California Air Resources Board

Job Co-benefit Assessment Methodology

California Climate Investments
Greenhouse Gas Reduction Fund

November 2024

Table of Contents

List of Equations

Section A. Introduction

The goal of California Climate Investments is to reduce greenhouse gas (GHG) emissions and further the objectives of the California Global Warming Solutions Act of 2006, Assembly Bill (AB) 32. The California Air Resources Board (CARB) is responsible for providing guidance on reporting and quantification methods for all State agencies that receive appropriations from the Greenhouse Gas Reduction Fund (GGRF). Guidance includes developing methodologies for estimating GHG emission reductions and other economic, environmental, and public health benefits of projects, referred to as "co-benefits."

CARB staff will use the Jobs Co-benefit Assessment Methodology (methodology) to estimate the number of direct, indirect and induced jobs supported by California Climate Investments. Most co-benefit assessment methodologies are intended for use by administering agencies, project applicants, and/or funding recipients to estimate the outcomes of California Climate Investments for each project. For this methodology, CARB will instead estimate employment co-benefits across all of California Climate Investments to be reported, in aggregate, in the *Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds*. This policy change is intended to streamline the administrative workload for reporting modeled jobs co-benefits and to standardize data quality and reproducibility. An updated version of the legacy, project-specific jobs modeling tool will still be made available on *CARB's Co-Benefits Assessment Methodologies page.* General guidance on assessing California Climate Investments co-benefits is available in CARB's Funding Guidelines for Agencies Administering California Climate Investments (Funding Guidelines), found at: ***www.arb.ca.gov/cci-fundingguidelines***.

Job Co-benefit Description

Job co-benefits refer to California jobs supported, not created, by California Climate Investments. A job is defined as one full-time equivalent (FTE) employee position over one year, equal to approximately 2,000 hours of work. Jobs supported by California Climate Investments include direct, indirect, and induced employment:

> *Directly supported jobs* refer to labor to complete California Climate Investments projects, through direct employment or contracted work paid with GGRF dollars (e.g., housing construction, ecosystem restoration, or technical assistance) and labor to produce equipment or materials purchased with GGRF dollars (e.g., manufacturing zero-emission vehicles or anaerobic digesters).
> *Indirectly supported jobs* exist in the supply chains supporting California Climate Investments projects. Funding a project generates demand for intermediate inputs of materials and equipment needed to complete the project, leading to expanded production and employment in the relevant upstream industries (e.g., manufacturing construction equipment, zero-emission vehicle parts, or solar panel components).

Induced jobs are linked to the spending of income from directly and indirectly supported jobs. The personal consumption expenditures of workers in jobs directly and indirectly supported by California Climate Investments projects (i.e., increased household spending) stimulate demand for goods and services in the wider California economy.

Methodology

CARB will use this Jobs Co-Benefit Assessment Methodology, consistent with the guiding principles of California Climate Investments. This methodology will:

- Provide a uniform method that can be applied statewide and is accessible by all applicants and funding recipients;
- Use existing, authoritative, peer-reviewed sources and methods, whenever available;
- Include the expected period of time for when co-benefits will be achieved;
- Identify the appropriate data needed to calculate co-benefits.

Previous Work

In January 2019, CARB released a Co-benefit Assessment Methodology in consultation with the Center for Resource Efficient Communities at the University of California, Berkeley (UC Berkeley).

UC Berkeley assessed peer-reviewed literature and consulted with experts, as needed, to identify:

- The direction and magnitude of the co-benefit;
- Project types to which the co-benefit is relevant;
- The limitations of existing empirical literature;
- Existing assessment methods and tools; and
- Knowledge gaps and other issues to consider in developing co-benefit assessment methods.

This work is summarized in a literature review on this co-benefit, which can be found at: www.arb.ca.gov/cci-cobenefits. UC Berkeley also considered ease of use, specifically the availability of project-level inputs and the development of an accompanying modeling tool for users of this methodology.

UC Berkeley recommended using an input-output model to develop a tool to estimate employment co-benefits of California Climate Investments. Specifically, UC Berkeley suggested the use of information from IMPLAN, a proprietary input-output model that prohibits the publication of underlying data. To ensure consistency with the guiding principles of transparency and accountability, CARB instead used data from a different input-output model, the Regional Input-Output Modeling System (RIMS II), to develop the accompanying Job Co-benefit Modeling Tool for California

Climate Investments. The RIMS II data used in this tool are non-proprietary and available for public use.

