 billion available for ZETCP, \$910 million comes from the GGRF and the remaining \$190 million comes from Public Transportation Account (PTA) funding. The funding will be available for four total Fiscal Years, with PTA funding only being use for the first year. The money may be used by RTPAs for zero-emission transit equipment or to fund transit operations expenditures that prevent service reduction or elimination, in order to maintain or increase transit ridership.

ZETCP Quantification Methodology

CARB staff developed this ZETCP Quantification Methodology to provide direction to applicants and California State Transportation Agency (CalSTA) -contracted technical-assistance providers for estimating greenhouse gas (GHG) emission reductions from quantifiable projects elements. The primary purpose of this document is to guide applicants and technical-assistance providers on the requirements for reporting quantifiable project elements at the time of application. A list of quantifiable projects is provided in Table 1 of this Quantification Methodology.

Due to the multitude of project types integrated under the ZETCP, this ZETCP Quantification Methodology quantifies GHG emission reductions and co-benefits using CARB calculators from various California Climate Investments programs. Table 1 lists the ZETCP projects that can be quantified. The availability of a tool to quantify the benefits of a project element should not be construed as eligibility for funding. Please refer to the ZETCP Program Guidelines for ultimate determination of eligible uses of ZETCP funds. All CARB quantification methodologies and calculators are available on the [CARB California Climate Investments Quantification, Benefits, and Reporting Materials webpage](#).

Quantification methodologies estimate the GHG emission reductions and selected co-benefits based on applicant-supplied data. Applicants will need to determine and submit the necessary data inputs and supporting documentation. Tables 2 through 15 identify the required data inputs for each project. Technical assistance providers will then use the quantification methodologies and tools to estimate the total emission reductions and co-benefits from quantifiable projects using the required data inputs listed in Tables 18 through 28.

Introduction

California Climate Investments is a statewide initiative that puts billions of cap-and-trade dollars to work facilitating GHG emission reductions; strengthening the economy; improving public health and the environment; and providing benefits to residents of disadvantaged communities, low-income communities, and low-income households, collectively referred to as “priority populations.” Where applicable and to the extent feasible, California Climate Investments must maximize economic, environmental, and public health co-benefits to the State.

Greenhouse Gas Emissions Quantification

CARB is responsible for providing guidance on estimating the GHG emission reductions and co-benefits from projects receiving monies from the Greenhouse Gas Reduction Fund (GGRF). This guidance includes quantification methodologies, co-benefit assessment methodologies, and benefits calculator tools. CARB develops these methodologies and tools based on the project types eligible for funding by each administering agency, as reflected in the program expenditure records available on the [CARB Expenditure Record and Attestation Memos webpage](#).

For the ZETCP, CARB developed this ZETCP Quantification Methodology to aggregate estimated GHG emission reductions and selected co-benefits of each proposed quantifiable project. This methodology incorporates CARB quantification methodologies developed for existing California Climate Investments programs posted through September 29, 2023 on the [CARB Quantification Resources webpage](#). These existing quantification methodologies are used to estimate carbon sequestration, GHG emission reductions, avoided GHG emissions, and GHG emissions associated with the implementation of ZETCP projects.

Co-Benefits Quantification

Applicants will work with their technical assistance provider to estimate and report the combined total GHG emission reductions and selected co-benefits estimated using the applicable CARB quantification methodologies as well as the combined total GHG emission reductions per dollar of GGRF funds requested.

Using largely the same inputs required to estimate GHG emission reductions, the ZETCP Benefits Calculator Tool estimates the following co-benefits and key variables from ZETCP projects:

- Total, local, and remote ROG emission reductions (lbs);
- Total, local, and remote NO_x emission reductions (lbs);
- Total, local, and remote PM_{2.5} emission reductions (lbs);
- Total, local, and remote diesel PM₁₀ emission reductions (lbs);
- Passenger VMT reductions (miles);
- Fossil fuel use reductions (gallons);
- Fossil fuel based energy use reductions (kWh and/or therms);

- Renewable energy generated (kWh);
- Renewable fuel generated (gallons and/or scf);
- Travel cost savings (\$); and
- Energy and fuel cost savings (\$).

