Joint Impact Model v3.1

Methodology

December 2023

Contents

1 Introduction

This document provides a comprehensive overview of the methodologies, data sources, and calculations used in the Joint Impact Model. It starts with introductions to the methodologies applied to each impact: direct impacts, supply chain and induced impacts, financing enabling impacts, and power enabling impacts. These introductions are followed by discussions of the rationale behind the methodology choices and the associated key assumptions and limitations.

The Attribution section details the necessary inputs used to calculate the "attribution shares", corresponding to the impact an investor is entitled to claim considering its investment in the investee companies.

In the Potential Adverse Impact indicators section, we dive extensively in the methodology and calculations applied in the model to quantify SFDR's PAI reporting standards, with which the JIM is aligned.

The data sources section then offers information regarding the primary data sources utilized in the model, encompassing macro-economic statistics and user-input data. Finally, the document explores the confidence level of the results. Users of the JIM should rely on this document as a technical reference guide. It is intended to provide in-depth answers to questions regarding the JIM's calculation methodology and underlying reasoning.

1.1 Impact indicators

The key economic and environmental impact indicators of the model are:

- *Employment*: all working age people (15 years and older) who are engaged in any activity to produce goods or provide services for pay or profit, expressed in number of people.[1] Employment is further broken down in:
    - *Female employment:* all working age females (15 years and older) engaged in any activity to produce goods or provide services for pay or profit.
    - *Formal employment:* all working age people (15 years and older) hired by an employer under an established working agreement.
    - *Informal employment:* all working age people (15 years and older) working for an organisation despite not being provided with a working agreement[2];
    - *Youth employment:* all people, regardless of gender, between 15 and 25 years old who are engaged in any activity to produce goods or provide services for pay or profit.

[1] The employed comprise all persons of working age who, during a specified period, were in the following categories: a) paid employment (whether at work or with a job but not at work); or b) self-employment (whether at work or with an enterprise but not at work). Source: ILOSTAT; This means that the employment results do not reflect fulltime equivalents (FTE).

[2] Specifically, informal employment is defined as an employment relationship not covered in law or practice by national labour legislation, income taxation, social protection, or employment benefits. Likewise, formal employment is defined as an employment relationship that is covered by national labour legislation. Source: ILOSTAT.

- *Value added:* the sum of wages, taxes and savings, equivalent to gross domestic product, expressed in monetary value.
    - *Wages* (salaries): value of net wages paid to all full-time and part-time employees of the organization during the reporting period.
    - *Taxes:* all transfers to the government made by a client over the reporting period.
    - *Savings* (profit): value of the organisation's net earnings (profit).
- *GHG emissions:* the sum of CO_2 and non-CO_2 emissions, expressed in CO_2-eq:
    - *CO_2 emissions:* CO_2 emitted from the combustion of fossil fuels.
    - *Non-CO_2 emissions:* methane (CH_4), nitrous oxide (N_2O) and fluorinated gases (F-gases) emitted.

Not included are*:* CO_2 emissions from forestry and other changes in land use.

Users can combine indicators to obtain additional insights. For example, the value added per job or salaries per job give some indication of the quality of jobs supported, although there are many other elements of job quality that are not (yet) covered (e.g. working conditions, workplace safety, etc). Furthermore, the GHG emissions per unit of value added can be compared to national ambitions to reduce the GHG emissions per unit of GDP.

1.2 Scope of impacts

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. In particular, the model covers the following impacts:

For these indicators the model covers the following impacts:

- *Direct:* impacts at the client company/ project.
- *Supply chain:* impacts at the client company/ project's suppliers and their suppliers.
- *Induced:* impacts associated with the spending of wages earned by employees of the client company/ project, its suppliers and their suppliers.
- *Finance enabled:* impacts at companies, suppliers of companies, and their suppliers associated with the financial intermediary's lending.
- *Power enabled:* impacts associated with the additional output generated by companies using the additional power generated by the client project, as well as by the companies' supply chain.

For GHG emissions, the key reference point is the GHG Protocol. The table below provides more details on the coverage of emissions by the JIM for each of the GHG Protocol scopes. Keeping the limitations described in this document in mind, users could use these for their PCAF reporting.

Table 1: GHG Protocol Scopes covered by the JIM

Scope	Definition	Comment[3]
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. Not included are: end-of-life treatment of sold products, use of sold products and downstream transportation and distribution.[4]

The impacts quantified are *gross* impacts: the model does not consider any substitution effects. Employment and value-added impacts are limited to the *local* (i.e. domestic) economy– they only capture impacts that arise in the country in which the client operates (or the project takes place) –, while GHG emissions include cross-border emissions as well.

The model does not measure re-spending of taxes by the government, re-spending of royalties paid by firms, productivity impacts of better logistics and connectivity, and re-spending of personal loans, insurance, or mortgages.

1.3 Use of JIM in the investment cycle

The JIM can be used for both ex-post and ex-ante impact quantification.

1.3.1 Ex-post

The JIM can be used for impact quantification as part of portfolio monitoring and evaluation (ex-post). Users can use the JIM to quantify:

- The impact of a user's outstanding portfolio in a particular year, based on data of all clients the user provided financing to and that are still active accounts in that particular year.
- The change in impact of a user's outstanding portfolio over time:
    - Change in impact between a user's full portfolio in year 1 and in year 2, based on full portfolio data for year 1 and year 2 (sample for both years will not be the same due to exits, loan repayments and new entries).
    - Change in impact for a sample of companies that were in a user's portfolio both in year 1 and year 2.

[3] Emissions financed through a financial intermediary are not yet part of the PCAF reporting.

[4] The JIM does not cover Scope 3 categories 9-15, which can be significant (5-20% of total emissions for most sectors, and 70-85% for coal, oil & gas and transport OEMS). https://cdn.cdp.net/cdp-production/cms/guidance_docs/pdfs/000/003/504/original/CDP-technical-note-scope-3-relevance-by-sector.pdf

1.3.2 Ex-ante

The JIM can also be used at the investment stage (ex-ante). Users can use the JIM to quantify:

- The expected future impact of a user's committed (or intended) portfolio, based on data of all clients the user committed (or intends to commit) financing to in a particular year.
- The change in expected future impact of a user's committed portfolio over time:
    - Change in expected future impact between a user's committed portfolio in year 1 and in year 2, based on all committed financing in year 1 and year 2.

The ex-ante approach is based on some additional assumptions compared to the ex-post approach:

- Impacts quantified are the expected future impacts of the client/financing over all time.
- Constant production structure, labour productivity and capital productivity of clients and suppliers.
- Committed financing will be fully disbursed.

Data input requirements for ex-post and ex-ante impact quantifications are to a large extent the same. The few differences are further explained the User Guide.

2 Inputs

2.1 Statistics

The methodology relies on key statistics for deriving direct, supply chain, and induced impacts. These statistics encompass Social Accounting Matrices (SAMs), employment intensities, and greenhouse gas (GHG) intensities. When assessing finance enabling impacts, the methodology requires additional inputs, including average private sector asset turnover ratios and capital endowments. For power enabling impacts, specific additional inputs are essential, which include data on country power consumption, GDP (current USD), and power translation factors.

Social Accounting Matrices (SAMs)

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.

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. The SAM describes financial flows of all economic transactions within an economy.

Exhibit 1 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.

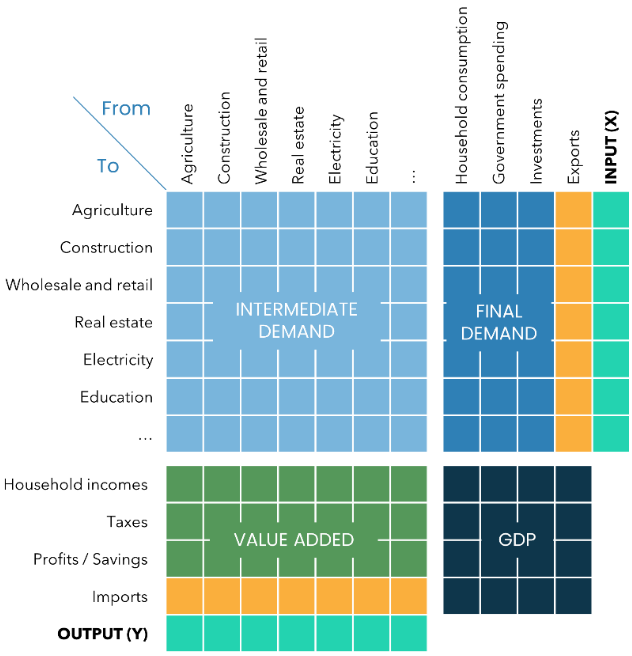

Exhibit 1: Simplified SAM

The JIM uses SAMs for 141 countries (of which 93 low and middle income countries are activated for JIM 3.0) , 17 regions and 76 sectors (for a full list see Appendix 1)[5]. The base year of the SAMs in JIM version 3.0 is 2017. Data to compile the SAMs was derived from the Global Trade Analysis Project (GTAP). Datasets that have been used are firms' domestic purchases, household domestic purchases, firms' imports, firms' expenses on endowments and taxes. More information on GTAP is provided in Section 7.

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 intensities

GHG intensities reflect the metric tonnes of CO_2 and non-CO_2 emissions per unit of output in a certain country and sector.

$$\left(\frac{\text{GHG}}{\text{Output}}\right)$$

The JIM uses GHG intensities for 76 sectors, 93 individual countries and 17 regions, with 2017 as base year. The GHG intensities have been derived by combining:

- *CO_2 and non-CO_2 emission data*: the CO_2 emitted in the combustion of fossil fuels and methane (CH_4), nitrous oxide (N_2O) and fluorinated gases (F-gases), expressed in CO_2-eq. The data has been obtained from GTAP for 93 countries and 76 sectors and has 2017 as a base year.[8]
- *Output data*: the value of goods and services produced in a given period by a sector. The data has been obtained from GTAP for 93 countries and 76 sectors and has 2017 as a base year.

As the countries and sectors of the output data are the same as for the CO_2 and non-CO_2 emission data, no mapping was needed to derive the GHG intensities. GHG emissions per sector and country/region were divided by the output per sector and country/region. GHG intensities are updated every 2-4 years when new GTAP data is released.

Employment intensities

Employment intensities reflect the number of employed people per unit of output in a certain country and sector.

$$\left(\frac{\text{Employment}}{\text{Output}}\right)$$

The JIM uses employment intensities for 93 individual countries, 17 regions and 14 sectors. The base years of the employment intensities in JIM version 3.0 are 2017, 2018, 2019, 2020 and 2021. The employment intensities have been derived by combining:

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[5] 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. https://www.gtap.agecon.purdue.edu/databases/regions.aspx?Version=11.211

[6] Aguiar, A., Chepeliev, M., Corong, E., McDougall, R., & van der Mensbrugghe, D. (2019). The GTAP Data Base: Version 10. *Journal of Global Economic Analysis, 4(1)*, 1-27.

[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.

[8] Non-CO_2 emissions are converted to CO_2-eq based on their global warming potential (GWP). The GWP numbers used by GTAP are from the UNFCCC.

- *Employment data:* the number of working age people who are engaged in any activity to produce goods or provide services for pay or profit[9]. The data has been obtained from ILOSTAT, which has modelled estimates available for 2017, 2018, 2019, 2020 and 2021, for 14 sectors (ISIC rev. 4, level 1) and 189 countries. Employment data is disaggregated by gender, age group and job types. More information on ILOSTAT is provided in Section 6.1.2.

- *Output data:* the value of goods and services produced in a given period. Output for 2018, 2019, 2020 and 2021 has been estimated by combining GTAP and World Bank data:
    - *2017 Output data* has been obtained from GTAP for 93 individual countries and 76 sectors.
    - *2017 to 2018, 2019, 2020* and *2021 GDP growth* rates have been obtained from the World Bank Development Indicators (WBDI) for 93 individual countries and 4 sectors (i.e. agriculture, manufacturing, industry, services).

To derive 2018 output per country and sector, GTAP output of 2017 per country and sector has been multiplied by the GDP growth rates from the WBDI (Exhibit 2). For all GTAP agricultural sectors, the WBDI growth rate for agriculture was used, for all GTAP manufacturing sectors the WBDI growth rate for manufacturing was used, etc. If WBDI data per sector was not available, the model used data on total GDP change (2017-2018). The key assumption here is that output grows in line with GDP. Forecasted output per country and sector for the other years is derived following the same process.

$$\left(\text{Output 2017(\$)}\right) \times \left(\begin{matrix}1 + \Delta\ \text{GDP} \\ \text{2017-2018 (\%)}\end{matrix}\right) = \left(\text{Output 2018 (\$)}\right)$$

Exhibit 2: Calculations to derive 2018 output

Countries and sectors of the employment and output data have been matched using the greatest common denominator.[10] The mapping list between the SAM sectors of GTAP and the ISIC rev. 4 sectors of ILOSTAT is included in Appendix 2. After the mapping, employment per sector and country/region has been divided by the output per sector and country/region.