The Bureau of Economic Analysis (BEA) developed RIMS II as a tool for economic impact studies. The California Department of Finance and other federal, State, and local government agencies use multipliers from RIMS II to evaluate how various types of projects may affect regional economies.[1]

BEA regularly updates RIMS II using national input-output accounts and regional economic information. The RIMS II multipliers released in 2024 are based on 2017 national benchmark data and 2022 regional data.[2] These multipliers include California-specific values for 376 industries.

This Job Co-benefit Assessment Methodology uses RIMS II Type I and Type II final-demand and direct-effect employment multipliers.

Type I employment multipliers are used to estimate total direct and indirect jobs. Type II employment multipliers also account for induced jobs.

Final-demand employment multipliers measure the increase or decrease in jobs when the demand for an industry's outputs changes. Direct-effect employment multipliers measure the increase or decrease in jobs when employment in an industry changes.

---

[1] BEA does not endorse the results of this co-benefit assessment methodology or any study conducted using RIMS II multipliers.

[2] The RIMS II multipliers released in 2021 must be applied to investments in 2023 dollars because the underlying regional data are from 2023. Consequently, the Job Co-benefit Modeling Tool is designed to adjust user inputs to 2023 dollars using an implicit price deflator for government gross investment.
https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&select_all_years=0&nipa_table_list=97&series=a&first_year=2013&last_year=2020&scale=-99&thetable

Updates

CARB staff periodically review each co-benefit assessment methodology to evaluate its effectiveness and update methodologies to make them more robust, user friendly, and appropriate to the projects being quantified.

This update consists of the following changes to the methodology:

- Updated RIMS II employment multipliers to their 2024 versions;
- Re-calculated dollar-year-adjustment factor to 2023 baseline, the latest period for which a full year of data were available.

Program Assistance

For questions and feedback about this Co-benefit Assessment Methodology, please contact: GGRFProgram@arb.ca.gov.

For more information on CARB's efforts to support implementation of California Climate Investments, see: www.arb.ca.gov/auctionproceeds.

Section B. Assessment Method

Introduction

CARB estimates employment outcomes supported by California Climate Investments in aggregate across the entire portfolio of funded projects. Overall, the methods for assessing job co-benefits are quantitative, based on the regional input- output model RIMS II from the United Stated Bureau of Labor Statistics, and project data reported in the California Climate Investments Reporting and Tracking System (CCIRTS). Appendices A, B, and C provide additional detail on the data sources and supporting calculations used to arrive at these portfolio-wide estimates.

Regional input-output models characterize the relationships between all industries in an economy, with the foundational assumption that an initial change in economic activity prompts additional spending. For instance, increased demand for the outputs of one industry generates demand for intermediate inputs from supporting industries. Greater employment and earnings in the affected industries lead to higher household spending, resulting in additional demand for goods and services throughout the region.

The methodology aims to estimate the direct, indirect, and induced employment benefits of California Climate Investments by applying the RIMS II model's employment multipliers to verifiable GGRF expenditure data reported by administering agencies on California Climate Investments-funded project activities. This updated methodology allows CARB to estimate portfolio-wide employment benefits through a streamlined and more transparent process, while accurately conveying the underlying assumptions.

Process

Step 1: Classify California Climate Investments-funded projects to allow associating project activities with RIMS II Employment Codes. Using data reported in CCIRTS, each project is assigned into a hierarchical schema consisting of:

Sector: Defining the intent or objective of each overarching California Climate Investments program (e.g. Public Transportation)

Category: The area within that sector the project acts upon, often attempting to relate to a specific CARB quantification method (e.g. Infrastructure).

Action: category stating the actual implementation funded by the grant (e.g. "planning" vs "construction").

These classifications were assigned based on certain keywords from CCIRTS in text fields such as "project description" and "project type" as submitted by administering agencies. A dictionary of terminology used for defining each level of categorization is

available as a supplement to this methodology by contacting ggrfprogram@arb.ca.gov.

Step 2: Associate California Climate Investments project classifications with RIMS II Employment Activity Codes.

Once each project is classified into its sector, category, and action (SCA), each unique SCA combination is associated with one or more RIMS II employment activity codes. These employment activities are, in most cases, based on consultations with administering agencies. See Appendix A for more detailed information on how project classifications were associated with employment activity codes.

Employment activity codes are connected to the RIMS II employment multipliers used in Step 3. Appendix B details a preliminary data preparation step to prepare the RIMS II employment multipliers for this analysis.

