



Joint Impact Model v3.0

Methodology: Summary for PCAF signatories

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1 Introduction

1.1 Background

To prevent warming beyond 1.5C, we need to reach net zero emissions by 2050. The financial industry can facilitate the transition in line with the Paris Climate Agreement by shifting capital flows from high to low carbon activities. A key first step in making this shift is harmonised and transparent Greenhouse gas (GHG) accounting. To facilitate this, a group of financial institutions launched a global initiative to develop a global GHG accounting standard (“the Standard”), the Partnership for Carbon Accounting Financials (PCAF). The Standard has been reviewed by the GHG Protocol and conforms with the requirements set forth in the Corporate Value Chain (Scope 3) Accounting and Reporting Standard for category 15 investment activities.

As of October 2023, more than 439 institutions have joined PCAF and committed to assess and disclose the GHG emissions of its financial portfolio following PCAF methods. PCAF recognizes that often the data required to calculate the borrower’s or investee’s emissions (“financed emissions”) might not be readily available. They recommend institution to use the best available data in accordance with the data hierarchy for the asset class. If observed emission data of borrowers or investees is not available, modelling can be used for some asset classes.

The Joint Impact Model (JIM) can be used to fill the gap in GHG emission data and also to apply the PCAF attribution methodology for business loans, listed/unlisted equity, corporate bonds and project finance asset classes. The JIM works with a data hierarchy: if real data is available, this is used. If there is no observable data, the JIM uses modelling to derive impacts. In this way the JIM enables institutions to derive economic activity based GHG emissions (data quality score 4 & 5) in a harmonised way.

The JIM enables users to estimate the gross Scope 1, Scope 2 and upstream Scope 3 GHG impacts of companies in developing markets in a single year, and to track changes in these impacts over time. The JIM is a portfolio-level tool that relies on modelling, using statistics reflecting sector and country averages. Impact results from the model can be considered robust at the portfolio level. Results for individual investments or small portfolios will be indicative only; alternative impact measurement tools will generally be preferred.

1.2 This document

This document provides more information on the JIM methodology for GHG emissions for PCAF signatories, who would like to use the JIM for their PCAF reporting. First, it addresses the GHG emissions in scope of the JIM. Second, it addresses the methodology used to model GHG emissions. Third, this document provides an overview of the statistical and financial inputs required for modelling the GHG emissions. Fourth, it provides more information about the outputs of the model; and finally, assumptions and limitations of the model are highlighted. For more information about the other indicators in the JIM, and a more elaborate explanation of the methodology, calculations, and inputs, please see the Methodology Paper and User Guide on the JIM website.

2 Scope

The GHG emissions estimated by the JIM are:

- *CO₂ emissions*: CO₂ emitted from the combustion of fossil fuels.
- *Non-CO₂ emissions*: methane (CH₄), nitrous oxide (N₂O) and fluorinated gases (F-gases) emitted.

Not included are: CO₂ emissions from forestry and other changes in land use (about 11% of GHG emissions worldwide)¹.

In quantifying impacts, the JIM takes the borrower or investee (“client”) as the starting point (for financing through financial intermediaries this means the investee of the financial intermediary). The model estimates both the direct impacts and (part of) the indirect impacts of clients. These are further categorised by scope, as defined by the GHG Protocol. The table below provides more details on the coverage of emissions by the JIM for each of the GHG Protocol scopes.

Table 1: Scope of the JIM

Scope	Definition	Comment ²
Scope 1	Direct emissions from owned or controlled sources.	Direct GHG emissions of client.
Scope 2	Indirect emissions from the generation of purchased energy.	Supply chain (upstream) GHG emissions related to the client’s direct electricity supplier.
Scope 3	All indirect emissions (not included in Scope 2) that occur in the value chain of the client.	Supply chain (upstream) GHG emissions are included. Results are split between Scope 3 emissions related to the client’s local supply chain and Scope 3 emissions related to the client’s international supply chain. Financed emissions (downstream) are included. <u>Not included are</u> : end-of-life treatment of sold products, use of sold products and downstream transportation and distribution
n/a		Induced GHG emissions, downstream GHG emissions related to activities enabled by additional power supply.