Employment intensities are updated on an annual basis to capture changes in labour productivity over time. They are likely to be one year behind as data of the previous fiscal year only becomes available in the course of the next year.

Formal/informal employment share

As the clients' suppliers are not expected to only have formal employees, the JIM provides a formal/informal jobs breakdown for supply chain and induced employment.

The formal/informal employment share 2017, 2018, 2019, 2020 and 2021 per continent have been compiled as follows:

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[9] https://ilostat.ilo.org/

[10] Regional employment intensities are based on individual country data of countries in the specific region. Data needs to be available for both datapoints for the countries to be included.

1. First, the share of informal sector GDP and employment has been identified for 6 regions, based on the following data sources:

   - *Share of informal sector GDP*: the share of GDP contributed by the informal economy.[11] The data has been obtained from the regional economic outlook for Sub-Saharan Africa, published by the IMF (2017), which has unweighted estimates available for 6 regions worldwide. The base year of the data is 2010-2014.

   - *Share of informal sector employment*: the share of working age people employed in the informal economy[12]. The data have been obtained from ILOSTAT, which has estimates available for 69 countries, with varying base years. Countries were mapped to the regions used in the IMF paper, and an unweighted average was derived for the same 6 regions worldwide, using the base year closest to 2014.

2. Second, the total formal/informal employment and output per continent has been determined by multiplying total employment and output in the continent by the estimated informal sector shares of their corresponding region.

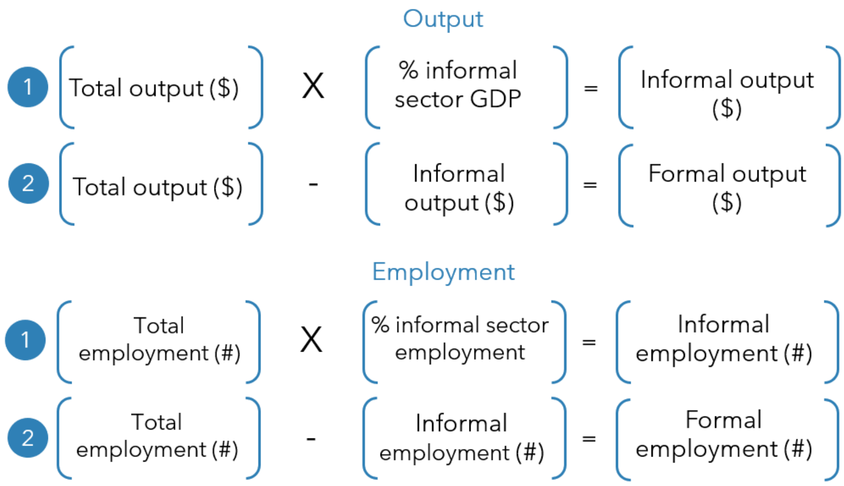

Exhibit 3: Quantification of total informal and formal employment and output

3. Third, the formal/informal employment and output had to be distributed over the SAM sectors to be able to derive the share of formal/informal employment per sector. Based on the sector assumptions in Table 2, the "clear" formal/informal employment and output per sector could be estimated.

Table 2: Assumptions on formal sector

[11] In the IMF report, the informal economy was defined as including (1) household enterprises that have some production at market value but are not registered; and (2) more broadly, underground production, where productive activities are performed by registered firms but may be concealed from the authorities to avoid compliance with regulations or the payment of taxes or are simply illegal. See IMF. (2017). Retrieved online 20 February 2020 from https://www.imf.org/en/Publications/REO/SSA/Issues/2017/05/03/sreo0517

[12] ILO defines the informal economy as including own-account workers outside the formal sector, contributing family workers, employers, and members of producers' cooperatives in the informal sector, and employees without formal contracts. Retrieved online 13 March 2020 from ILO webpage https://ilostat.ilo.org/topics/informality/)

ISIC sector	GTAP Sectors	Assumption[13]	Formal sector data
Agriculture; forestry and fishing	1-14	Only informal sector	Clear (none)
Mining and quarrying	15-18	Mix formal & informal sector	Unclear
Manufacturing	19-45	Mix formal & informal sector	Unclear
Utilities	46-59	Only formal sector	Clear (all)
Construction	60	Mix formal & informal sector	Unclear
Wholesale and retail trade; repair of motor vehicles and motorcycles	61	Mix formal & informal sector	Unclear
Transport; storage and communication	63-67	Mix formal & informal sector	Unclear
Accommodation and food service activities	62	Mix formal & informal sector	Unclear
Financial and insurance activities	68 69	Only formal sector	Clear (all)
Real estate	70	Only formal sector	Clear (all)
Business and administrative activities	71	Only formal sector	Clear (all)
Public administration and defence; compulsory social security	73	Only formal sector	Clear (all)
Education	74	Mix formal & informal sector	Unclear
Human health and social work activities	75	Mix formal & informal sector	Unclear
Other services	72	Mix formal & informal sector	Unclear

For SAM sectors 1-14 all employment and output has been allocated to the informal sector ("clear" informal sector employment and output). For SAM sectors 46-59, 68-71 and 73, all employment and output has been allocated to the formal sector ("clear" formal sector

[13] ILO estimates the informal employment in agriculture to be at least 90%; Retrieved 1 March 2020, www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_627189/lang--en/index.htm. Assumptions for other sectors are based on the informal sector data from the Kenyan statistical office report titled "Economic Survey 2014 – Kenya", which shows that persons engaged in informal sector activity are in manufacturing, construction, wholesale and retail trade, hotels and restaurants, transport and communications, community, social and personal services.

employment and output)[14]. The remaining sectors are assumed to be a mix of formal and informal sector, for which the exact numbers are unclear.

4. Subsequently, to determine the formal/informal employment and output, in the "unclear" sectors, the "clear" formal/informal sector employment and output have been deducted from the totals. Subsequently, the share of "unclear" formal output in the total "unclear" output was applied to the total output of the remaining sectors (15-45, 60-67, 72 and 74-75) to derive the formal output in these sectors. The same was done for employment. Hence each of the four variables (i.e. total formal employment, total informal employment, total formal GDP, and total informal GDP) are conserved.

1. Total informal output ($) - Output sectors 1-14 ($) ='clear' informal output = 'Unclear' informal output sectors 15-45, 60-67, 72, 74-75 ($)

2. Total formal output ($) - Output sectors 46-59, 68-73($) ='clear formal output' = 'Unclear' formal output sectors 15-45, 60-67, 72, 74-75 ($)

3. 'Unclear' informal output sectors 15-45, 60-67, 72, 74-75 ($) + 'Unclear' formal output sectors 15-45, 60-67, 72, 74-75 ($) = 'Unclear' total output sectors 15-45, 60-67, 72, 74-75 ($)

4a. Output sectors 15-45, 60-67, 72, 74-75 ($) X ('Unclear' formal output sectors 15-45, 60-67, 72, 74-75 ($) / 'Unclear' total output sectors 15-45, 60-67, 72, 74-75 ($)) = Formal output sectors 15-45, 60-67, 72, 74-75 ($)

4b. Output sectors 15-45, 60-67, 72, 74-75 ($) X ('Unclear' informal output sectors 15-45, 60-67, 72, 74-75 ($) / 'Unclear' total output sectors 15-45, 60-67, 72, 74-75 ($)) = Informal output sectors 15-45, 60-67, 72, 74-75 ($)

Exhibit 4: Quantification of formal and informal output for "unclear" sectors

5. Finally, formal/informal employment shares were respectively divided by the total employment per sector to derive the formal/informal employment share.

Asset turnover ratios

Financial institutions struggle to directly measure the impacts of their clients, including factors like value added, greenhouse gas emissions, and employment, and face challenges when attempting to estimate these impacts based on physical activity or turnover data, especially in the case of numerous clients in various sectors, including emerging markets and developing countries.

A potential solution to these challenges is the use of asset turnover ratios (ATRs). In such cases, FIs can estimate their share of client turnover by multiplying their investment (a contribution to the

[14] Assumptions based on the fact that agriculture, forestry and fishing in many developing countries are characterized by high degrees of informality, while the utilities, business services, and public services sectors are highly unlikely to have informal employment given the nature of the work.

client's total assets) by a sectoral ATR. Although using sectoral averages for individual firms might not be ideal, it can balance out for FIs with multiple investments in a given sector.

Modelling the anticipated impacts of individual investments should be understood to be more conservative in terms of scale of impact than modelling for portfolio-level financed impacts, where investors take on responsibility for their share of the existing footprint.

Average private sector asset turnover ratios

The average private sector asset turnover ratios reflect how much output is supported by one unit of private sector capital stock in a certain sector and region.

$$\left(\frac{\text{Output (\$)}}{\text{Capital (\$)}}\right)$$

The JIM uses average private sector asset turnover ratios for 76 sectors and 7 regions (i.e. Europe, Africa, Asia excluding China, China, Latin America and Caribbean, North America and Oceania). The asset turnover ratios are developed on a regional level instead of individual country level. This higher level of aggregation reduces the effect of outliers due to limited availability and reliability of capital data per sector (especially when sectors are smaller. The base year of these ratios in JIM version 3.0 is 2017. The average private sector asset turnover ratios have been derived by combining private sector capital stock data (estimated using various indicators) and output:

- *Private sector capital (stock) data:* the total value of all private sector assets used for the production of goods and services in a given period. Private sector capital stock data for the 76 sectors and 7 regions has been estimated by combining GTAP and WBDI data and has 2017 as a base year.
    - *Capital stock data* has been obtained from GTAP for 121 countries and has 2017 as a base year.
    - *Capital endowment data* has been obtained from GTAP for 76 sectors and 121 countries and has 2017 as a base year[15].
    - *Gross fixed capital formation (% of GDP)* (GFCF) has been obtained from the WBDI for 207 countries for 2017[16].
    - *Gross fixed capital formation, private sector (% of GDP)* has been obtained from the WBDI for 63 countries for 2017[17].

This data has been used as follows. First, the capital stock data was divided over GTAP sectors using the sector's capital endowment share in total capital endowments for the specific region (weighted average of individual countries within the region).

[15] Value of purchases of capital demanded by all firms in a particular sector in a given region, at agent's prices. It is one of five available endowments that are factors of production (the others are land, skilled labour, unskilled labour and natural resources). It is calculated as the price of capital demanded times the quantity of capital demanded.

[16] The total value of fixed assets in a country/region. It includes land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, schools, offices, hospitals, private residences, and commercial and industrial buildings.

[17] the total value of private sector investments (including private non-profit agencies) on additions to its fixed domestic assets.

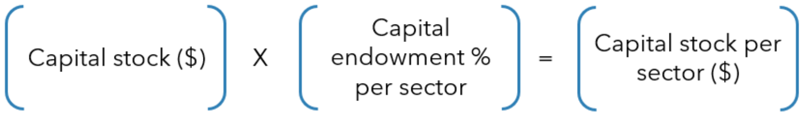

Exhibit 5: Calculations to derive capital stock per sector

Second, to get to the *private sector capital stock* per sector, the average private sector GFCF share (out of total GFCF) of the individual countries within a region has been calculated, and subsequently been multiplied to the capital stock per sector.

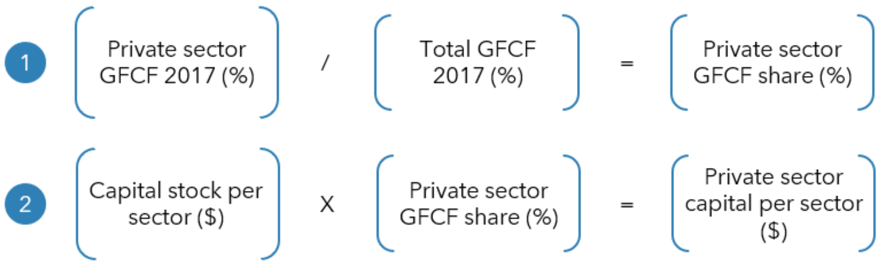

Exhibit 6: Calculations to derive private sector capital stock per sector

- *Output data*: the value of goods and services produced in a given period by a sector. The data has been obtained from GTAP for 76 sectors and 7 regions has 2017 as a base year.

To derive the average asset turnover ratios, the output per sector and region was divided by the private sector capital stock data per sector and region.

Firm size adjustment asset turnover ratio

The asset turnover ratio is adjusted for firm sizes (i.e. micro enterprises, SMEs and large enterprises). Please see Appendix 3 for definitions of micro enterprises and SMEs. The adjustments are based on a study from Bas et al (2010). Using WBES data, they argue that lack of access to finance may impede growth of small and medium enterprises (SMEs) in developing countries more compared to large corporate firms. The JIM uses the inverse of the average ratio of firms' total liabilities to their total assets by firm size of Bas et al (2010)'s findings, to account for the effect of firm size in translating a capital investment to firm output. [18] The numbers show that micro enterprises and SMEs produce 1.2 times more output with one unit of capital than the economy average, and corporates only 0.73.