Additional co-benefits for which CARB assessment methodologies were not incorporated into the Benefits Calculator Tool may also be applicable to the project. Applicants should consult the ZETCP Guidelines, CalSTA guidance, and agreements to ensure they are meeting ZETCP requirements. All CARB co-benefit assessment methodologies are available on the [CARB Quantification Resources webpage](#).

All ZETCP awardees are required to report the potential employment benefits associated with their project as estimated using the jobs co-benefit assessment methodology developed by CARB. The CARB Jobs Co-Benefit Assessment Methodology and modeling tool are available on the [CARB Methodologies webpage](#).

Jobs Reporting

All ZETCP projects must foster job creation and employment of California workers and businesses. In addition to the requirement above, awarded grantees will also be required to report on the employment outcomes of their projects by reporting the actual jobs provided during the implementation of the project, including: the type of jobs provided, education and experience required, whether priority population residents are employed and provided training, and wages and benefits provided.

Methodology Development

CARB and CalSTA developed this ZETCP Quantification Methodology consistent with the guiding principles of California Climate Investments, including ensuring transparency and accountability. CARB and CalSTA developed this ZETCP Quantification Methodology to be used to estimate the outcomes of proposed projects and track results of funded projects. The implementing principles ensure that the methodology would:

- Apply at the project level;
- Provide uniform methods to be applied statewide, and be accessible by all applicants;
- Use existing and proven tools and methods;
- Use project-level data, where available and appropriate; and
- Result in GHG emission reduction estimates that are conservative and supported by empirical literature.
- CARB used existing California Climate Investment quantification methodologies that have been developed using peer-reviewed literature and tools and consultation with experts, as needed, to determine methods

appropriate for the quantifiable projects. CARB also consulted with CalSTA to determine the availability of inputs at the project -level. The methods were developed to provide estimates that are as accurate as possible with data readily available at the project level.

CARB released the Draft ZETCP Quantification Methodology for public comment in September 2023. The Final ZETCP Quantification Methodology will be updated to address public comments, where appropriate, and for consistency with updates to the ZETCP Guidelines.

Tools

Applicants must use the ZETCP Quantification Methodology and other applicable CARB quantification methodologies and tools to estimate the GHG emission reductions and co-benefits of the proposed project. The Quantification Methodology are subject to change pending stakeholder comments and final ZETCP guidelines. The ZETCP Benefits Calculator Tool and other CARB quantification methodologies and tools can be downloaded from the [CARB Quantification Resources webpage](#).

Benefits calculator tools rely on CARB-developed emission factors. CARB has established a single repository for emission factors used in CARB benefits calculator tools, referred to as the California Climate Investments Quantification Methodology Emission Factor Database, available on the [CARB Quantification Resources webpage](#). The Emission Factor Database Documentation explains how emission factors used in CARB's benefits calculator tools are developed and updated.

Program Assistance

Applicants will have the option to work with CalSTA-contracted technical assistance providers to estimate GHG emission reductions and selected co-benefits for quantifiable projects. Technical assistance providers will use the final ZETCP Quantification Methodology and accompanying Benefits Calculator Tools to estimate the GHG emission reductions associated with quantifiable projects. CARB and CalSTA staff will review the GHG emission reduction estimates to ensure that the methods described in this document were properly applied to estimate the total GHG emission reductions for the quantifiable projects. Applicants should use the following resources for additional questions and comments:

- Questions on this document should be sent to the [GGRF Program email](#).
- For more information on CARB's efforts to support implementation of California Climate Investments, see the [CARB Cap-and-Trade Program Webpage](#).
- Questions pertaining to the ZETCP should be sent to the [SB 125 CalSTA email](#).

Methods

Overview

The following section provides details on the methods supporting emission reductions estimates in the CARB benefits calculator tools. Applicants will follow the steps in this section to estimate the emission reductions from quantifiable projects.

Step 1: Identify Quantifiable Projects that Reduce GHG Emissions

For GHG quantification purposes, CalSTA identified several quantifiable project categories. Per the ZETCP Guidelines, applicants must propose a minimum of three quantifiable projects that represent at least 50 percent of the total ZETCP funds requested. Other projects may be included in ZETCP Plans for up to 50% of the total funds requested. A complete list of quantifiable projects and the applicable CARB quantification methodologies is provided in Table 1.