¹ More specifically the following GHG emission are excluded: GHG emissions from biomass burning, tropical forest fire, deforestation, biomass combustion, land sources and sinks of land use, changes of land use and forestry, other CO₂ emissions not attributable to fossil fuel combustion such as emissions from chemical, metallurgical and mineral transformation processes, and methane emissions from underground storage and geothermal energy; Combustion of fossil fuels represents about 65% of total GHG emissions worldwide, while non-CO₂ gases represent about 24% of all GHG emissions worldwide: <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>.

² Emissions financed through a financial intermediary are not yet part of the PCAF reporting.

On top of the GHG Protocol Scopes, the JIM also provides insights into induced GHG emissions and power enabling GHG emissions.³ Finally, emissions financed through financial intermediaries are provided but not (yet) part of PCAF reporting.

3 Methodology

The approach for determining the GHG emissions of a portfolio of investments (the financed emissions) consists of two key steps as depicted by exhibit 1 (from the PCAF standard):

1. Quantifying the total GHG emissions of the borrower or investee;
2. Determining and applying the attribution factor.

The methodology for each of these steps is further described below.

$$\text{Financed emissions} = \sum_i \text{Attribution factor}_i \times \text{Emissions}_i \quad (\text{with } i = \text{borrower or investee})$$

$$\text{Attribution factor}_i = \frac{\text{Outstanding amount}_i}{\text{Total equity} + \text{debt}_i}$$

Exhibit 1: Methodology for quantifying financed emissions (PCAF standard)

3.1 Quantifying GHG emissions

The GHG emissions can either be quantified using observed data from the borrower or investee, or by using modelling if observed data is not available. This section describes how the JIM models direct and indirect GHG emissions.

Direct emissions

Scope 1 GHG emissions, are modelled by linking data on company revenues to the GHG intensity (“GHG emission factor”) of the country and economic sector in which the company operates. These GHG emission factors are based on country and sector averages and can be developed by combining statistics on GHG emissions and output per country and economic sector. For more information on GHG emission factors used in the model, and their sources see Section 4.1.

Indirect emissions

Scope 2 and Scope 3 GHG emissions are modelled using an IO methodology. IO modelling traces company revenues through an economy revealing linkages between the company and other domestic sectors. This methodology, which was developed by the Nobel Prize winning economist Wassily Leontief, is commonly used by economists to quantify indirect impacts.

IO modelling has several advantages. First, it captures direct and indirect effects in an industry-specific manner, which means the scope covers an entire economy. Second, it requires little data

³ Induced GHG emissions: emissions associated with the spending of wages earned by employees of the client, its suppliers and their suppliers; power enabling GHG emissions: emissions associated with the additional output created by companies that use the additional power generated by the client, as well as by non-power using firms in their supply chain (e.g. small-scale agriculture).

on the studied intervention. This makes it particularly useful in regions where data is scarce or unavailable. For regions with limited data availability, such as many developing countries, IO tables are typically the best data that is available.⁴ Lastly, the number of interventions that can be included scales up easily.

The key ingredient of the IO model is a Social Accounting Matrix (SAM), which is a statistical and static representation of the economic structure of an economy. For more information on the SAMs used in the model, and their sources see Section 4.1.

The SAM describes financial flows of all economic transactions within an economy. **Error! Reference source not found.** shows an example of such a SAM. Columns represent buyers (expenditures) and rows represent sellers (receipts). In the SAM the number of columns and rows are equal because all sectors or economic actors (industry sectors, households, government and the foreign sector, etc.) are both buyers and sellers. Of the four quadrants in the SAM, three are relevant here: consumption and exports, intermediary demand, and value added.