Step 3: Average together the employment multipliers for each type of employment (direct, indirect, and induced) for each SCA (Equation 1).

All multipliers are averaged together without weighting, except for the codes associated with four different RIMS II employment activities that CARB classifies as project administration costs in most cases:

- Grantmaking, giving, and social advocacy organizations (813A00)
- Environmental and other technical consulting services (5416A0)
- Management consulting services (541610)
- Public sector administration, local or state (H00000)

CARB staff determined that unless a project is specifically reporting one of these as their primary activity or activities, no more than 10% of the cost of a project typically falls under any of these administrative tasks. If the project is, for example, focusing on outreach or a reported intermediary administrative expense, then this weighting factor is not applied. This step was added to ensure that the relatively high employment multipliers associated with administrative tasks were not overestimating the jobs produced by implementation grants.

Equation 1 is used to calculate the weighted average, if applicable, of employment multipliers for each unique instance of sector, category, and action, by year project activity was reported to CARB.

Equation 1: Average employment multiplier for project action

$$\bar{M}_x = \begin{cases} 0.1 \cdot M_{admin,x} + 0.9 \cdot Avg(M(c)_x | c \neq admin) & if\,"admin" \\ Avg(M(c)_x) & otherwise \end{cases}$$

Where,   _Units_

$\bar{M}$	=	Averaged employment multipliers for each iteration of sector/category/action	FTE
x	$\in$	{D, I, N} Direct, Indirect, & Induced	FTE
M_{admin}	=	Employment multiplier for Education, Outreach, Technical Assistance, Capacity-Building, and Administration	FTE
$Avg(M(c)_x | c \neq admin$	=	Average of employment multipliers for all codes excluding Education, Outreach, Technical Assistance, Capacity-Building, and Administration	FTE
$Avg(M(c)_x)$	=	Average of all employment multipliers	FTE/$M

Step 4: Adjust the dollar amounts to account for inflation. This method estimates modeled jobs for the portfolio across all reporting years.

The relative value of a dollar of government direct investment over time should be standardized relative to a baseline derived from NIPA table 3.9.4. This is calculated with an adjustment factor where the 2023 value– corresponding to the latest available, averaged data for consideration with the 2024 RIMS II codes–is set = 1. NIPA values for price adjustment due to inflation are calculated as percentages of this value and applied as an adjustment to the implemented GGRF funding term of equation 1.

Equation 2 For each unique instance of sector, category, and action, by year project activity was reported to CARB:

Equation 2: Dollar CPI adjustment by year

$$J_x = \frac{GGRF \cdot (\frac{1}{CPI}) \cdot \bar{M}_x}{\$1{,}000{,}000}$$

Where,   Units

J =   Jobs   FTE

x ∈   {D, I, N} Direct, Indirect, & Induced   FTE

CPI =   CPI adjustment factor corresponding to year that the   Unitless
project was reported to CARB.

$GGRF$ =   Greenhouse Gas Reduction Fund dollars implemented $

$\bar{M}$ =   Averaged employment multipliers for each iteration of   FTE
sector/category/action

Limitations

This Job Co-benefit Assessment Methodology provides prospective estimates of likely job co-benefits of California Climate Investments projects. The *RIMS II user's guide* includes a list of assumptions that should be considered when applying its outputs. In addition, CARB notes the following limitations:

- The modeled outputs are estimates of jobs supported, but not necessarily created, by GGRF dollars. Since GGRF investments are transfers of existing funds within California, it would be necessary to assess an alternative scenario without GGRF investments in order to establish a causal link between California Climate Investments and job creation.
- The methodology is based on state-level RIMS II employment multipliers. As such, estimated jobs cannot be linked to specific locations within California.
- The methodology includes only general information about employment per industry, so job quality is beyond the scope of the Job Co-benefit Modeling Tool.
- The methodology assigns relevant employment multipliers based on an aggregated dataset of project sectors, categories and actions, and therefore does not provide expected employment outcomes at an individual project level.
- Direct and indirect employment in government cannot be modeled using RIMS II. Appendix A describes how induced employment related to investments in government is estimated.

Bibliography

Bureau of Economic Analysis (2024). RIMS II Online Order and Delivery System [RIMS II 2017/2022 Multipliers]. Retrieved from: *https://apps.bea.gov/regional/rims/rimsii/*. Accessed 10-15-2024.

Bureau of Economic Analysis (2024). National Income and Product Accounts

[Table 6.4D. Full-Time and Part-Time Employees by Industry]. Retrieved from: *https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&nipa_table_list=193*. Accessed 10-15-2024.