Table 3: Firm size adjustments to asset turnover ratios

Firm size	**Value**
Micro enterprise & SME	1.20
Large enterprise	0.73

[18] These adjustments are based on leverage estimates that include short- and long-term debt as well as equity share of capital. See Bas, T. Muradoglu, G & Phylaktis, K. (2010). Determinants of Capital Structure in Developing Countries. https://www.researchgate.net/publication/228465937_Determinants_of_Capital_Structure_in_Developing_Countries

Capital endowment data

It is the firm's expenses on capital. It has been obtained from GTAP for 76 sectors and 93 countries and has 2017 as a base year.[19]

Firm size adjustment to employment intensities

The formal sector employment intensities applied to quantify the jobs supported at direct clients of financial intermediaries are adjusted for firm sizes if this information is known (i.e. SMEs and large enterprises) (see Appendix 3 for a definition of SMEs). The adjustments are based on a study by IFC on SME access to financial services in the developing world, which discusses the role of SMEs in economic development.[20] The report highlights that "studies indicate that formal SMEs contribute up to 45 percent of employment and up to 33 percent of GDP in developing economies". That means SMEs require 1.36 times (45/33) the people to produce the output while corporates need 0.82 times (55/67) the people to produce the output (see Table 4).

Table 4: Firm size adjustment

Firm size	**Value**
Micro enterprise & SME	1.36
Large enterprise	0.82

Power-to-output translation factor

The power-to-output translation factor is a straight average of the sector multipliers of 4 case studies for which data has been verified with experts (i.e. Nigeria, Uganda, Uruguay and Turkey). This factor, of 1:0.02, is applied to all countries and sectors.

Electricity consumption

The JIM uses total electricity consumption (GWh) per country from the International Energy Agency (IEA) database. Electricity consumption data is available for 166 countries for 2017.

To supplement the energy data from the IEA, the JIM uses data from the Energy Information Agency (EIA), a bureau within the US Government's Department of Energy that collects, analyses and disseminates energy information. The JIM uses electricity consumption data provided by the EIA for countries in which IEA data is unavailable, thereby improving coverage. Data is available for 2017 and for 230 countries and regions.

Net capacity factors

A net capacity factor is a measurement of the amount of actual electricity generated over a given period in time relative to the maximum amount of electricity generated over that same period. It is typically expressed as a percentage and varies for different types of power generation technologies.

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[19] Value of purchases of capital demanded by all firms in a particular sector in a given region, at agent's prices. It is one of five available endowments that are factors of production (the others are land, skilled labour, unskilled labour and natural resources). It is calculated as the price of capital demanded times the quantity of capital demanded.

[20] IFC. (2010). "Scaling-Up SME Access to Financial Services in the Developing World". Financial Inclusion Experts Group with SME Finance Sub-Group for G20 Seoul Summit 2010. Pg 6. https://www.enterprise-development.org/wp-content/uploads/ScalingUp_SME_Access_to_Financial_Services.pdf

$$\left(\text{Power production (MWh)}\right) / \left(\left(\text{Installed capacity (MW)}\right) \times \left(\text{Potential operations time (H)}\right)\right) = \left(\text{Net capacity factor (\%)}\right)$$

Exhibit 7: Calculation formula for net capacity factor

For renewable energy technologies, the JIM uses net capacity factors from the US EIA based on the 2017 average net capacity factors of utility scale plants in the United States[21]. Seven renewable energy net capacity factors are used in the JIM: biomass, geothermal, hydro, solar, wind, wood, and nuclear power.

For non-renewable energy technologies, including base-load power such as coal and natural gas, and peak load power such as petroleum fired technology, we assume net capacity factors. Since the scope of the JIM is focused on developing countries, using EIA net capacity factors, which are based on utility-scale power plants in the US, where data is more available and plants are more efficient, would underestimate the non-renewable generation. Base-load power net capacity factors, which apply to coal and natural gas, are assumed to operate at near full capacity (100%) since energy is scarce in many developing countries, meaning thermal power is heavily relied on. However, to account for losses and maintenance, among other factors, we assume base-load power capacity factors of 80%. The net capacity factor of peak load plants can be as low as 5%. However, in emerging markets the use of these plants is often more than what is intended: they are often required for base load power. Thus, a realistic approach is to assume a net capacity factor of 40%.

Table 5: Net capacity factors

Non-fossil fuels	**Net capacity factor**
Geothermal	73.2%
Hydro	43%
Nuclear	92.3%
Biomass	61.8%
Solar PV[22]	25.6%
Solat thermal	21.8%
Wind	34.6%
Wood	60.2%
Misc. renewables	n/a

Fossil fuels	**Net capacity factor**
Base load	
Coal	80%
Natural gas	80%
Peak load	
Petroleum	40%
Misc non-renewables	n/a

2.2 Client financials

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").

[21] EIA. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels. Retrieved on August 21st, 2023, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b

[22] i.e. photovoltaic.

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 revenue 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).

For finance enabling, FI enabling impacts are estimated when clients do not have data on the companies in FIs’ portfolios benefitting from their loans. It is used when only the amounts of capital provided to these companies by FIs is available.

- *Outstanding amount – financial intermediary*: value of disbursed capital remaining on the finance provider's balance sheet at the end of the reporting period. If outstanding amounts are unavailable, clients can use committed amounts instead.

For power enabling impacts, either power production or installed capacity and the power technology type must be provided. If power production is not available, installed capacity and the technology type can be used to estimate power production based on modelling. If neither are available, power enabling impacts cannot be measured.

- *Power production (MWh)*: energy delivered to off taker(s) during the reporting period.
- *Installed capacity (MW)*: maximum output of electricity that a power plant can produce under ideal conditions, i.e. the intended full-load sustained output of a power plant.
- *Power technology type*: category of energy technology used to generate power. This can include wind, solar, hydro, geothermal, natural gas, biomass or heavy fuel. A full list is available in Appendix 5.

The data inputs for attribution can be found on section 4.

A full list of client financial data inputs per client type can be found in Section 3.3 of the User Guide, including optional data inputs.

3 Impacts

3.1 Direct Impact

Insights into direct impacts of businesses can often be obtained from observable data. However, some indicators are easier to track than others. For example, GHG emissions are often not measured by clients. The JIM requires users to insert as much directly observable data as possible.

3.1.1 Methodology

Where possible, the direct impacts are taken directly from client data. Where client data is not available, the JIM combines client financial data with macro-economic statistics to make an estimate.

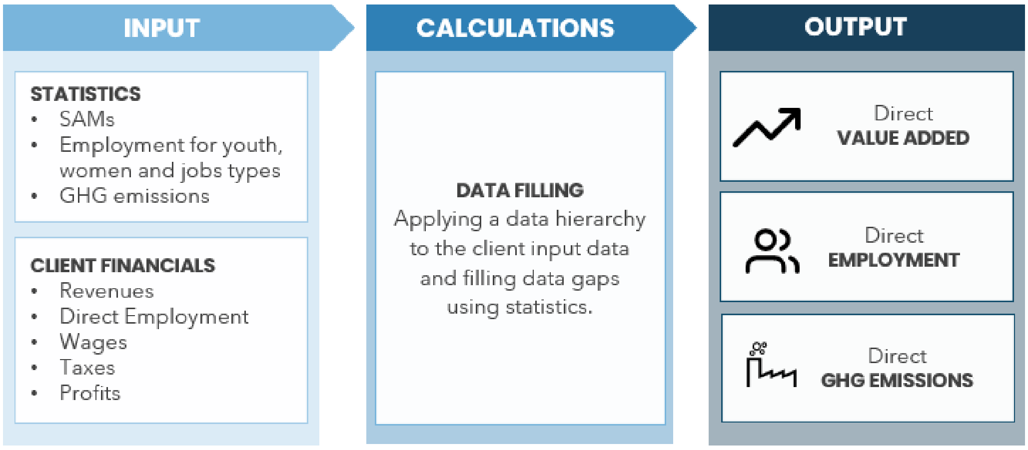

Exhibit 8: Overview methodology for direct impact

3.1.2 Calculations

Data filling

The first step is to map the client data to the SAM model countries and sectors. Subsequently the model applies a data hierarchy to identify the best-available direct impact data for each client. The data hierarchy is the same for clients and projects in operations and construction phase.

<u>Absolute emissions – Scope 1/Emission removals</u>

If absolute emissions – Scope 1 (direct emissions) are provided, the input is split between CO2 and non-CO2 using the client's sector and country relative emissions pattern.

If data on absolute emissions – Scope 1 is not provided, the emissions are estimated by multiplying the client's revenue by the GHG emission intensity of the client's sector and country.

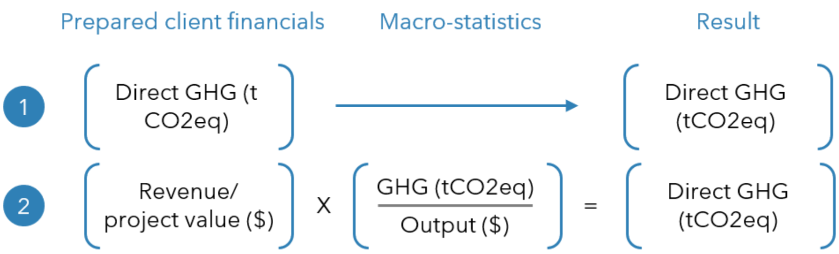

Exhibit 9: Data hierarchy client financials absolute emissions – Scope 1

Emission removals are never estimated by the JIM. If data is not available, no results are provided.

Employment

Total direct employment can either be provided directly by the user or estimated from revenue/project value. If data is provided on direct employment for third party hires, this is deducted from the direct operations employment. Third party hires are already included in the estimations of supply chain jobs and keeping them as part of the direct operations jobs would mean they are counted twice.

Finally, in the last scenario, the revenue/project value is multiplied by formal sector adjustment and the employment intensity of the relevant sector and country to estimate the direct jobs.

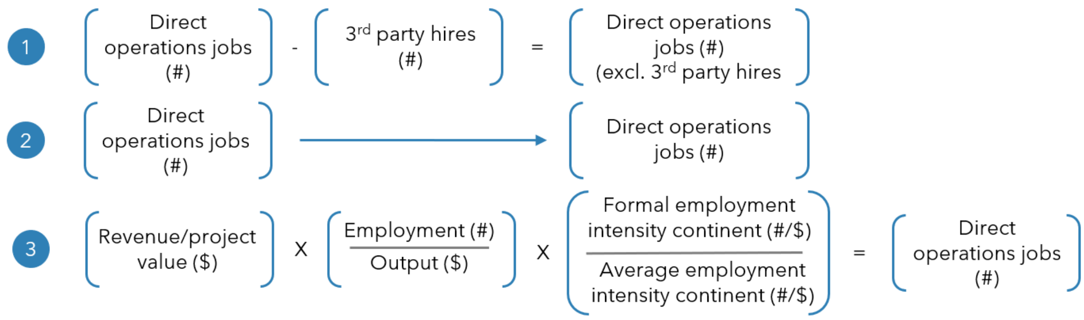

Exhibit 10: Data hierarchy for quantification direct employment impact

For female jobs, the model uses the same data hierarchy as for the total jobs. When estimating direct female jobs, the model uses total direct employment and statistics on the percentage of jobs for women in a particular sector and country.

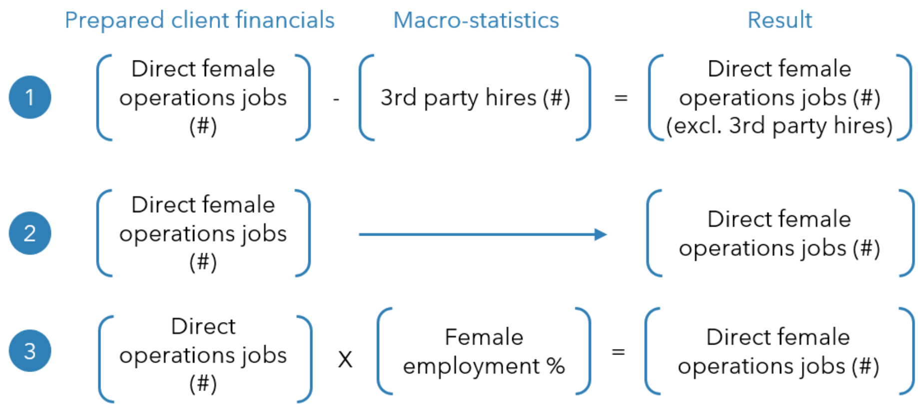

Exhibit 11: Data hierarchy for quantification direct female employment impact

For youth employment, the share from total employment is always provided, but not applied to the estimated results. This share is based on the percentage of jobs for youth in a particular country (ILO).

Value added

For the value added categories (i.e. wages, taxes, savings), the best available input is observed data on the client's wages and tax payments and savings. If this data is provided, payroll taxes are deducted from the direct wages, and added to the direct taxes to get to the net wages for households and total direct tax payments for governments (and savings for companies) (see step 1 in Exhibit 12).

If no direct data on value added categories is provided, the JIM estimates these by multiplying the total revenue of the client by the average proportion of revenue spent on wages/taxes/savings derived from the client's sector in the SAM (step 2 in Exhibit 12). If one of the value added components (e.g. wages) is provided and the other components are not available, only the components that are not available are estimated (e.g. taxes and savings).