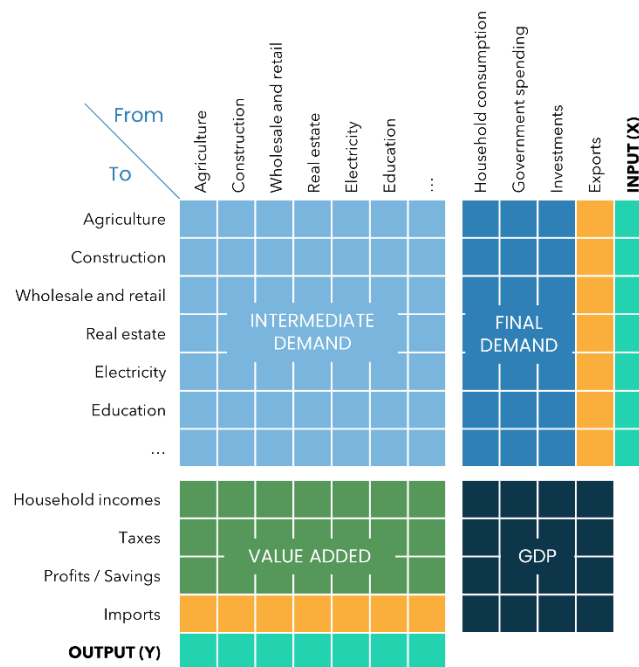


Exhibit 2: SAM

Final consumption and exports of a company's goods and services induces production, which leads to financial transfers between various sectors that subsequently generate incomes for households, the state (taxes) and businesses (dividends and savings). The latter is also referred to as value added. Households subsequently spend these incomes again on consumption which leads to induced money flows. These supply chain and induced money flows can subsequently be linked to employment intensities and GHG emission factors to estimate the employment and GHG impact.

⁴ See West, G. R. (1995). Comparison of input-output, econometric and computable general equilibrium impact models at the regional level. *Economic Systems Research*, 7: 209-227.

More specifically, Scope 2 and Scope 3 emissions (upstream) are modelled as follows:

- *Scope 2 GHG emissions.* First, the electricity spending of a company is estimated using company revenues and the SAM of the country and sector in which the company operates.

The SAM shows how much each company on average spends on electricity (as % of total revenues) (Exhibit 3). By multiplying the electricity spending of the company by the GHG emission factor of the electricity sector in the country, the Scope 2 GHG emissions of the company can be quantified.

$$\left(\begin{array}{c} \text{Electricity output} \\ (\$) \end{array} \right) \times \left(\begin{array}{c} \text{GHG (tCO}_2\text{eq)} \\ \text{Output (\$)} \end{array} \right) = \left(\begin{array}{c} \text{Scope 2 emissions} \\ \text{(tCO}_2\text{eq)} \end{array} \right)$$

Exhibit 3: Scope 2 emissions calculation

- Scope 3 GHG emissions (upstream). This category is split between:
 - *Scope 3 GHG emissions related to local sourcing.* First, the spending of a company on other local sectors (except electricity) is estimated using company revenues and the SAM of the country and sector in which the company operates. The SAM shows how much each company on average spends on other sectors (as % of total revenues) (Exhibit 3). Second, the total economic output related to the company's local sourcing is estimated using IO modelling. Third, the economic output per sector is multiplied by the GHG emission factor per economic sector in the country, to quantify the Scope 3 GHG emissions related to local sourcing;

$$\left(\begin{array}{c} \text{Local supply chain} \\ \text{output (\$)} \end{array} \right) \times \left(\begin{array}{c} \text{GHG (tCO}_2\text{eq)} \\ \text{Output (\$)} \end{array} \right) = \left(\begin{array}{c} \text{Local scope 3 emissions} \\ \text{(tCO}_2\text{eq)} \end{array} \right)$$