NOTE: Some of the projects listed in Table 1 are quantifiable in more than one CARB Quantification Methodology. Different CARB benefits calculator tools will produce the same outputs for a given project element. Applicants are encouraged to reduce the total number of tools submitted for verification by quantifying multiple project elements in the same calculator when possible. However, to avoid double-counting of GHG emission reduction estimates, applicants must *not* quantify estimates for project elements multiple times in separate CARB quantification methodologies.

Quantification Methodology for the CalSTA ZETCP

Table 1. Quantifiable Projects and CARB Quantification Reference, by ZETCP Strategy

ZETCP Strategy	Quantifiable Projects	CARB Quantification Methodology	Quantification Calculator Tool
Transit Capital Projects	<ul style="list-style-type: none"> • New service • System and efficiency improvements • Cleaner Vehicles/Technology/Fuels • Fuel/Energy Reduction 	Quantification Methodology for the CalSTA Transit and Intercity Rail Capital Program (TIRCP)	Benefits Calculator Tool
Operations Projects	<ul style="list-style-type: none"> • New expanded/enhanced transit service (bus, train, ferry, shuttle, or vanpool) • Increased ridership (including via fare subsidies/vouchers) • Fuel/Energy Reductions • Technology conversion 	Quantification Methodology for Caltrans Low Carbon Transportation Operation Program (LCTOP) (January 9, 2023)	Benefits Calculator Tool
Solar PV Installation	<ul style="list-style-type: none"> • Including solar PV installation in new construction or substantial rehabilitation of transit hubs and maintenance centers 	Quantification Methodology for the SGC Affordable Housing and Sustainable Communities (AHSC) Program (December 15, 2022)	Benefits Calculator Tool
Energy Efficiency, and Appliance Electrification	<ul style="list-style-type: none"> • Upgrades, retrofits, and repairs to improve overall building energy efficiency 	Quantification Methodology for CSD Low-Income Weatherization Program (LIWP) (February 28, 2023)	Benefits Calculator Tool
Low Carbon Fuels Production	<ul style="list-style-type: none"> • New Facilities • Expanded Facilities 	Quantification Methodology for CEC Low Carbon Fuels Production (LCFP) Program (September 2019)	Benefit Calculator Tool

Step 2: Determine and Submit Data Inputs and Documentation to Estimate GHG Emission Reductions

Data inputs required from the applicant to quantify GHG emission reductions vary based on the quantifiable projects identified in Step 1. The tables in this section list and describe the applicant-supplied information necessary to quantify the GHG emission reductions for each project category. Additional inputs determined by the technical assistance providers are described in Appendix A.

The required inputs listed are from the latest version of existing CARB quantification methodologies available on the [CARB Quantification Resources webpage](#).

Transit Capital Projects

The required inputs listed in Table 2 below are from the CARB Quantification Methodology for CalSTA TIRCP. Full documentation of the approach for estimating the GHG emission reduction can be found within the TIRCP Quantification Methodology. Some fields may be required depending on the type of vehicle required. The calculator tool is programmed to automatically make required cells available for input.

Table 2: Applicant-Supplied Inputs for Transit Projects Within the TIRCP Benefits Calculator Tool

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
ZETCP Funds Requested for LCTOP Project Elements (\$)	Required	Required	Required	Required
Other GGRF Leveraged Funds (\$)	Required	Required	Required	Required
Non-GGRF Leveraged Funds (\$)	Required	Required	Required	Required

Project Information Section

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
Project Type	Required	Required	Required	Required
Service Type	Required	Required	Required	Required
Type of Region	Required	Required	Required	Required
Region	Required	Required	Required	Required
Year 1	Required	Required	Required	Required
Year F	Required	Required	Required	Required

Displaced Passenger Auto VMT Section

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
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Yr1 Ridership	Required	Required	NA	NA
YrF Ridership	Required	Required	NA	NA
Adjustment Factor	Required	Required	NA	NA
Length of Average Trip	Required	Required	NA	NA

New Service Vehicle Section

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
Vehicle Type	Required	NA	Required	NA
Engine Tier	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Engine Horsepower	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Fuel Type	Required	NA	Required	NA
Hybrid Vehicle	Required	NA	Required	NA
Model Year	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Project-Specific GHG Emission Factor	Optional	NA	Optional	NA
Annual VMT	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Annual Fuel Use	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA

Baseline Vehicle Inputs Section

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
Vehicle Type	Optional	NA	Required	NA
Engine Tier	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Engine Horsepower	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA

Fuel Type	Depends on Vehicle Type	NA	Required	NA
Model Year	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Annual VMT	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA
Annual Fuel Use	Depends on Vehicle Type	NA	Depends on Vehicle Type	NA

Fuel/Energy Reduction Inputs Section

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
Vehicle Type	Optional	Optional	Optional	Required
Engine Tier	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type
Engine Horsepower	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type
Fuel Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Required
Model Year	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type
Annual Fuel Use	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type

Travel Cost Saving Section

Required Input Fields	New Service	System/ Efficiency Improvements	Clean Vehicles /Technology/F uels	Fuel/Energy Reductions
Baseline Average One-Way Fare Cost	NA	Optional	NA	NA
New Average One-Way Fare Cost	Optional	Optional	NA	NA
Average Transit Facility Parking Cost	Optional	Optional	NA	NA

Average Avoided Parking Cost	Optional	Optional	NA	NA
Average Avoided Toll Cost	Optional	Optional	NA	NA

- Project Type: Eligible TIRCP projects fall into four project types. Select the project type that best describes this component.
- Service Type: The transit service (e., InterCity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that service multiple services, select Multi-Modal.
- Type of Region: The type of region that best encompasses the geographic location for the proposed project type.
- Region: The County or Air Basin where the majority of the service occurs.
- Year 1 (Yr1): The first year of service or the first year the facility or rolling stock will be in use.
- Year F (YrF): The final year of service or the final year the facility or rolling stock's useful life.
- Yr1 Ridership: The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).
- YrF Ridership: The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.
- Adjustment Factor: Discount factor applied to annual ridership to account for transit-dependent riders. Use document project-specific data or system average developed from a recent, statistically valid survey or default.
- Length of Average Trip: Annual passenger miles over unlinked trips directly associated with the proposed project.
- Vehicle Type: The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.
- Engine Tier: The engine tier for the vehicle(s) that will operate the new service.
- Engine Horsepower: The engine horsepower rating for the vehicle(s) that will operate the new service.
- Fuel Type: The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new service, or of the new vehicle(s) to be procured.
- Hybrid Vehicle: Is the vehicle for the new service, or vehicle(s) to be procured, a hybrid? (Only applicable to non-zero emission fuel types)
- Model Year: The engine model year of the vehicle that will operate the new service, or of the new vehicle(s) to be procured.
- Project-Specific GHG Emission Factor: If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.

- Annual VMT: The estimated annual VMT required to operate the new service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel. For vehicles with multiple engines (e.g., DMUs), provide the cumulative VMT across all the engines.
- Annual Fuel Use: The estimated annual fuel (i.e., gallon of diesel, kWh of electricity) required to operate the new service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000). Units of gallons for biodiesel, diesel, gasoline, LNG, renewable diesel; scf for CNG and renewable natural gas; kWh for electric; kg for hydrogen.
- Baseline Average One-Way Fare Cost: The average fare cost per trip per rider prior to project implementation. If expanding service, baseline fare cost is zero.
- New Average One-Way Fare Cost: The new expected average fare cost per trip per rider resulting from the proposed project.
- Average Transit Facility Parking Cost: The average expected cost of parking per trip per rider that riders would pay at the transit facility where the trip originates. Consider that not all transit riders may use the parking. However, the calculations will already take into account that parking is only paid once per round trip.
- Average Avoided Parking Cost: The average expected cost of parking per trip per rider that riders would have otherwise paid if not using the service resulting from the project. The calculations will already take into account that parking is only paid once per round trip.
- Average Avoided Toll Cost: The average expected cost of tolls per trip per rider that riders would have otherwise paid if not using the service resulting from the project. The calculations will already take into account that tolls are only paid once per round trip.

Continuous Operations Transit

The required inputs listed in Table 3 below are from the CARB Quantification Methodology for Caltrans LCTOP. Full documentation of the approach for estimating the GHG emission reductions and air pollutant emission co-benefits can be found within the LCTOP Quantification Methodology.