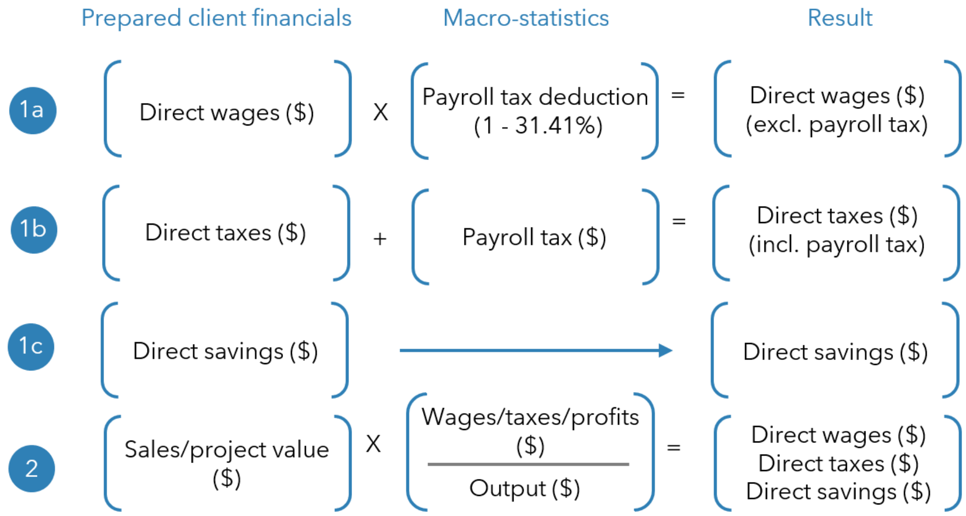

Exhibit 12: Data hierarchy for quantification direct value added impact

When direct value added data is estimated (step 2 in Exhibit 12), the JIM makes sure that the sum of the provided/estimated direct value added data and the total procurement balance out the provided revenue.

If there is a gap, the model will adjust the estimated values to match the revenue. This might lead to the estimation of negative values. To prevent odd results, two key assumptions are applied:

- If estimated total procurement is to become negative, it is set to 0 and further adjustments are made to any other estimated value.
- If estimated wages are to become negative, it is set to 0 and further adjustments are made to any other estimated value.

Finally, the user can also provide EBITDA as an optional input, on top of the other financials. In this case, the value added is quantified as shown in Exhibit 13. EBITDA is used as a proxy for taxes and profits.

Exhibit 13: Quantification of direct value added impact using EBITDA

Job results adjustments for ex-ante investments/projects

In some instances, the client data available may not correspond to a 12-month fiscal year. When this is the case, jobs results need to be annualised in order to avoid unit mismatch. Indeed, if non-annualised financials are inserted, the quantified supply chain jobs will be in job-years instead of jobs.

The following calculation is applied to make this unit conversion and align the jobs results with the other results' units.

$$\underbrace{\left(\text{Jobs per sector (job-years)}\right)}_{\text{Intermediary output}} \times \underbrace{\left(\frac{12}{\#\text{ of months}}\right)}_{\text{Adjustment}} = \underbrace{\left(\text{Jobs per sector (jobs)}\right)}_{\text{Result}}$$

Exhibit 14: Adjustment to jobs result

3.2 Supply chain and induced impact

3.2.1 Methodology

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 intensities to estimate the employment and GHG impact.

Exhibit 15 shows how the JIM combines client financial data and statistics to derive supply chain and induced impacts.

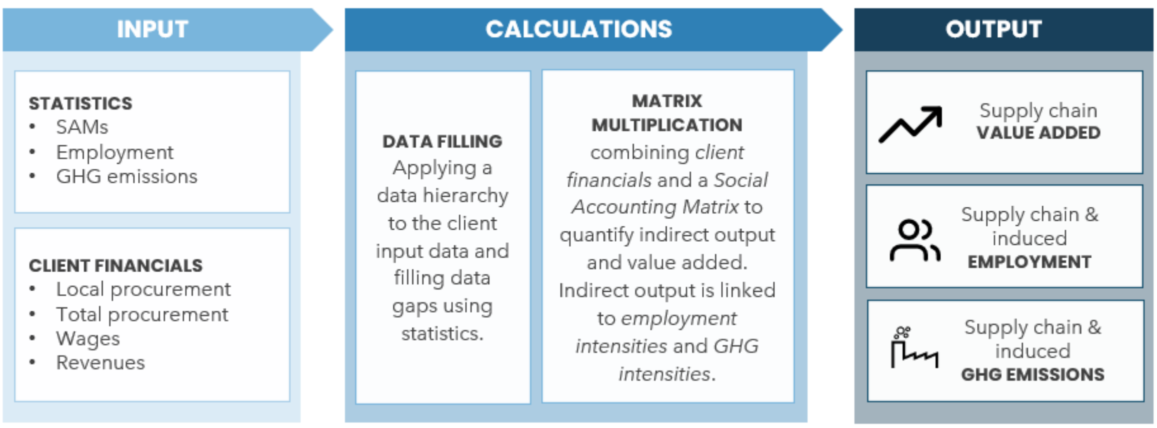

Exhibit 15: Overview methodology supply chain and induced impact

3.2.2 Calculations

Data filling

Data filling consists of three steps:

<u>Mapping of client financials to model sectors and countries</u>

The client financials are mapped to the countries and sectors for which SAMs are available in the following way:

- *Country/region mapping*: the country/region names of the client financials are mapped to SAM countries/regions. For most countries, individual country SAMs are available. If this is not the case, sub-regional statistics will be applied. For example, for Angola individual country statistics are not available, and the country is therefore mapped to the SAM of the region "Middle Africa". See Appendix 1 for a list of all available SAM countries and regions.

- *Economic activity mapping*: the client's economic activity is mapped to corresponding SAM sectors, according to a mapping list from NACE (level 1-4), ISIC (level 1-4) or GICS sectors to GTAP sectors.

If one NACE sector maps to several SAM sectors, the financial data will be distributed across SAM sub-sectors using the proportions of the corresponding sectors in the SAM. Exhibit 16 provides an example of how revenue is distributed when the client's economic activity maps to two GTAP sub-sectors.

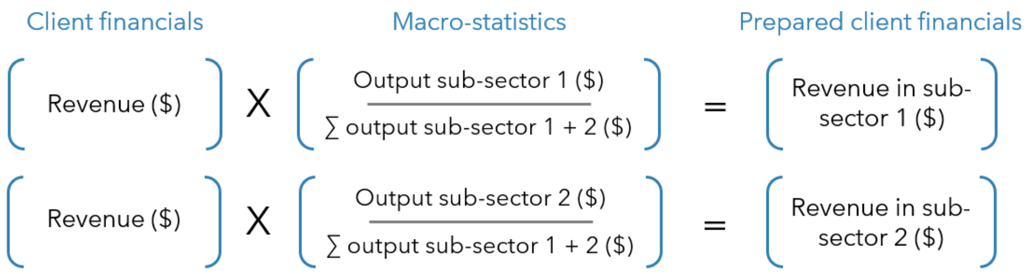

Exhibit 16: Example of how revenue client data is divided over 2 SAM sectors

If multiple economic activities are inputted for a single client using the "Customised breakdown" feature (see Section 3.3.1 of the User Guide), a similar mapping is carried out for each economic activity inserted.

<u>Estimating the key model inputs</u>

The JIM identifies the best-available client financial input data using a fixed data hierarchy, and subsequently applies SAM data to derive the key model inputs.

- *For the supply chain impact calculations*: the key model input is local procurement per sector, together with import procurement for import GHG emissions. This is derived by multiplying the relevant client financial input data by data from the client's sector in the SAM. Exhibit 18 and Exhibit 18 summarise the data hierarchy for client financial data for quantification of the supply chain procurement.

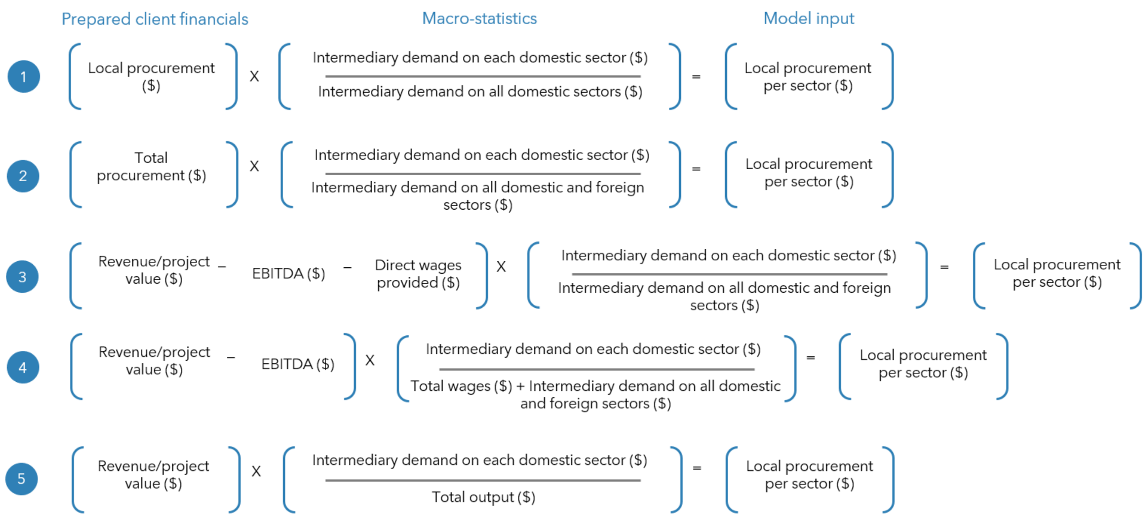

Exhibit 17: Data hierarchy for quantifying local supply chain procurement

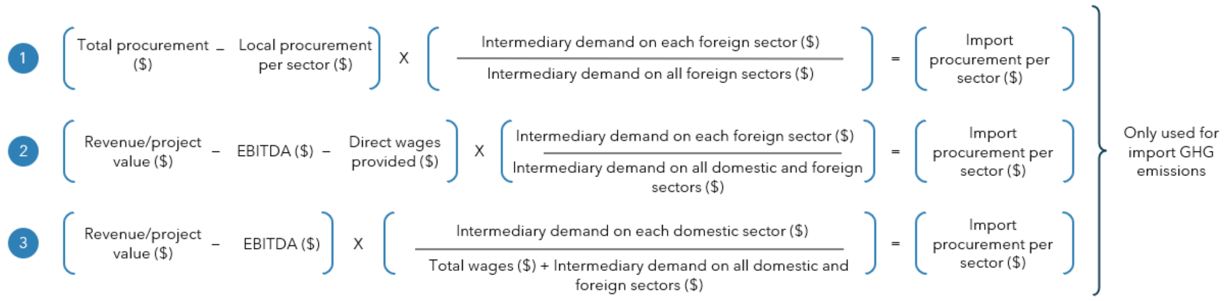

Exhibit 18: Data hierarchy for quantifying import supply chain procurement

- *For construction projects* (which do not yet have revenues): the default model assumption is that the project value is spent on construction (e.g. of a power plant or road). Hence, the model estimates the local procurement expenditures based on project value and the construction sector of the SAM.
- *For the induced impact calculations*: the model uses an additional input: "direct wages". If direct wages have been reported, payroll taxes are deducted as these are not spent by households on consumption. The JIM assumes an average payroll tax (31.41%) for all sectors and regions.[23] When wages are not reported by clients, they can be estimated based on the client's total revenue or project value. The proportion spent on wages is then derived from the client's sector in the SAM. Exhibit 19 summarises the data hierarchy for client financial data to quantify the induced impact.

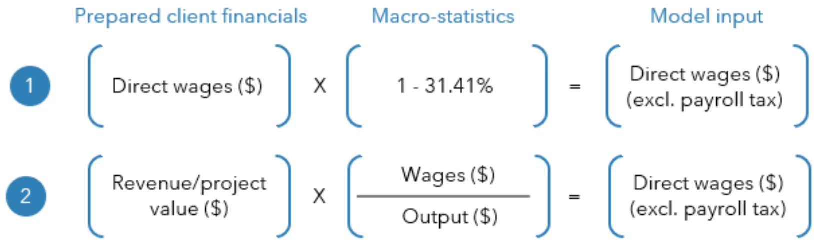

Exhibit 19: Data hierarchy for quantification induced impact

After data has been mapped to the SAM countries and sectors and data has been filled, the model can read the input data, and the supply chain and induced impacts can be quantified.

Absolute emissions – Scope 2

If scope 2 absolute emissions are provided, the input is split between CO_2 and non-CO_2 using the client's country relative GHG emissions pattern for sectors 46 to 57 (breakdown of former electricity sector) from the GTAP data.

If the data is not provided, it will be estimated by the model (Exhibit 20).

[23] This is based on 2018 global average data available from KPMG's individual income tax rates table.