Exhibit 4: Local scope 3 emissions calculation

- *Scope 3 GHG emissions related to sourcing of imports.* First, the spending of a company on economic sectors abroad is estimated using company revenues and the SAM of the country and sector in which the company operates. The SAM shows how much each company on average spends on imports (as % of total revenues). Second, the total economic output related to the company's sourcing from abroad is estimated using IO modelling. Third, the economic output per sector is multiplied by the GHG emission factor per economic sector (world average), to quantify the Scope 3 GHG emissions related to imports.

$$\left(\begin{array}{c} \text{Import supply} \\ \text{chain output (\$)} \end{array} \right) \times \left(\begin{array}{c} \text{GHG (tCO}_2\text{eq)} \\ \text{Output (\$)} \end{array} \right) = \left(\begin{array}{c} \text{Import scope 3 emissions} \\ \text{(tCO}_2\text{eq)} \end{array} \right)$$

Exhibit 5: Import scope 3 emissions calculation

3.2 Determining the attribution factor

The JIM determines the attribution factor according to the methodology of the PCAF Global Standard.

For listed clients, it is calculated as follow:

$$\textit{Attribution factor}_c = \frac{\textit{Outstanding amount}_c}{\textit{Enterprise Value Including Cash}_c}$$

For unlisted clients, it is calculated this way:

$$\textit{Attribution factor}_c = \frac{\textit{Outstanding amount}_c}{\textit{Total equity} + \textit{debt}_c}$$

In the JIM the calculation would be expressed in the following way:

- *Numerator*: for debt financing and equity financing to listed companies the JIM uses the outstanding amount directly from the input sheet (see Section 4.3). For equity financing to unlisted companies and projects, the outstanding amount is calculated in the JIM by multiplying the relative equity share by the total equity of the company or project.
- *Denominator*: the JIM takes the sum of total debt and equity as provided in the input sheet (see Section 4.3). In case total equity and debt are not available, the total balance sheet value is used as a fall-back approach.

If for unlisted equity the total equity is not available, the relative equity share will be used as the attribution factor.

4 Inputs

4.1 Statistics

The key statistics used in the methodology to derive the supply chain and induced impact are SAMs, employment intensities and GHG intensities.

Statistics for the GHG emission calculations have been derived from the Global Trade Analysis Project (GTAP), more specifically the GTAP11A release. The GTAP 11A release includes data for 141 countries (covering 99.1% of World GDP), 19 aggregate regions, and 65 sectors extended to 76 with the power module. Data is available for multiple reference years (2004, 2007, 2011, 2014, 2017). The dataset includes both economic and GHG emission data.

GTAP is a global database of bilateral trade patterns, production, consumption and intermediate use of commodities and services. The database uses input from a global network of institutes, researchers and policy makers conducting quantitative analysis of international policy issues. It is coordinated by the Center for Global Trade Analysis in Purdue University's Department of Agricultural Economics. Underlying the database there are several data sources that are heterogeneous in sources, methodology, base years and sectoral detail.

The JIM uses both GHG emission data and economic data from GTAP to develop SAMs and GHG emission factors. Additionally, World Bank Development Indicators (WBDI) are combined to GTAP data to calculate the average asset-turnover ratios.

SAMs

SAMs are a statistical and static representation of the economic structure of an economy. They describe financial flows of all economic transactions within an economy. SAMs can be derived by combining multiple datasets on intermediate (local and imported) consumption and value added from GTAP. Table 2 provides an overview of the GTAP datasets used to develop the SAMs.

The SAMs in the JIM are based on economic data for 93 developing countries, 76 sectors and reference year 2017. For the countries for which no data is available, a regional proxy is developed⁵.

Table 2: GTAP datasets SAMs

GTAP datasets	Description	Underlying data
EVFB	Primary factor purchases, by firms, at basic prices	National statistical institutes. Data is harmonised using UN COMTRADE, WBDI, OECD and FAO data.
VDFB	Domestic purchases, by firms, at basic prices	
VMFB	Import purchases, by firms, at basic prices	
EVFP	Primary factor purchases, at purchasers' prices	
VDFP	Domestic purchases, by firms, at purchasers' prices	
VMFP	Import purchases, by firm, at purchasers' prices	

⁵ The regions in the JIM are based on the UN Geoscheme. For the regional SAMs, individual country tables and "rest" tables are used of countries within the region. "Rest" tables from GTAP typically cover multiple countries for which no individual tables are available. For an overview of the regional tables, please see JIM Methodology Paper.