The LCTOP tool is designed to calculate the benefits from new or expanded services that increase ridership and reduce GHG emissions. New or expanded services are eligible; however, the purpose of the LCTOP tool in this methodology is to calculate the benefit of continuing a service. For continuous operations projects, applicants should select New Service. When entering the ridership values, applicants should use the amount of ridership lost if the service were to stop. The tool calculates the benefit of keeping riders who would otherwise take alternative modes of transportation if the service is not available.

Table 3. Applicant-Supplied Inputs for Transit Projects Within the LCTOP Benefits Calculator Tool

Required Input Fields	New/ Expanded Service	Increased Ridership	Fuel/Energy Reductions	Technology Conversion
Project Type	Required	Required	Required	Required
Service Type	Required	Required	Required	Required
Vehicle Type	Required	Depends on Service Type	Required	Required
Year 1	Required	Required	Required	Required
Yr1 Ridership	Required	Required	Required	NA
YrF Ridership	Required	Required	Required	NA
Engine Tier or Horsepower	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type
Hybrid Vehicle	Required	NA	Required	Required
Fuel/Energy Type	Required	Depends on Vehicle Type	Required	Required
Model Year	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type	Depends on Vehicle Type
ZETCP Funds Requested for LCTOP Project Elements (\$)	Required	Required	Required	Required

Required Input Fields	New/ Expanded Service	Increased Ridership	Fuel/Energy Reductions	Technology Conversion
Other GGRF Leveraged Funds (\$)	Required	Required	Required	Required
Non-GGRF Leveraged Funds (\$)	Required	Required	Required	Required

- Project Type: The transit project element proposed by the applicant (i.e., new/expanded service, cleaner vehicles/technology/fuels, fuel reductions, or system and efficiency improvements).
- Service Type: The transit service or connectivity method (e.g., Intercity/Express Bus, Light Rail, Vanpool) directly associated with the proposed project. For projects that support multiple services, use “Multi-modal.”
- Vehicle Type: The vehicle type (e.g., transit bus, streetcar, ferry) that will operate the new service or be supported by the capital expenditure. If the project proposes to replace an existing vehicle, provide both existing and new vehicle types.
- Year 1: The first year of service or the first year the facility or rolling stock will be in use.
- Year F: Final year of the project element (e.g., the final year of operation for the new/expanded service funded, the final year of service the capital expenditure will support, the final year of increased ridership as a result of capital expenditure). Determined using default useful life guidance in the LCTOP quantification methodology.
- Project Year 1 Ridership: Increase in annual unlinked passenger trips directly associated with the proposed project in the first year.
- Project Year F Ridership: Increase in annual unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, the same ridership value should be input for Year 1 and Year F.
- Engine Tier: The engine tier for new heavy rail service or technology. For ferry or DMU / EMU, engine horsepower will be required, instead of engine tier.
- Hybrid Vehicle: Indication of whether the vehicle is a hybrid.
- Fuel/Energy Type: Fuel or energy type (e.g., electric, renewable diesel) of the vehicle for the new/expanded service or the new vehicle(s) to be procured. If the project proposes to replace an existing vehicle, provide both existing and new vehicle types.
- Model Year: Engine model year of the vehicle to be acquired, operate the new service or be supported by the capital expenditure. If the project proposes to replace an existing vehicle, provide both existing and new vehicle types.

- ZETCP Funds Requested for LCTOP Project Elements (Calculator Field: FY 2020-21 LCTOP GGRF Funds Requested (\$)): Total amount of ZETCP funds requested from this solicitation to implement the transit project.
- Other GGRF Leveraged Funds (\$): Project dollars leveraged from non-LCTOP GGRF programs (California Climate Investments) for this project element. For ZETCP projects, please enter the total amount of GGRF funds requested to implement this project element in this field. Include GGRF funds previously awarded to the project by CalSTA or another California Climate Investments program, GGRF funds currently being requested from another California Climate Investments program, and GGRF funds the project plans to request in the future. Identify California Climate Investments program(s) from which the project has been awarded GGRF funds (include award date), is currently requesting GGRF funds, or plans to request GGRF funds. For a list of GGRF funded programs, go to the [California Climate Investments Webpage](#).
- Non-GGRF Leveraged Funds (\$): Total project dollars leveraged from non-GGRF programs (non-California Climate Investments) for this project element.

Solar PV

The required inputs listed in Table 4 below are from the CARB Quantification Methodology for the SGC AHSC program. Full documentation of the approach for estimating the GHG emission reductions and air pollutant emission co-benefits can be found within the AHSC Quantification Methodology.