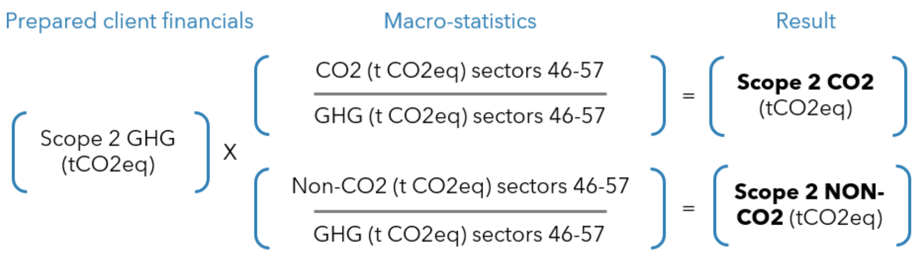

Exhibit 20: Quantification of scope 2 absolute impact

<u>Absolute emissions - Scope 3</u>

If scope 3 absolute emissions are provided, the input is split between local and import emissions, and subsequently between CO_2 and non-CO_2. This is done using the modelled scope 3 split for local/import and the client's country relative GHG emissions pattern for all sectors from the GTAP data.

Note that, even though scope 3 emissions include both local and import emissions, the geographic split is made to align with the output template. Finally, scope 3 is assumed to only include supply chain emissions, not enabled emissions.

If the data is not provided, it will be estimated by the model (Exhibit 21).

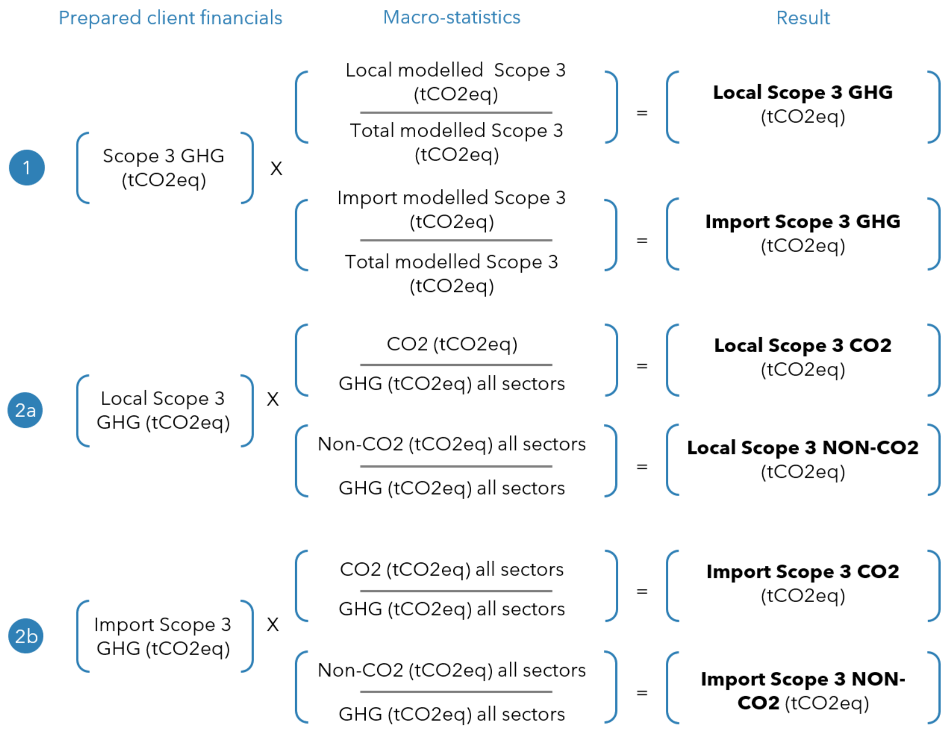

Exhibit 21: Quantification of scope 3 absolute impact

Matrix multiplications

<u>Supply chain impact</u>

The local procurement expenditures per sector of a client are routed through the SAM using a Leontief matrix calculation in order to derive the total domestic supply chain output and value added generated in other economic sectors (step 1 Exhibit 21). Subsequently, this output can be linked to employment and GHG (CO_2 and non-CO_2) intensities for each sector to quantify the supply chain employment and GHG emissions (step 2 Exhibit 22).

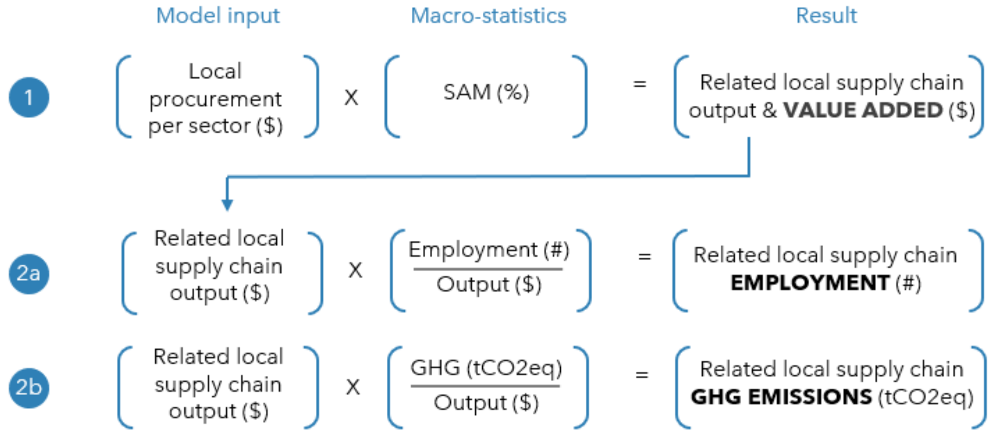

Exhibit 22: Supply chain impact calculations

Similarly, import GHG emissions are derived from import procurement per sector. It is run through the World SAM using a Leontief matrix calculation to estimate the total foreign supply chain output. Ultimately, the output is linked to World GHG intensities per sector to quantify the import supply chain GHG (Exhibit 23).

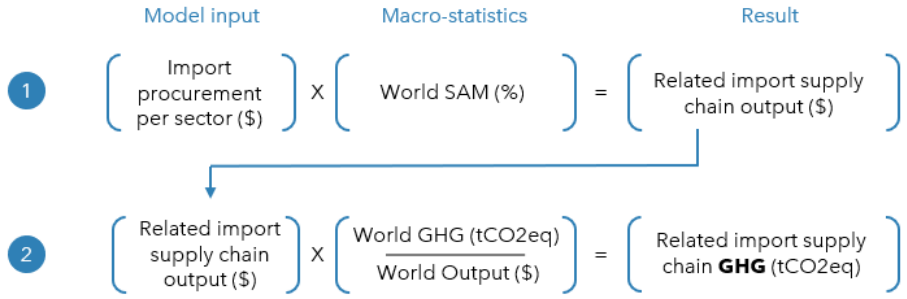

Exhibit 23: Import supply chain impact calculation

The supply chain impacts can be further broken down into sub-categories:

- The related value added impact is the sum of salaries, taxes, and savings. The split between these three sub-categories is directly derived from the SAM.
- The related employment impact can be broken down by gender, age category and formal/informal work (see Exhibit 24).
    - Female jobs are calculated by multiplying the related supply chain employment per country and sector by the share of employed women in the specific country and sector, and, if provided, deducting the female 3rd party hires.
    - To quantify jobs for youth, the model uses percentages reflecting jobs for people below 25 years old out of the total jobs in the country. As the shares are only available at country level, the youth employment is only provided as a percentage.

- Finally, to estimate formal/informal jobs breakdown, supply chain employment per country and sector is multiplied by the share of formal/informal employment applied to the inputted country and sector.

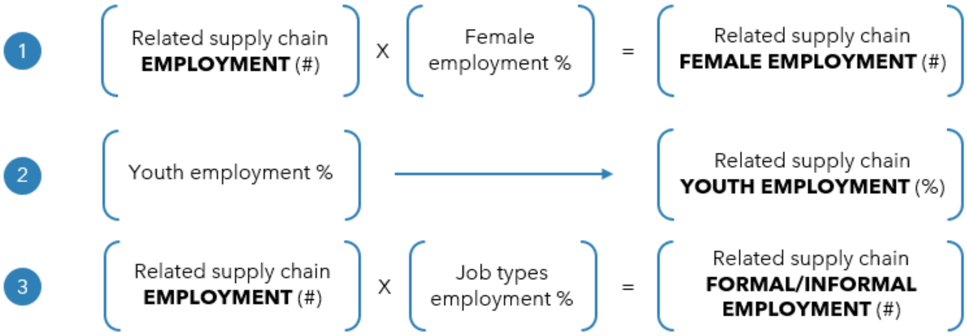

Exhibit 24: Calculations of employment sub-categories

- The related GHG emissions can be split between CO_2 and non-CO_2 emissions (Exhibit 25) using the JIM's CO_2 and non-CO_2 intensities. This is applicable for both local and import GHG emissions.

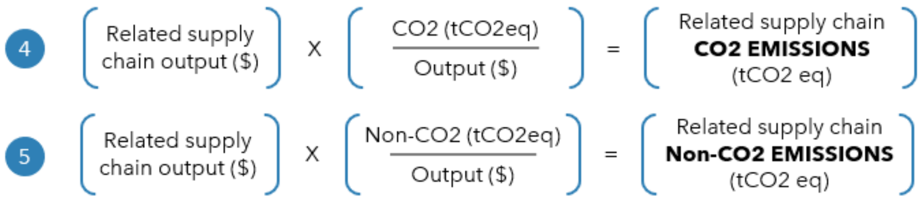

Exhibit 25: Calculations of GHG emissions sub-categories.

Furthermore, Scope 2 emissions (related to direct sourcing of electricity) are reported separately from Scope 3 supply chain and induced emissions (Exhibit 26).

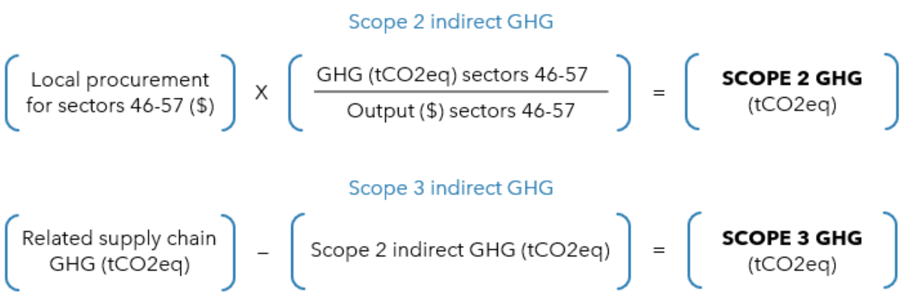

Exhibit 26: Calculations of GHG emissions scopes

<u>Induced impact</u>

To quantify the induced impacts, first, the indirect wages are quantified by routing the local procurement expenditures per sector of a client through the SAM using a Leontief matrix calculation (step 1 Exhibit 27). Second, the direct and indirect wages (excluding payroll tax) together are inputted to the SAM using a Leontief matrix calculation in order to derive the induced output generated in other economic sectors (step 2 Exhibit 27). And third, this output is linked to employment and GHG intensities (CO_2 and non-CO_2) for each sector to quantify the induced employment and GHG emissions (step 3 Exhibit 27).

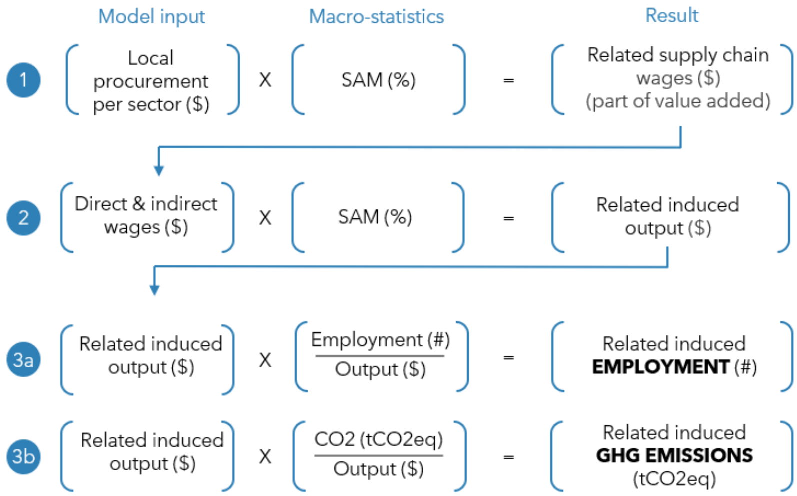

Exhibit 27: Induced impact calculations

The induced value added is not quantified to avoid double counting salaries both as an input (to quantify the induced impact) and as a result (part of the direct value added impact).

Similarly to the supply chain related impacts, the induced employment can be broken down per gender, age group and job types (Exhibit 24), and GHG emissions impacts can be split into CO_2 and non-CO_2 emissions (Exhibit 25).

Job results adjustments for ex-ante investments/projects

For some projects and investments, the client data available may not correspond to a 12-month fiscal year. If these non-annualised financials are inserted, the quantified supply chain and induced jobs will be in job-years instead of people employed during the project lifetime (the impact indicator in the JIM). To avoid this unit mismatch and any double counting of jobs (two job years is equivalent to one person employed over two years of the project's lifetime), job results will be annualised using the 'Project timeline' column.