<i>PTAX</i>	Net output taxes or subsidies
<i>VDPB</i>	Domestic purchases, by firms, at purchasers' prices
<i>VMPB</i>	Import purchases, by households, at basic prices
<i>VDPP</i>	Domestic purchases, by households at producer prices
<i>VMPP</i>	Import purchases, by households, at purchasers' prices
<i>VDGB</i>	Domestic purchases, by government, at basic prices
<i>VMGB</i>	Import purchases, by government, at basic prices
<i>VDGP</i>	Domestic purchases, by government, at purchasers' prices
<i>VMGP</i>	Import purchases, by government, at purchasers' prices
<i>VXSB</i>	Non-margin exports, at basic prices
<i>VFOB</i>	Non-margin exports, at FOB prices
<i>VCIF</i>	Imports, at CIF prices
<i>VMSB</i>	Imports, at basic prices
<i>VDIB</i>	Domestic purchases, by investment, at basic prices
<i>VDIP</i>	Domestic purchases, by investment, at purchasers' prices
<i>VMIB</i>	Import purchases, by investment, at basic prices
<i>VMIP</i>	Import purchases, by investment, at purchasers' prices
<i>EVOS</i>	After (income) tax value of endowment supply
<i>VST</i>	Margin exports

The SAMs in the JIM have been simplified in the sense that factors and institutions are combined in three value added categories: salaries, taxes and savings. These are compiled from data on endowments (i.e. from land, unskilled labour, skilled labour, capital and natural resources) and taxes.⁶ Subsistence farming and dwellings are excluded from the SAMs so that the SAMs only represent economically productive sectors and exclude non-market transactions.⁷

GHG emission factors

GHG emissions factors reflect the GHG emissions per unit of revenue in a certain country and sector. They are derived by dividing the total GHG emissions by the total output in a certain country and sector. The total GHG emissions per country and sector are derived from GTAP. The output data per country and sector could be derived from the SAMs, which is described above.

⁶ Aguiar, A., Chepeliev, M., Corong, E., McDougall, R., & van der Mensbrugge, D. (2019). The GTAP Data Base: Version 10. *Journal of Global Economic Analysis*, 4(1), 1-27. Retrieved from <https://www.jgea.org/resources/jgea/ojs/index.php/jgea/article/view/77>

⁷ As a large share of agriculture in low- and lower middle-income countries is subsistence farming, sourcing by agricultural companies from other agricultural companies, and private sector consumption of agriculture is put to zero. Income classification of countries is based on the World Bank list of economies as of June 2018. The dwellings sector in GTAP reflects imputed rents of houses occupied by owners. They are assumed not to contribute to market transactions.

Table 3: GTAP datasets GHG emission factors

GTAP datasets	Description	Underlying data
MDF	CO ₂ emissions from domestic product in current production (Mt CO ₂)	Carbon emissions from fossil fuel combustion by sectors are compiled based on the GTAP energy volume data. The main data source for energy volumes is the International Energy Agency's Extended Energy Balances.
MIF	CO ₂ emissions from imports in current production (Mt CO ₂)	
NCQO	Non-CO ₂ emissions associated with output by industries (Mt CO ₂ -eq)	FAOSTAT dataset is used for sourcing agricultural non-CO ₂ emissions, EDGAR databases are used to source non-agricultural emissions.
NCQE	Non-CO ₂ emissions associated with endowment by industries (Mt CO ₂ -eq)	
NCQF	Non-CO ₂ emissions associated with input use by industries (Mt CO ₂ -eq)	

Average asset-turnover ratios

The average asset-turnover ratios measure the value of a company's revenues relative to the value of its assets. It is used in the model as an indicator of the efficiency with which a company translates financing into revenues when direct revenue figures are not made available⁸.