Bureau of Economic Analysis (2024). National Income and Product Accounts

[Table 6.5D. Full-Time Equivalent Employees by Industry]. Retrieved from: *https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&nipa_table_list=197*. Accessed 10-15-2024.

Bureau of Economic Analysis (2024). National Income and Product Accounts [Table 3.9.4. Price Indexes for Government Consumption Expenditures and Gross Investment]. Retrieved from:

https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&select_all_years=0&nipa_table_list=97&series=a&first_year=2013&last_year=2020&scale=-99&thetable. Accessed 10-15-2024.

Bureau of Economic Analysis (2019). 2017 National Distribution Costs Data. [Table C – Composition of NIPA Final Demand – I-O Commodity Composition of NIPA Final Use by Personal Consumption Expenditures]. Retrieved from: *https://apps.bea.gov/regional/rims/rimsii/viewerdistribution.aspx?selectedOrderDetailKey=17808&Sample=Yes*.

Appendix A. RIMS II Employment Activities and Project Classifications

RIMS II contains multipliers for 406 industries, which are defined based on the North American Industry Classification System (NAICS). In order to match California Climate Investments projects to the appropriate RIMS II multipliers, CARB staff took the following approach:

- Examined expenditure records and program descriptions from administering agencies to identify activities conducted with GGRF dollars;
- In consultation with administering agencies, created program-specific lists of possible project activities;

Some project activities, such as establishing conservation easements and leasing right-of-ways, do not involve paying worker salaries. These activities were assumed not to support employment and were assigned null multipliers. Real estate and legal services in support of these purchasing activities were included as multipliers contributing to the employment co-benefits from relevant project activities. Direct and indirect employment in government cannot be modeled using RIMS II multipliers. However, induced employment from California Climate Investments in government activities can still be captured. When government employees paid with GGRF dollars spend their earnings, their personal consumption expenditures support induced jobs throughout the state. This Co-benefit Assessment Methodology applies a RIMS II multiplier for induced employment from household spending to the earnings of government employees in order to estimate induced jobs supported by California Climate Investments in government activities.

Appendix B. Derivation of Employment Multipliers

RIMS II employment multipliers produce combined estimates of direct, indirect, and induced full-time and part-time jobs. CARB staff adjusted the RIMS II employment multipliers to convert total full-time and part-time jobs to FTE and separately estimate direct, indirect, and induced jobs.

BEA's National Income and Product Account (NIPA) tables include total full-time and part-time employees per industry and FTE per industry for 95 industry groupings.[3] Using these data, CARB staff calculated FTE conversion factors to apply to RIMS II multipliers, following Equation 3.

The November, 2024 update did not alter this portion of the methodology from previous versions.

Equation 3: FTE Conversion Factors

$$FTE\ Conversion\ Factor = \frac{FTE\ Employees}{Full\text{-}time\ and\ Part\text{-}time\ Employees}$$

Where,			Units
FTE Conversion Factor	=	FTE per total employees for NIPA industry aggregation	FTE per total full-time and part-time employees
FTE Employees	=	Number of FTE employees per NIPA industry aggregation	FTE employees
Full-time and Part-time Employees	=	Number of full-time and part-time employees per NIPA industry aggregation	Total full-time and part-time employees

---

[3] *https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&nipa_table_list=193*;
https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&nipa_table_list=197

To adjust the RIMS II Type I and Type II final-demand multipliers to estimate FTE per industry, CARB staff applied the FTE conversion factors from Equation 3 to each industry component of the disaggregated Type I and Type II final-demand employment multipliers, per Equation 4.

Equation 4: FTE-adjusted Final-demand Employment Multipliers

$$\text{FTE-adjusted Final-demand Employment Multiplier} = \sum (\text{Industry Component} \times \text{FTE Conversion Factor})$$

Where,			Units
FTE-adjusted Final-demand Employment Multiplier	=	Adjusted industry-specific RIMS II Type I or Type II multiplier for FTE jobs associated with initial increase in demand	FTE jobs per million dollars final demand in industry
Industry Component	=	Industry component of disaggregated RIMS II Type I or Type II final-demand employment multiplier	Jobs per million dollars final demand in industry
FTE Conversion Factor	=	FTE per total employees in NIPA industry aggregation corresponding to RIMS II industry component, from Equation 3	FTE per total full-time and part-time employees

---

CARB staff derived separate industry-specific direct employment multipliers and adjusted them to estimate FTE according to Equation 5.