The following calculation is applied using the # of months input in the *project timeline* column to make this unit conversion and align the jobs results with the other results' units.

Exhibit 28: Adjustment to jobs result

3.3 Finance enabling impact

IFIs and other investors do not always invest directly into companies or projects, sometimes they invest indirectly through financial intermediaries. The financial intermediaries (FIs) they invest in use these investments to increase their company lending, thereby enabling companies (i.e. end-beneficiaries) to increase capacity/economic activity. However, insights into the enabled revenues of on-lending by FIs are often limited by lack of observable data. To overcome these issues, the JIM combines data on capital invested by FIs with economic modelling and statistics to provide insights into the enabled impacts at end-beneficiaries.

3.3.1 Methodology

The FI enabling methodology described here explains how the JIM determines the supported revenues (i.e. output) of companies receiving financing from FIs. Once the enabled revenues are determined, IO modelling can be applied to derive the enabled direct, supply chain and induced employment, value added and GHG emissions.

To estimate the revenues supported by FI capital, the JIM uses asset turnover ratios (capital-to-output ratios). In the JIM version 3.0, average asset turnover ratios are applied, which reflect the average amount of output supported per unit of private sector capital in a particular region and/or sector. They do not distinguish new capital from existing capital and are therefore most appropriate for impact accounting.

The average asset turnover ratios were determined by using total private sector capital stock per sector and total output per sector for 7 regions (i.e. Europe, Asia, China, Africa, North America, Latin America and Caribbean, Oceania).

By multiplying the FI's outstanding amount by the asset turnover ratio (and the firm size adjustment) the direct enabled output of the FI's clients can be quantified. Subsequently, using the direct enabled output, the model quantifies the enabled direct, supply chain and induced employment, value added and GHG impacts from the FI financing.

The methodology to quantify all enabled impacts is similar to the methodology described in sections 3.1 and 3.2, except for the quantification of the enabled direct jobs. Enabled direct employment can be quantified by multiplying the enabled direct output by the employment intensity of the corresponding sector and country. However, the JIM employment intensities account for all employed persons, including people in informal employment, while it is assumed that companies that receive financing from FIs are likely to be formal sector firms in most sectors. As a consequence, applying the employment intensities without adjusting them for the higher productivity of the formal sector, will lead to an overestimation of the number of direct jobs supported by the enabled output. The JIM therefore applies a formal sector adjustment ratio to quantify the enabled direct jobs, distinguishing between SMEs and large enterprises.

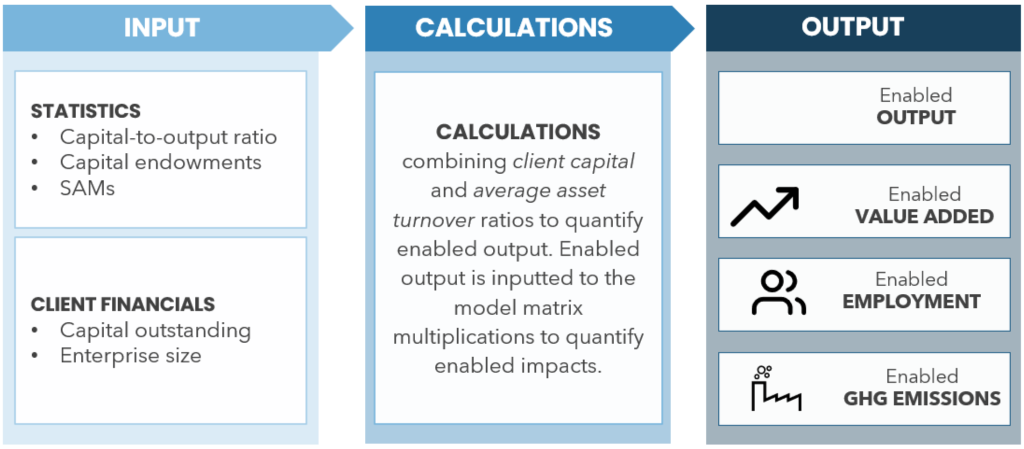

Exhibit 29: Overview methodology finance enabling impact

3.3.2 Calculations

Data filling

Before the finance enabling impacts can be calculated, client financials need to be mapped to the model sectors and countries. The client's economic activity is mapped to corresponding SAM sub-sectors according to a mapping list between NACE, ISIC and GICS sectors and GTAP sectors (see Appendix 2). If the client's economic activity maps to several SAM sectors, the outstanding (or committed, depending on availability) amount will be distributed across SAM sub-sectors based using the proportion of the corresponding sectors in total capital endowments.

Client financials | Statistics | Prepared client financials

$$\left(\text{Outstanding amount (\$)}\right) \times \left(\frac{\text{Capital endowments sub-sector 1 (\$)}}{\sum \text{capital endowments sub-sector 1 + 2 (\$)}}\right) = \left(\text{Outstanding amount in sub-sector 1 (\$)}\right)$$

$$\left(\text{Outstanding amount (\$)}\right) \times \left(\frac{\text{Capital endowments sub-sector 2 (\$)}}{\sum \text{capital endowments sub-sector 1 + 2 (\$)}}\right) = \left(\text{Outstanding amount in sub-sector 2 (\$)}\right)$$

Exhibit 30: Example of how outstanding amount is divided over 2 SAM sectors

Quantification of enabled output

To quantify the direct output enabled by the FI financing, the distributed outstanding amount per sector is multiplied by the average asset turnover ratio (which depends on the sector and region). Additionally, if the firm size of the investees benefiting from the outstanding amount is known, the amount is split, and an adjustment is applied depending on the firm size. The enabled output reflects the expected firm revenues' increase from capital provided by FIs.

Client financials | Average asset turnover ratios | Firm size adjustment

$$\left(\text{Outstanding amount per sector (\$)}\right) \times \left(\frac{\text{Output (\$)}}{\text{Capital (\$)}}\right) \times \left(\text{Share of capital in specific firm size (\%) } \textit{(if known)}\right) \times \left(\text{Relevant size adjustment value (\#) } \textit{(if known)}\right) = \left(\text{Enabled direct output (\$)}\right)$$

Exhibit 31: Calculating enabled output

Matrix multiplication

The enabled output of direct FI clients can be used to quantify the enabled direct impacts from the FI financing, as well as the enabled supply chain and induced impacts.

Enabled direct impact

The JIM estimates the enabled direct employment by multiplying the direct enabled output by the employment intensity of the appropriate sector and country (for miscellaneous, SME and corporate clients), the formal sector adjustment of the continent, and the firm size adjustment value (for SMEs and corporates). If the client is a micro enterprise, the average employment intensity is used.

$$\overset{\text{Model input}}{\left(\begin{array}{c}\text{Enabled direct}\\ \text{output (\$) } \textit{(per}\\ \textit{firm size if know)}\end{array}\right)} \times \overset{\text{Employment intensity}}{\left(\frac{\text{Employment (\#)}}{\text{Output (\$)}}\right)} \times \overset{\text{Formal sector adjustment}}{\left(\frac{\text{Formal employment intensity continent (\#/\$)}}{\text{Average employment intensity continent (\#/\$)}}\right)} \times \overset{\text{Firm size adjustment employment intensity}}{\left(\begin{array}{c}\text{Adjustment value}\\ \text{(\%)}\\ \textit{(if known and}\\ \textit{relevant)}\end{array}\right)} = \overset{\text{Result}}{\left(\begin{array}{c}\text{Enabled direct}\\ \text{employment (\#)}\end{array}\right)}$$

Exhibit 32: Calculations of enabled direct employment

The JIM estimates the enabled direct value added by multiplying the direct enabled output by the average proportion of output spent on wages/taxes/savings derived from the client's sector in the SAM (as explained in Section 3.1.2).

$$\overset{\text{Model input}}{\left(\begin{array}{c}\text{Enabled direct}\\ \text{output (\$)}\end{array}\right)} \times \overset{\text{Statistics}}{\left(\frac{\text{Wages/taxes/profits (\$)}}{\text{Output (\$)}}\right)} = \overset{\text{Result}}{\left(\begin{array}{c}\text{Enabled direct wages (\$)}\\ \text{Enabled direct taxes (\$)}\\ \text{Enabled direct profits (\$)}\end{array}\right)}$$

Exhibit 33: Calculations of enabled direct value added

The JIM estimates the enabled direct GHG emissions by multiplying the direct enabled output by the GHG intensity of the appropriate sector and country.

$$\overset{\text{Model input}}{\left(\begin{array}{c}\text{Enabled direct}\\ \text{output (\$)}\end{array}\right)} \times \overset{\text{GHG intensity}}{\left(\frac{\text{GHG (tCO2eq)}}{\text{Output (\$)}}\right)} = \overset{\text{Result}}{\left(\begin{array}{c}\text{Enabled direct GHG}\\ \text{(tCO2eq)}\end{array}\right)}$$

Exhibit 34: Calculations of enabled direct GHG emissions

Enabled supply chain impact

To quantify the supply chain impacts, the enabled direct output of an FI is routed through the SAM using a Leontief matrix calculation in order to derive the enabled supply chain output and value added generated in other economic sectors (step 1 Exhibit 35). Subsequently, this enabled output can be linked to employment and GHG (CO_2 and non-CO_2) intensities for each sector to quantify the enabled supply chain employment and GHG emissions (step 2 Exhibit 35).

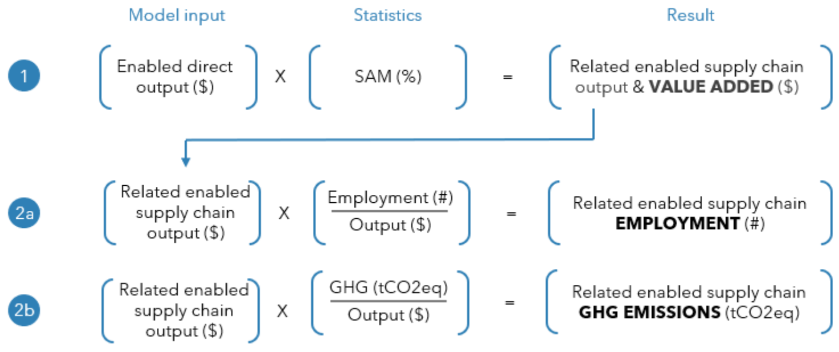

Exhibit 35: Enabled supply chain impact calculations

Enabled induced impact

To quantify the enabled induced impact, first, the indirect wages are quantified by routing the local procurement expenditures per sector of a client through the SAM using a Leontief matrix calculation (step 1 Exhibit 36). Second, the direct and indirect wages (excluding payroll tax) together are inputted to the SAM using a Leontief matrix calculation in order to derive the induced output generated in other economic sectors (step 2 Exhibit 36) Third, this output is linked to employment and GHG intensities (CO_2 and non-CO_2) for each sector to quantify the induced employment and GHG emissions (step 3 Exhibit 36).

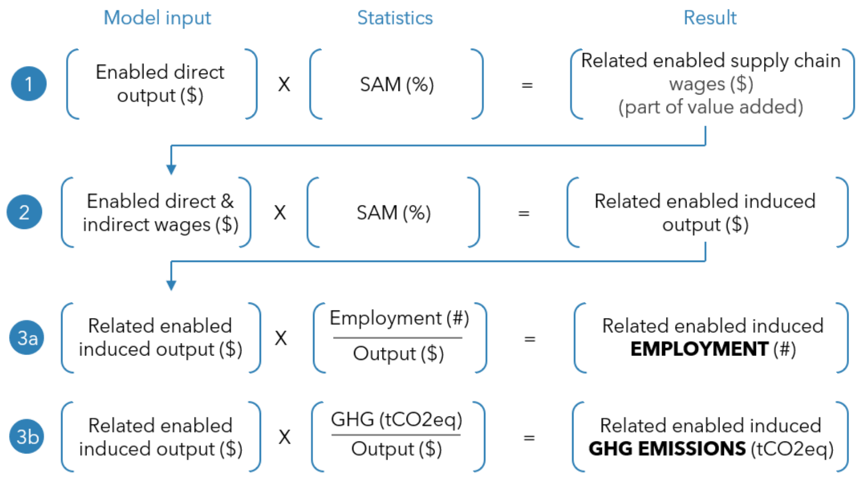

Exhibit 36: Enabled induced impact calculations

3.4 Power enabling impact

Electric power is widely recognised as a critical input to economic development. But in many developing countries, electric power supply is low. As a result, power outages are pervasive and stunt growth by forcing businesses to halt operations, or find ways to work without grid electricity, such as investing in back-up generators. By investing in power companies (or projects), investors raise the supply of power, reducing the burden of outages and enabling economic impact.

However, collecting data for estimating these economic impacts enabled by power provision is often difficult, especially if there are many power companies in an investment portfolio. Data may be unavailable all together as projects need time to construct before generating revenues, or they may not have data management systems to collect the data needed to evaluate the economic impacts of the power company.