Table 4: Sources asset-turnover ratios

Sources / Datasets	Description	Underlying data
GTAP		
VKB	Amount of common and preferred shares companies are authorized to issue, according to their corporate charter (US\$)	Capital stocks data are collected from Penn World Tables.
WBDI		
GDP (current US\$)	Sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (current US\$)	World Bank national accounts data, and OECD National Accounts data files.
Gross fixed capital formation (current US\$)	Investments covering land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, and other infrastructures (commercial, industrial, residential, public buildings) (current US\$)	
Gross fixed capital formation (% of GDP)	Gross fixed capital formation as a percentage of GDP (%)	
Gross fixed capital formation, private sector (% of GDP)	Gross private investments by the private sector (including private non-profit agencies) on additions to its fixed domestic assets (%)	

⁸ For more detail on the asset-turnover ratios please refer to the methodology document

4.2 Client financials for impact results

The model uses a parsimonious approach. There are only a few “required inputs” for the model to be able to run. However, more data can be provided to refine the calculations (“optional inputs”). Additionally, data can be provided to calculate the attribution factor.

4.2.1 Required inputs for impact results

Quantifying GHG emissions

For clients and projects that are operational, the minimum financial data input required is “Revenue”, whereas for projects that are temporary and/or in construction phase, the minimum data input is “Project value”:

- *Revenue*: gross value of sales over the reporting period.
- *Project value*: the cumulative value of all project costs in the reporting period.

In addition to these financial inputs, the JIM requires some general client information (e.g. country of operations, economic activity). A full list of client financial data inputs per client type can be found in the User Guide.

4.2.2 Optional inputs for impact results

Optional inputs improve/replace the model calculations and should always be inputted when available. These include:

- *Absolute emissions - Scope 1*: Amount of greenhouse gases emitted through the organisation's operations from direct emissions sources during the reporting period.
- PCAF data quality score - Scope 1: When data for absolute emissions - Scope 1 is entered, the model allows the user to include the PCAF data quality score for the same scope.
- *Absolute emissions - Scope 2*: Amount of greenhouse gases emitted by the organisation's direct electricity supplier.
- PCAF data quality score - Scope 2: When data for absolute emissions - Scope 2 is entered, the model allows the user to include the PCAF data quality score for the same scope.
- *Absolute emissions - Scope 3*: Amount of greenhouse gases emitted by the organisation's suppliers and suppliers of suppliers (except direct electricity supplier).
- PCAF data quality score - Scope 3: When data for absolute emissions - Scope 3 is entered, the model allows the user to include the PCAF data quality score for the same scope.
- *Emission removals*: Emissions that are being sequestered through the investment.
- *Power technology type (for power projects)*: category of energy technology used to generate power. This can include wind, solar, hydro, geothermal, natural gas, biomass or heavy fuel.

A full list of optional data inputs per client type can be found in the User Guide.

4.3 Client financials for attribution share

Attribution is calculated by combining investment and client data. The investment and client data required differ between listed and unlisted clients. The inputs required for each of these client

types are further detailed below, including alternative options if preferred datapoints are not available.

4.3.1 For listed clients

Investment data

- *Outstanding amount - Debt*: book value of the debt that the borrower owes to the lender (i.e. disbursed debt minus any repayments).

AND/OR

- *Outstanding amount - Listed equity*: market value (i.e., market price times number of shares)

Client data

Preferred:

- *Enterprise Value Including Cash (EVIC)*: the sum of the market capitalization of ordinary shares at fiscal year-end, the market capitalization of preferred shares at fiscal year-end, and the book values of total debt and minorities' interests.

Alternative:

- *Total equity*: market capitalization of ordinary shares at fiscal year-end plus the market capitalization of preferred shares at fiscal year-end. It should be provided with "Total debt" if "EVIC" is not available.
- *Total debt*: book values of total debt, which includes both current and long-term debt from the balance sheet of a client. It should be provided with "Total equity" if "EVIC" is not available.
- *Total balance sheet value*: to provide if the breakdown between "Total equity" and "Total debt" is not available. It corresponds to the sum of total equity and liabilities, which is equal to a client's total assets.