Please note that the calculator inputs for solar PV projects must be determined using [the PVWatts web-based tool](#). Applicants who choose to quantify solar PV projects with the AHSC calculator must use PVWatts. Table 4 lists inputs required by PVWatts. Please refer to the AHSC User Guide for additional guidance.

Table 4. Applicant-Supplied Inputs for Solar PV Within the AHSC Benefits Calculator Tool

Required Input Fields	Solar PV
Zip Code	Required
DC System Size (kW)	Required
Module Type	Required
Array Type	Required
Primary Use of Electricity Generated	Required

For the tool to calculate benefits correctly, applicants must provide the ZETCP Funds Requested and Additional GGRF Funds Requested for all Solar project components. The following inputs should be added to the "Project Info" tab of the AHSC Calculator Tool:

- ZETCP Funds Requested for AHSC Project Elements (\$): Total amount of ZETCP funds requested from CalSTA to implement the affordable housing and transportation project. Please provide the amount of ZETCP dollars for this project element for this field.
- Other GGRF Leveraged Funds (\$): Project dollars leveraged from GGRF programs (California Climate Investments) for this project element. For ZETCP, please enter the total amount of GGRF funds requested to implement the project element in this field. Include GGRF funds previously awarded to the project by CalSTA or another California Climate Investments program, GGRF funds currently being requested from another California Climate Investments program, and GGRF funds the project plans to request in the future. Identify California Climate Investments program(s) from which the project has been awarded GGRF funds (include award date), is currently requesting GGRF funds, or plans to request GGRF funds. For a list of GGRF funded programs, go to the [California Climate Investments Webpage](#).

- Non-GGRF Leveraged Funds (\$): Total project dollars leveraged from non-GGRF programs (non-California Climate Investments) for this project element.

Once the correct funding information has been entered into the "Project Info" tab, move over to the "Solar PV" tab to input the rest of the information.

- Zip Code: Entered into the PVWatts calculator tool. The zip code in which project will be located.
- DC System Size (kW): Entered into the PVWatts calculator tool. Number of panels multiplied by the panel power output, less any solar PV system required by code.
- Module Type: Entered into the PVWatts calculator tool. Select from standard, premium, or thin film.
- Array Type: Entered into the PVWatts calculator tool. Select from fixed open rack, fixed roof mount, 1-axis tracking, 1-axis backtracking, or 2-axis tracking.
- Primary Use of Electricity Generated: Entered into the PVWatts calculator tool. Select sector (commercial, residential, or transportation) that will consume the majority of the electricity generated.

Low Carbon Fuel Production

The required inputs listed in Table 5 below are from the CARB Quantification Methodology for the CEC LCFPP. Full documentation of the approach for estimating the GHG emission reductions can be found within the LCFPP Quantification Methodology.

Table 5. Applicant-Supplied Inputs for Low-Carbon Fuel Production Program Projects Within the LCFPP Benefits Calculator Tool

Inputs- Production Facility

Required Input Fields	New Facilities	Facility Expansion
Project Type	Required	NA
Date Operational	Required	NA
Project Life	Required	Required
Annual Facility Uptime	Required	Required
Project Primary Fuel Type	Required	Required
Description of Primary Fuel Type	Required	Required
Primary Fuel Energy Density	Depends on Fuel Type	Depends on Fuel Type
Units for Primary Fuel Energy Density	Depends on Fuel Type	Depends on Fuel Type
Annual Primary Fuel Production Capacity	Required	Required
Project Primary Fuel Carbon Intensity	Optional	Optional
Primary Fuel Energy Economy Ratio	Depends on Fuel Type	Depends on Fuel Type
Baseline Primary Fuel Type	Optional	Optional
Project Secondary Fuel Type	Optional	Optional
Project Tertiary Fuel Type	Optional	Optional
Increase in Onsite Stationary Natural Gas Usage to Support new Production Capacity	Required	Required
Onsite Stationary Natural Gas Savings	Depends on Fuel Type	Optional
Onsite RNG Substitution	Depends on Fuel Type	Optional
RNG Production for Stationary End Uses	Optional	Optional