To address this data availability issue, the JIM uses an economic modelling approach to measure the impact of (a portfolio of) such investments in power. This approach is described below.

3.4.1 Methodology

Modelling the relationship between power supply (i.e. electricity) and economic activity is a chicken-and-egg situation since the linkages between growth and power are plausibly multi-directional – power provision can lead to growth, growth can lead to power provision, or there may be no relationship at all.

Numerous impact studies have investigated the connection between power and economic growth in developing countries. These studies, conducted in collaboration with International Financial Institutions (IFIs), include partnerships with entities like IFC (in Turkey and the Philippines), BII (Uganda), Proparco (India and Uruguay), and Finnfund (Honduras).

In these studies, the relationship between power and economic growth is analysed, with a focus on the impact of power investments. Researchers create power supply and demand curves to illustrate how increased power supply affects electricity affordability and reliability. Improved power reliability results in businesses operating for longer hours, leading to increased output and higher company revenues. These findings, combined with statistical data, are used to estimate the overall impact of power investments.

To calculate power enabled impacts the JIM combines two main factors to model the effects of power: the share of energy in a country contributed by the generation of the company/project invested in, and a fixed power-to-output translation factor of 0.02 for all countries and sectors. This is a straight average of the sector multipliers of four out of the 11 case studies (i.e. Uganda, Nigeria, Uruguay and Turkey). This selection of four case studies excludes outliers, and countries for which only high-level data was available.

Combining the power-to-output translation factor with the share of power contributed to a country determines the percentage output increase supported. This is combined with SAM output data to estimate the total output enabled. Total output enabled is subsequently used to estimate value added, employment and GHG emissions impacts.

Power enabled output is neither a direct nor supply chain impact. It is a measure of the total output related to the amount of power produced by a given company/project. As such, these impacts are not labelled as "direct" or "supply chain" impacts in the JIM.

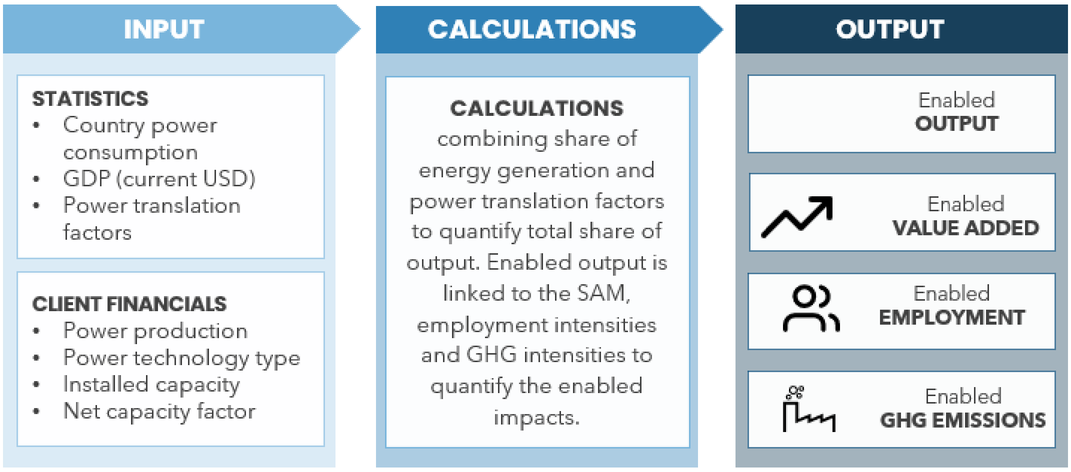

Exhibit 37: Power enabling methodology

3.4.2 Calculations

Data filling

The model will identify the best-available client input data using a fixed data hierarchy and uses modelling to fill data gaps. For the power enabling calculations, the required input is power production. If power production is unavailable for whatever reason, it can be filled if installed capacity, and power technology type are provided. To fill the data, installed capacity is multiplied by the net capacity factor for the technology type and the total potential operations time. Net capacity is either provided as an optional input or based on the average for the power technology type. Potential operations time is the total number of hours a power company/plant could theoretically be in operation. It is assumed to be a fixed number calculated as total hours in a year, which is equal to 24 hours per day times 365 days a year.

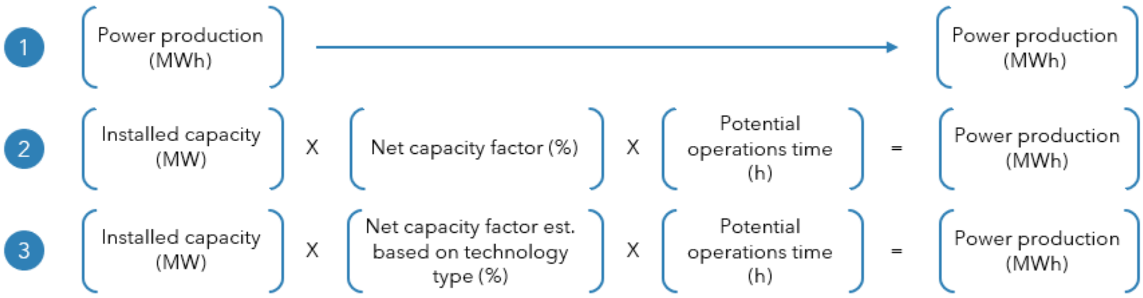

Exhibit 38: Data hierarchy and calculation for power production

Quantification of enabled output

To quantify the output enabled by the power production, the JIM follows the following steps:

1. *Calculation of effective power addition:* the effective power addition represents the change in power supported by the power company/project. It is calculated as the amount of power produced by a given power company/project relative to the total amount of power consumption in a country. By comparing the project's total new power production to the power consumption in the country, the JIM assumes that all additional power produced by the plant is distributed locally, and no power is lost in distribution or transmission.

2. *Estimation of effective output shares per sector:* the effective power addition is multiplied by the power-to-output translation factor to determine the effective output shares per (aggregated) sector. The power-to-output translation factor is used to translate the relative increase in effective generation capacity into a relative change in economic output.

3. *Quantification of total enabled output:* the effective output shares per (aggregated) sector are multiplied by the total output in the country per detailed sector to estimate total enabled output. Total output is based on GTAP data, which has a base year of 2017 and in millions. This data is projected forward to estimate total output in 2018, 2019, 2020 and 2021 using GDP growth rates from the World Bank Development Indicators database.

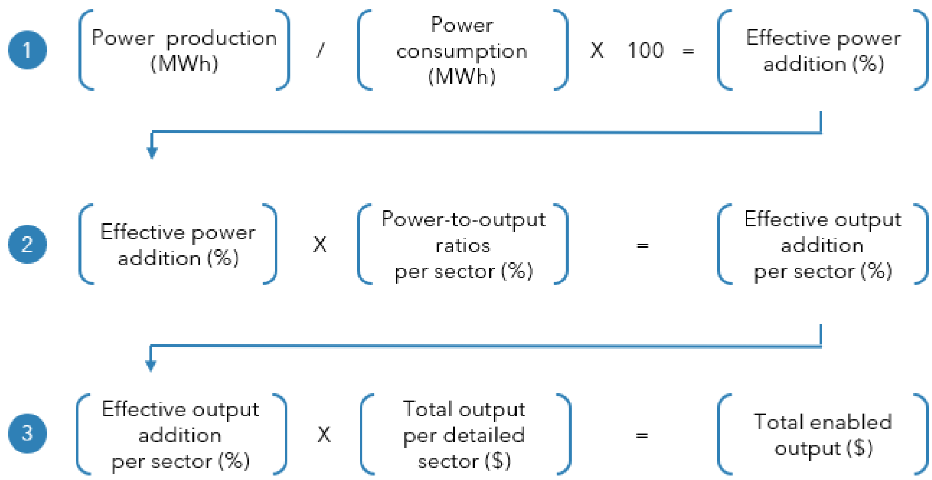

Exhibit 39: Total enabled output calculation

Quantification of enabled impact

The total enabled output can be used to quantify the enabled employment, value added and GHG impacts from the power plant, following the methods employed in other JIM modules. The enabled output is multiplied by the value added categories of the SAM to derive the enabled value added, by the employment intensities to derive the enabled employment, and by the GHG intensities to derive the enabled GHG emissions. Note that impacts in the electricity sector itself are excluded to avoid double counting.

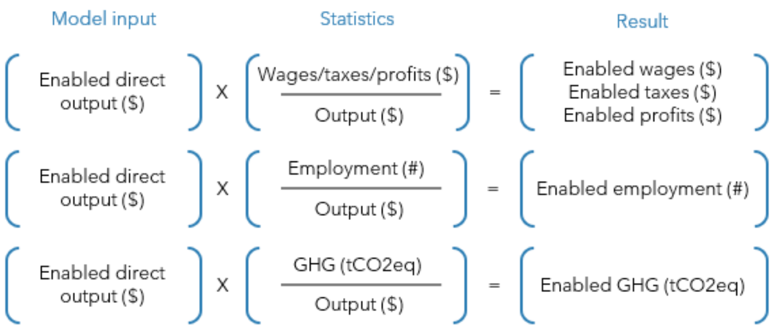

Exhibit 40: Calculations of enabled value added, employment and GHG emissions

3.5 Outputs

The employment, value added and GHG results quantified are:

- *Gross impacts*: the model does not consider that (part of) these impacts may be offset by a fall in gross employment in less successful firms.
- *Local (i.e. domestic) impacts*: the model only quantifies the impacts that occur in the country of operations of the client; impacts from imports are only captured by the model for GHG emissions.
- *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 data. The difference in impact between the two years reflects the change in gross impacts of a client. If year-specific employment intensities are available for both years, changes in labour productivity over time will be reflected in the results. Results over time should however not be aggregated. For example, the gross jobs quantified for a company in year one are the same jobs as the gross jobs quantified for that company in year two.

Power enabling

The impacts quantified are local impacts, and not time bound to the year of the operations modelled. The JIM assumes that power produced in a given year supports a share of output in that year and thus the other impacts in that same year. In reality however, there may be more of a sequential nature to the impact; power is first consumed, outages are reduced, operations increase, output rises, and then other impacts are enabled. The temporal nature through which these impacts might actually occur is not accounted for.

The level of robustness of these impact calculations, like others in the JIM, declines as additional modelling is involved given the higher levels of uncertainty surrounding the accuracy of the numbers. The confidence level is highest when actual power production data is used and when the power-to-output translation factors are based on a country case study. In comparison, the confidence level is lowest when the power production is modelled using the installed capacity and technology type, and when the power-to-output translation factors are based on modelling.

3.6 Assumptions and limitations

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 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.[24] Lastly, the number of interventions that can be included scales up easily. However, IO modelling also has clear limitations 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.[25] 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 average, not marginal, effects[26].

- *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 IFIs are likely to be atypical of their sectors (they may be more capital intensive, for example).

- *Overstated employment intensities*: imported intermediates are not separated out, which means that the backward linkages and thus the employment multipliers are not confined to the domestic economy and may be overstated (with this being uneven across sectors depending on how much of a sector's intermediate inputs are imported)[27].

- *No diversification of spending patterns*: the model assumes that all households have the same spending pattern. However, consumption patterns of low-income households are likely to deviate from those of households with a higher income level.

Due to these assumptions the method risks some over overestimation.[28,29] On the other hand, other firm-level development impacts (e.g. from tax contributions, product innovations, foreign exchange savings from exports, knowledge spill overs, imports) are not accounted for, even though they likely create further impacts.

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[24] 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.

[25] 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

[26] 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.

[27] 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

[28] 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.

[29] 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.

Computable General Equilibrium (CGE) modelling is theoretically more sound than IO modelling as it relies on fewer assumptions allowing it to mitigate some of the drawbacks of IO modelling: it accounts for supply-side adjustments and it considers responses in investment, land supply, population and (commodity and factor) prices.[30] This makes CGE models, in principle, capable of capturing both positive gross multiplier and negative displacement effects from external influences.[31] As a result, CGE modelling is theoretically superior to IO modelling.

Nevertheless, there are disadvantages of using this approach. It is comparatively data intensive. To run the model, many price elasticities must be specified, which is challenging in contexts with low data availability. Moreover, CGE modelling requires intensive calibration of the model and its variables, because the number of variables in a CGE model tends to (far) outstrip the number of equations. This makes it a costly and time-consuming approach. Finally, the complexity of the interactions between variables makes interpreting, explaining and/or communicating results difficult.

Given these trade-offs, IO modelling is more appropriate for use in the JIM. CGE modelling could arguably be impracticable for investors backing multiple businesses in multiple (developing) countries. However, CGE models are available or under development in a range of developing countries, such as South Africa and India. We will explore the feasibility of implementing (elements of) CGE modelling in the future.

A key limitation of modelling the direct impact of clients is that the model assumes all companies in a certain sector and country have the same production structure. In reality, each business has a unique way of producing its goods and services, and businesses backed by IFIs are likely unrepresentative of their sectors (they may be more capital intensive, for example). Preferably, direct impacts should be based on observed data only.