Calculation

$$\text{Preferred option} \left\{ \begin{array}{l} \frac{\text{"Outstanding amount - Debt"} + \text{"Outstanding amount - Listed equity"}}{\text{Enterprise Value Including Cash (EVIC)}} \\ \text{or} \frac{\text{"Outstanding amount - Debt"} + \text{"Outstanding amount - Listed equity"}}{\text{Total equity} + \text{Total debt}} \\ \text{or} \frac{\text{"Outstanding amount - Debt"} + \text{"Outstanding amount - Listed equity"}}{\text{Total balance sheet value}} \end{array} \right.$$

4.3.2 For unlisted clients

Investment data

- *Outstanding amount - Debt*: book value of the debt that the borrower owes to the lender (i.e. disbursed debt minus any repayments).

AND/OR

- *Relative equity share*: corresponds to the number of shares that the financial institution holds in the respective investee divided by the total number of shares of the investee.

Client data

Preferred:

- *Total equity*: total equity on the balance sheet of a client. In cases where the total company equity value according to the client’s balance sheet is negative, total equity shall be set to 0.
- *Total debt*: book values of total debt, which includes both current and long-term debt from the balance sheet of a client.

Alternative:

- *Total balance sheet value*: to provide if the breakdown between “Total equity” and “Total debt” is not available. It corresponds to the sum of total equity and liabilities, which is equal to a client’s total assets.

Calculation

$$\text{Preferred option} \left\{ \begin{array}{l} \frac{\text{"Outstanding amount - Debt"} + (\text{Relative equity share} \times \text{Total equity})}{\text{Total equity} + \text{Total debt}} \\ \text{OR} \frac{\text{"Outstanding amount - Debt"} + (\text{Relative equity share} \times \text{Total equity})}{\text{Total balance sheet value}} \end{array} \right.$$

If “Total equity” is missing the attribution share will be:

$$\frac{\text{"Outstanding amount - Debt"}}{\text{Total balance sheet value}} + \text{Relative equity share}$$

4.3.3 Note on conflicting data

If both “Outstanding amount - Listed equity” and “Relative equity share” are provided, the calculation will assume that the company is listed and calculate accordingly, see section above on “Listed clients”. As a result, the “Relative equity share” will not be used in the calculation.

5 Outputs

The GHG impacts quantified by the JIM are presented in the dashboard, the “table” tab and the “GHG” tab in the Excel file. The table below shows how the JIM sub-indicators relate to the PCAF reporting indicators.

Table 5: JIM Outputs

JIM scope	JIM sub-indicator	PCAF reporting indicator
Backward Permanent, Backward Temporary, Finance Enabling ⁹	Absolute emissions Scope 1 - CO2	Sum of these two sub-indicators links to the absolute emissions - Scope 1 for PCAF reporting
	Absolute emissions Scope 1 - Non-CO2	

⁹ Emissions financed through a financial intermediary are not yet part of the PCAF reporting.

	Absolute emissions Scope 2 - CO2	Sum of these two indicators links to the absolute emissions - Scope 2 for PCAF reporting
	Absolute emissions Scope 2 - Non-CO2	
	Absolute emissions Scope 3 Local - CO2	Sum of these four indicators links to the absolute emissions - Scope 3 for PCAF reporting ¹⁰
	Absolute emissions Scope 3 Local - Non-CO2	
	Absolute emissions Scope 3 Imports - CO2	
	Absolute emissions Scope 3 Imports - Non-CO2	
<i>Backward Permanent</i>	Emission removals	This indicator represents the emission removal for PCAF reporting
<i>Backward Permanent, Backward Temporary, Power Enabling</i>	Absolute emissions Other - CO2 Absolute emissions Other - Non-CO2	Sub-indicators not covered by the PCAF framework and should not be included during PCAF reporting

Additionally, the JIM will return the PCAF quality score, which ranges between 4 and 5 for data estimated through the JIM. If emissions data is entered, the quality score can be included as well (see section 4.2.2), in which case it could range from 1 to 5.