Equation 5: FTE-adjusted Direct Employment Multipliers

$$FTE\text{-}adjusted\ Direct\ Employment\ Multiplier$$
$$= \frac{Final\text{-}demand\ Employment\ Multiplier}{Direct\text{-}effect\ Employment\ Multiplier} \times FTE\ Conversion\ Factor$$

Where,			Units
FTE-adjusted Direct Employment Multiplier	=	Adjusted industry-specific RIMS II multiplier for direct FTE jobs	Direct FTE jobs per million dollars output in industry
Final-demand Employment Multiplier	=	RIMS II multiplier for total jobs associated with initial increase in industry demand	Jobs per additional million dollars demand in industry
Direct-effect Employment Multiplier	=	RIMS II multiplier for total jobs per industry associated with initial increase in industry employment	Jobs per additional job in industry
FTE Conversion Factor	=	FTE per total jobs in NIPA industry aggregation corresponding to RIMS II industry, from Equation 3	FTE per total full-time and part-time employees

CARB staff derived separate industry-specific FTE indirect employment multipliers according to Equation 6.

Equation 6: FTE-adjusted Indirect Employment Multipliers

FTE-adjusted Indirect Employment Multiplier
 = FTE-adjusted Type I Final-demand Employment Multiplier
 − FTE-adjusted Direct Employment Multiplier

Where,			Units
FTE-adjusted Indirect Employment Multiplier	=	Adjusted industry-specific RIMS II multiplier for indirect FTE jobs	Indirect FTE jobs per million dollars demand in industry
FTE-adjusted Type I Final-demand Employment Multiplier	=	Adjusted RIMS II multiplier for total direct and indirect FTE jobs per industry associated with initial increase in industry demand, from Equation 4	Direct and indirect FTE jobs per additional million dollars demand in industry
FTE-adjusted Direct Employment Multiplier	=	Adjusted industry-specific RIMS II multiplier for direct FTE jobs, from Equation 5	Direct FTE jobs per million dollars output in industry

CARB staff derived separate industry-specific FTE induced employment multipliers according to Equation 7.

Equation 7: FTE-adjusted Induced Employment Multipliers		
FTE-adjusted Induced Employment Multiplier $=$ *FTE-adjusted Type II Final-demand Employment Multiplier* $-$ *FTE-adjusted Type I Final-demand Employment Multiplier*		
Where,		Units
FTE-adjusted Induced Employment Multiplier	$=$ Adjusted industry-specific RIMS II multiplier for induced FTE jobs	Induced FTE jobs per million dollars demand in industry
FTE-adjusted Type II Final-demand Employment Multiplier	$=$ Adjusted RIMS II multiplier for total direct, indirect, and induced FTE jobs associated with initial increase in industry demand, from Equation 4	Direct, indirect, and induced FTE jobs per additional million dollars demand in industry
FTE-adjusted Type I Final-demand Employment Multiplier	$=$ Adjusted RIMS II multiplier for total direct and indirect FTE jobs per industry associated with initial increase in industry demand, from Equation 4	Direct and indirect FTE jobs per additional million dollars demand in industry

Appendix C. Retail Purchases

RIMS II multipliers must be applied to producers' values (i.e., production costs of goods or services, not including retail or wholesale markups or transportation costs). Some California Climate Investments projects provide consumers with vouchers or reimbursements for retail purchases. For these rebate-based projects, and for other project activities primarily involving retail purchases, CARB staff accounted for the difference between producers' and purchasers' values.

Increased production in retail industries does not always track closely to additional hiring. To avoid overestimating employment in either retail or manufacturing industries, CARB staff calculated the producer share of project retail purchases and used this value to estimate job co-benefits.

Following Equation 8, CARB staff used BEA's national distribution cost tables for personal consumption expenditures[4] to calculate an adjustment factor to apply to retail-based project costs as shown in Equation 1.

Equation 8: Adjustment Factor for Retail-based Projects

$$Retail\ Adjustment\ Factor = \frac{Producers'\ Value}{Purchasers'\ Value}$$

Where,

			Units
Retail Adjustment Factor	=	Ratio of production cost of good or service to price paid by consumer for good or service	Unitless
Producers' Value	=	Production cost of good or service, excluding retail or wholesale markups and transportation costs	Dollars
Purchasers' Value	=	Price paid by consumer for good or service	Dollars

---

[4] https://apps.bea.gov/regional/rims/rimsii/viewerdistribution.aspx?selectedOrderDetailKey=17808&Sample=Yes