Required Input Fields	New Facilities	Facility Expansion
Percentage of Onsite Use of RNG Produced for Stationary End use	Required/Depends on Fuel Type	Required/Depends on Fuel Type
Type of Onsite Electricity Generation using Produced RNG	Required/Depends on Fuel Type	Required/Depends on Fuel Type
Onsite Stationary Electricity Usage	Required	Required
Onsite Stationary Electricity Gas Savings	Required/Depends on Fuel Type	Optional
Renewable Electricity Generation for Stationary End Use	Optional	Optional
Organic Waste Conversion Rate	Optional	Optional
Water Savings from the Existing Operations	Required/Depends on Fuel Type	Optional

Inputs- Distribution

Required Input Fields	New Facilities	Facility Expansion
Percentage of Onsite Use of Primary Fuel	Required	Required
Primary Fuel Distribution Method	Required	Required
Quantity of Primary Fuel Transported per Vehicle Trip	Required	Required
Distribution Distance	Required	Required
Percentage of Onsite use of Secondary Fuel	Optional	Optional
Percentage of Onsite use of Tertiary Fuel	Optional	Optional

- Date Operational: The date when the facility is expected to become operational and start producing fuel for sale.
- Project Life: The number of years the facility is expected to be operational.
- Annual Facility Uptime: The percentage of hours in a year that the facility is typically expected to be operational, factoring in planned and unexpected downtime.
- Project Fuel Type: The main type of transportation fuel expected to be produced by the project.
- Description of Fuel Type: Text description providing additional clarification about the type of primary fuel (e.g., cellulosic ethanol, dairy biomethane, DME, etc.).
- Fuel Type Density: The energy density of the primary project fuel.
- Units for Primary Fuel Energy Density: The unit of measurement for the fuel energy density value entered above.

- Annual Fuel Production Capacity: The amount of annual primary fuel production capacity expected to be added by the project, assuming operation at full production capacity.
- Project Fuel Carbon Intensity: The Carbon Intensity (CI) of the primary fuel expected to be produced by the project.
- Fuel Energy Economy Ratio: The dimensionless ratio that represents the efficiency of the primary fuel as used in a powertrain as compared to a reference fuel used in the same powertrain.
- Baseline Fuel Type: The type of fuel that is expected to be displaced by the project's primary fuel.
- Increase In Onsite Stationary Natural Gas Usage to Support New Production Capacity: Annual Expected fossil and renewable natural gas consumption for onsite stationary uses at either new production facility or expected increase in consumption from added production capacity.
- Onsite Stationary Natural Gas Savings: Annual expected reductions in natural gas consumption from the efficiency improvements to the existing operation.
- Onsite RNG Substitution: Annual amount of renewable natural gas used to substitute the existing operations natural gas consumption.
- RNG Production for Stationary End Uses: The annual amount of renewable natural gas generated by the proposed project at full production capacity, for use in stationary applications.
- Percentage of Onsite Use of RNG Produced for Stationary End Use: The percentage of renewable gas production for stationary end uses, provided in the row above, that will be used onsite at the fuel production facility (not transported for offsite use).
- Type of Onsite Electricity Generation using Produced RNG: The technology used for onsite electricity generation using the renewable natural gas that is produced from the project.
- Increase in Onsite Stationary Electricity Usage to Support New Production Capacity: Annual expected grid electricity consumption for onsite stationary uses at the new production facility or the expected increase from added fuel production capacity.
- Onsite Stationary Electricity Gas Savings: Annual expected reductions in grid electricity consumption from the efficiency improvements to the existing operation.
- Renewable Electricity Generation for Stationary End Use: The annual amount of renewable electricity generated by the proposed project at full production capacity, for use in stationary applications.
- Organic Waste Conversion Rate: The tonnage of organic waste feedstock (green waste, food materials, or alternative daily cover that is newly diverted from landfills) used to produce one unit of primary fuel.

- Water Savings from the Existing Operations: Annual expected reductions in water usage from the installation of more efficient water measures for the existing operation.
- Percentage of Onsite Use of Fuel: The percentage of primary fuel produced by the facility that will be used for onsite fueling.
- Fuel Distribution Method: The mode in which the primary fuel would be distributed from the production facility to a terminal or offsite fueling station.
- Distribution Vehicle Fuel Type: The type of fuel used by the vehicle that distributes the primary fuel.
- Quantity of Fuel Transported per Vehicle Trip: The amount of fuel that the distribution vehicle is able to transport per trip.
- Distribution Distance: The average distance between the fuel production facility and an end destination for the primary fuel (e.g., blending terminal or offsite fueling station).