The GHG emission results quantified are:

- *Gross impacts*: the model does not consider that (part of) these impacts may be offset by a fall in production in less successful firms.
- *Not time bound*: these impacts might not all occur in the year of the operations modelled but take place over all time required to generate the purchased goods and services.
- *Reoccurring impacts for operational clients and permanent projects*: impacts are likely to recur every year for clients and projects that are operational, assuming they do not end operations or significantly change their spending pattern.
- *Temporary impacts for construction projects and other temporary projects*: impacts of these projects only last for a limited number of years due to the intrinsic short-term nature of these projects.

Impacts can be quantified for the same client for multiple years using the client's annual local procurement expenses. The difference in impact between the two years reflects the change in gross impacts of a client.

¹⁰ As mentioned in Section **Error! Reference source not found.** end-of-life treatment of sold products, use of sold products and downstream transportation and distribution are not covered by the JIM.

6 Assumptions and limitations

Users should be aware of the following assumptions and limitations:

- *Risk of double count*: clients with a portfolio of investments including power plants and other investees in the same country, risk double counting GHG emissions. The Scope 1 emissions of the power plant are likely also included as Scope 2 emissions of the other investees. The magnitude of double counting increases with the size of the power plant; the bigger the power plant, the more likely it becomes that the plant is serving a (significant part) of the other investees in the market (and emissions are also counted as Scope 2 emissions);
- *Coverage of Scope 3 GHG emissions is limited*: End-of-life treatment of sold products, use of sold products and downstream transportation and distribution are not included;
- *Coverage of CO₂ emissions is limited*: CO₂ emissions from forestry and other changes in land use are not included.

Further, there are some general limitations related to IO modelling as it depends on simplistic assumptions:

- *No supply and capacity constraints*: the model assumes additional output is generated regardless of the availability of resources (e.g. labour, raw materials, production capacity), which may be tied up in other activities;
- *Fixed production structures*: IO modelling assumes production structures are “frozen” in time. This implies no change in returns to scale and a fixed production structure with no substitution of inputs.¹¹ However, business growth is likely to impact the inter-relationships between sectors within an economy (for example, through competitive changes and displacement). Because of this, results describe gross, not net, effects;¹²
- *Fixed prices*: price changes in the local economy, which could result from policy or crowding out effects, are not considered. Thus, prices do not constrain input availability. The model is therefore most accurate for projecting the impact of relatively small and short-term changes in demand;
- *Sector averages*: IO modelling assumes that all companies in a certain sector have the same production structure. In reality, each business has a unique way of procuring its goods and services, and businesses backed by DFIs are likely to be atypical of their sectors (they may be more capital intensive, for example).

Due to these assumptions the method risks some overestimation.^{13,14} On the other hand, other firm-level development impacts (e.g. from tax contributions, product innovations, foreign

¹¹ Fiona Tregenna. (2018). Review of CDC’s Jobs Methodology, retrieved 17 March 2020 online from: https://assets.cdcgroup.com/wp-content/uploads/2019/08/08140530/Measuring-the-indirect-impact-of-Business-Growth-20190801_01.pdf

¹² For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount.

¹³ See e.g. the discussion in Partridge, M. D. & Rickman, D. S. (2008). Computable General Equilibrium (CGE) Modelling for Regional Economic Development Analysis. *Regional Studies*, (44)10. 1311-1328.

exchange savings from exports, knowledge spill overs) are not accounted for, even though they likely create further impacts.

¹⁴ See e.g. the discussion in the Australian Bureau of Statistics, retrieved 27 July 2017 online from:
<http://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/5209.0.55.001Main%20Features4Final%20release%202006-07%20tables>.