Energy Efficiency

The required inputs listed in Table 6 below are from the CARB Quantification Methodology for the CSD LIWP. Full documentation of the approach for estimating the GHG emission reductions can be found within the LIWP Quantification Methodology.

Table 6. Applicant-Supplied Inputs for Residential Energy Efficiency and Rooftop Solar PV Projects Within the LIWP Benefits Calculator Tool.

Required Input Fields	Energy Efficiency
Number of Single-family Dwellings	Required
Number of Multi-family Dwellings	Required
Zip Code	NA
DC System Size	NA
Module Type	NA
Array Type	NA
Primary Use of Electricity Generated	NA
TCC Funds Requested for LIWP Project Elements (\$)	Required
Other GGRF Leveraged Funds Requested or Awarded (\$)	Required
Non-GGRF Leveraged Funds Requested or Awarded (\$):	Required

- Number of Single-family Dwellings: Quantity of single-family residential dwellings anticipated to receive energy efficiency measures.
- Number of Multi-family Dwellings: Quantity of multi-family residential dwellings anticipated to receive energy efficiency measures.
- Zip Code: The zip code in which project will be located.
- DC System Size (kW): Determined as the quantity of panels multiplied by the panel power output less any solar PV system required by code.
- Module Type: Select from standard, premium, or thin film.
- Array Type: Select from fixed open rack, fixed roof mount, 1-axis tracking, 1-axis backtracking, or 2-axis tracking.
- Primary Use of Electricity Generated: Select sector (commercial, residential, transportation) that will consume the majority of the electricity generated.
- ZETCP Funds Requested for LIWP Project Elements (Calculator Field: Total LIWP GGRF Funds Requested or Awarded (\$)): Total amount of TCC funds requested from this solicitation to implement the residential energy efficiency project.

- Other GGRF Leveraged Funds (\$): Project dollars leveraged from GGRF programs (California Climate Investments) for this project element. For ZETCP, please enter the total amount of additional GGRF funds requested to implement the residential energy efficiency project. Include GGRF funds previously awarded to the project by CalSTA or another California Climate Investments program, GGRF funds currently being requested from another California Climate Investments program, and GGRF funds the project plans to request in the future. Identify California Climate Investments program(s) from which the project has been awarded GGRF funds (include award date), is currently requesting GGRF funds, or plans to request GGRF funds. For a list of GGRF funded programs, go to the [California Climate Investments webpage](#).
- Non-GGRF Leveraged Funds (\$): Total project dollars leveraged from non-GGRF programs (non-California Climate Investments) for this project element.

Outputs Table

Since there is no standalone calculator tool for this program, applicants will be required to fill out the table below with the outputs from each tool they used. Some applicants may not use every tool available and should not enter data for the calculators not used. For example, the AHSC Solar calculator will not output any VMT reductions. ZETCP funding is formula based, so these outputs will not be used to score or compare different applications; however, applicants are still required to fill out the correct calculator tools ZETCP projects must create a positive GHG reduction. Please reach out to CalSTA if additional clarification is needed.

All ZETCP projects must send their completed benefits calculators, any supporting documentation, and the completed Outputs table to CalSTA.

All the included tools contain an outputs tab. When entering the outputs in the table below, please ensure that the criteria pollutant values are correctly summed. Criteria pollutants include NO_x, ROG_s, P.M, and others. For the table below, you will need to manually sum the Criteria pollutants to ensure that the full benefit from the calculator is captured. In future versions of this methodology, CARB staff plans to create a standalone excel sheet that will take the place of this table.

Table 7: Cumulative Outputs

Calculator Tool	GHG reductions (MTCO₂e)	VMT Reductions (miles)	Criteria Pollutant Reductions (lbs)	Fuel and Energy Cost Savings (\$)	Fossil Fuel Energy Use Reduction (kWh)
Transit and Intercity Capital Rail Program					
Low Carbon Transit Operations Program					
Affordable Housing and Sustainable Communities					
Low Carbon Fuel Production Program					
Low-income Weatherization Program					
Totals					