The limitations of IO modelling also apply to the FI enabling impacts. The FI enabling approach however uses additional assumptions, which further reduces the confidence level of results. Instead of using observed company data as input (which is the case for the direct, supply chain and induced impacts), the FI enabling impacts are based on modelled company data (using the average asset turnover ratios).

The current approach to use average asset turnover ratio's – using different ratios per sector (76) and region (7) to calculate supported firm output in response to a capital financing – was used to align methodologies with PCAF's Global GHG Standard[32]. These ratios correspond to the lowest level of data quality endorsed by the Standard.

The average asset turnover ratios enable FIs to account for the impacts of their portfolio. However, they do not provide insights into the incremental impact (impact change) due to the capital they provided. For those estimates of impact change, marginal asset turnover ratios can be used. Typically, marginal asset turnover ratios will generate more conservative results than average asset turnover ratios. FIs should therefore be careful in communicating their results based on the average asset turnover ratios, especially for employment and value-added impacts. If assumptions are not carefully explained, it could lead to overclaiming.

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[30] Partridge, M. D. & Rickman, D. S. (2008). Computable General Equilibrium (CGE) Modelling for Regional Economic Development Analysis. *Regional Studies, (44)*10. 1311-1328.

[31] Idem.

[32] https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf page 65.

Last, there are a number of significant assumptions built into the power enabling impact calculations in the JIM, which reduces the confidence level of results. Instead of using observed company data as input (which is the case for the direct, supply chain and induced impacts), the power enabling impacts are based on modelled company data (using the constant power-to-output translation factor).

The current approach – using a constant power-to-output translation factor for all sectors and countries to calculate changes in firm output in response to an increase in power – was based on a straight average of four detailed case studies, following discussions on alignment of assumptions with IFC and others.

Further collaborations with new partners can improve upon the current approach. We could conduct additional case studies to improve insights into the linkages between access to power and additional firm output (particularly in Asian countries not covered by the current four cases) and reduce the impact of outliers on the power-to-output translation factors. Furthermore, we could use insights from other researchers on this topic once it becomes available.

4 Attribution

Previously, we discussed quantifying the total impact of clients. However, it's important to note that an investor's actions are just one of many factors influencing a company's impact. External factors, other investors, and changing conditions also play a role. This brings up the question of attribution, i.e., determining how much of a company's results can be attributed to the investor.

This attribution challenge isn't unique to indirect impact modelling but is more critical when dealing with larger indirect impacts. The JIM addresses this by using prorating to attribute a portion of the impact to the investor, following the PCAF Global GHG Accounting and Reporting Standard for the Financial Industry.

4.1 Methodology

Prorating is the allocation of a part of the results to an investor based on its capital invested. The advantage of this methodology is that it a simple, quantitative, and objective way to measure attribution, and data is relatively easy to collect. The prorating methodology determines the prorating share (Exhibit 44) and subsequently applies this to the client's impacts.

The model distinguishes two attribution approaches:

- *Commitment approach*. Users can use this approach for ex-ante impact estimations at time of commitment.
- *Outstanding approach*. Users can use this approach for ex-post impact estimations.

4.2 Inputs and calculation

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:

$$Attribution\ factor_c = \frac{Outstanding\ amount_c}{Enterprise\ Value\ Including\ Cash_c}$$

Exhibit 41: PCAF attribution methodology for unlisted clients

For unlisted clients, it is calculated this way:

$$Attribution\ factor_c = \frac{Outstanding\ amount_c}{Total\ equity + debt_c}$$

Exhibit 42: PCAF attribution methodology for unlisted clients

In the JIM the calculation would be expressed in the following way (see Exhibit 43 for exact formula):

- *Numerator:* for debt financing and equity financing to listed companies the JIM uses the outstanding amount directly from the input sheet. 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:* for unlisted clients, the JIM takes the sum of total debt and equity as provided in the input sheet (see 4.2). In case total equity and debt are not available, the total balance sheet value is used as a fall-back approach. For listed clients, the JIM takes the Enterprise Value Including Cash (EVIC) and uses the other input fields as fall-back options.

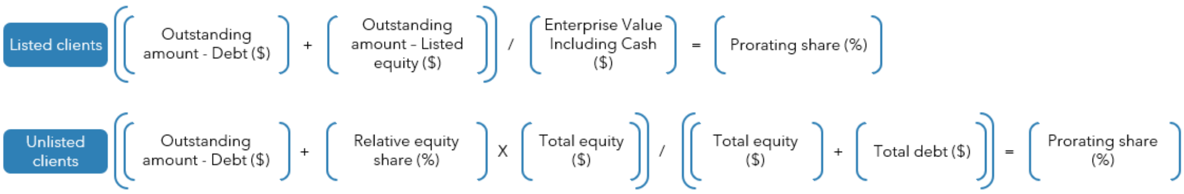

Exhibit 43: Prorating share calculation with outstanding data per company type

For the commitment approach, users also have the option to include capital mobilised, which would be added to the numerator.

Attributed impact

Once the prorating share is quantified, the client's attributed impact can be calculated as shown in Exhibit 44. Please note that only impact attributed from outstanding amounts is calculated in the JIM, the attribution from committed amounts must be manually calculated.

Exhibit 44: Calculation of attributed impact

Missing data points

In some instances, all required input data may not be readily available, but the model proposes alternative input options.

For listed clients, if the "Enterprise Value Including Cash" is not available, the user can provide both "Total equity" and "Total debt", which will be used as the denominator in the above calculations.

For listed and unlisted clients, if either "Total debt" or "Total equity" is not available, the user must provide "Total balance sheet value". Moreover, if Total equity is not provided for unlisted clients the attribution factor will be calculated as follows:

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

Exhibit 45: Unlisted clients' prorating share calculation with "Total equity" missing

4.3 Assumptions and limitations

Many impact investors recognise these relatively straightforward rules of prorating. However, the simplicity of the rule is also a weakness: it omits a number of relevant factors in the equation (such as the catalysing role of investors, the financial instrument, and other value adding services). Impact investors point out that prorating at best paints a simplified picture of their role, while most note that prorating alone does not adequately reflect the benefits of their intervention.[33]

One would ideally compare the situation with an intervention to what would have happened in the absence of the intervention (the counterfactual). However, such a comparison of the situation with and without the intervention is challenging because it is not possible to observe the counterfactual situation. It needs to be constructed by the researcher, which can be a complicated and costly exercise.[34] An example of such studies are randomised control trials (RCTs). Although these can provide detailed insights into attribution factors for a particular intervention, it is simply not feasible to conduct RCTs for a full portfolio of investments. IFIs are working on simplified approaches to counterfactuals.

Despite its limitations, prorating seems to be a useful approach to attribute part of the impact results to an investor. In the JIM it is included as an option that can be switched on and off, depending on user preferences. In the future, we will explore further refinements of the attribution approach.

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[33] Vosmer, W. and de Bruijn M. (2017). “Attribution in Results Measurement: Rationale and Hurdles for Impact Investors”. The Donor Committee for Enterprise Development. https://www.enterprise-development.org/wp-content/uploads/DCED-Report-on-Attribution-in-Results-Measurement-for-Impact-Investors.pdf

[34] Leeuw, F., and Vaessen, Jos. (2009). “Impact evaluations and development: NONIE guidance on impact evaluation” Washington, DC: World Bank. http://documents.worldbank.org/curated/en/411821468313779505/Impact-evaluations-and-development-NONIE-guidance-on-impact-evaluation

5 Principal Adverse Impact (PAIs) indicators

The JIM can be used to meet the sustainable finance disclosure requirements (SFDR) set forth in the EU's Taxonomy Regulation[35]. These provisions, known as "principal adverse impacts" (PAIs), require financial institutions to disclose the impacts of their investments on the environment, society, and good governance, as well as the risks associated with those impacts.

The SFDR module is an addition to the JIM, which allows financial institutions to input their JIM results and obtain SFDR values that can then be used to meet the PAI requirements set forth in the EU's Taxonomy Regulation. It is important to note that as the current regulation is not clear on how to assess the impact of financial institutions, this tool is on a best-effort basis.

This section covers the data collection process and calculations necessary to quantify the PAIs.

5.1 Methodology

The JIM currently has coverage for:

- GHG Emissions (PAI 1).
- Carbon Footprint (PAI 2).
- GHG Intensity (PAI 3).
- Exposure to companies active in the fossil fuel sector (PAI 4).
- Share of non-renewable energy consumption and production (PAI 5).
- Energy consumption intensity per high impact climate sector (PAI 6).

5.2 Additional inputs

Additional to the statistics required for the JIM (see section 2.1), the PAI module requires the inclusion of energy consumption in the JIM.

Energy consumption and intensities

For the calculation of PAI 5 and 6, the model needs energy consumption data, per energy source, sector, and country.

The JIM uses energy usage data available in GTAP. It is available for 16 different energy products[36] (Coal, Oil, Pipeline gas, Petroleum and coal products, Nuclear base load, Coal base load, Gas base load, Wind base load, Hydro base load, Oil base load, Other base load, Gas peak load, Hydro peak load, Oil peak load, Solar peak load and Distributed gas), for 160 countries. The data uses 2017 as a base year.

However, preliminary adjustments are necessary to make the GTAP data usable in the model.

[35] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R2088

[36] Electricity consumption mix doesn't change between sectors. Mix is taken at national level and applied proportionally across all sectors.

1. Conversion of the data from Mtoe to GWh through the OECD/IEA efficiency factors[37] and the IEA's conversion rate between GWh and Mtoe[38].

Energy products	Efficiency factor	Conversion rate (GWh/Mtoe)
Coal	100%	11,630
Oil	100%	11,630
Pipeline gas	100%	11,630
Petroleum and coal products	100%	11,630
NuclearBL	33%	3,837.9
CoalBL	39%	4,535.7
GasBL	39%	4,535.7
WindBL	100%	11,630
HydroBL	100%	3,837.9
OilBL	39%	4,535.7
OtherBL	31%	3,605.3
GasP	39%	4,535.7
HydroP	100%	3,837.9
OilP	39%	4,535.7
SolarP	100%	11,630
Distributed gas	100%	11,630

2. Subsequently, meticulous attention was given to the intricacies of accounting guidelines within the energy balance framework, aiming to eliminate the potential for double counting, particularly in cases of shared energy usage across linked sectors, such as petroleum in the manufacturing of plastic products. This adjustment is meant to only account for the energy-related usage of the energy products and discard the non-energy related use of the energy products as GTAP data aggregated both. Here, we used research from the Science Base Targets organisation and EUROSTAT, together with energy balance data from the IEA, to determine which energy products are used for non-energy related purposes. Our findings revealed that, for instance, most industries use oil as a lubricant, and that petroleum is used in the production of plastic.

   Considering the complexity of dealing with sectors with a risk of double counting, and the lack of data available to help make the distinction, we decided to apply a conservative approach and assumed that all of those sectors' energy usage is non-energy related.

The non-renewable energy data was then aggregated to derive the total non-renewable energy consumption per sector. This aggregation process was extended to encompass all energy consumption data, yielding the overall energy consumption per sector.

Further refinement involved calculating consumption intensities by dividing non-renewable and total energy consumption by the total output, as per the data available in the Input-Output tables, thereby obtaining non-renewable and total energy consumed intensities (measured in GWh consumed per USD) across countries and sectors.

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[37] Organization for Economic Co-operation and Development, International Energy Agency, Energy. Balances of OECD Countries 1992-1993 (Paris: OECD, 1995).

[38] https://www.iea.org/data-and-statistics/data-tools/unit-converter

5.2.1 Client inputs

As explained in section 2.2 the JIM uses a parsimonious approach in which there are only a few "required inputs" for the model to be able to run. These inputs are revenue or project value, country, economic activity, and power production (only for energy producing assets (PAI 5)).

For the PAI module it is required to also input the current outstanding and total assets (possible as total equity and total debt) in the Attribution tab of the input template.

Some optional inputs that improve the estimation of the PAIs are:

- Absolute emissions - Scope 1, 2 and 3 (PAIs 1-3): GHG emissions inputted by users replace the estimations from revenue or outstanding amount.
- Total consumption of energy (PAI 5-6): total energy consumption in KWh.
- Total consumption of purchased electricity (PAI 5-6): total consumption of energy purchased in KWh, excluding any self-generated electricity.
- Consumption of purchased electricity from renewable sources (PAI 5-6): consumption of purchased electricity from renewable sources in KWh, excluding any energy from non-renewable sources. Renewable energy sources refer to renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas.[39]

5.3 Calculations

5.3.1 PAI 1: GHG Emissions

Amount of greenhouse gases (GHG) emitted through the organization's operations from direct emissions sources during the reporting period. The GHG Protocol defines direct emissions as emissions from sources that are owned or controlled by the reporting entity.

Attributed scope 1, 2 and 3 emissions are calculated by dividing the current value of investment by the investee company's enterprise value multiplied by GHG emissions from the investee company. Both CO2 and non-CO2 are included. The use of enterprise value to calculate the "fair share" or "attributed amount" is in line with the PCAF standard. For non-listed companies, JIM users can use the sum of total debt and equity to calculate the total value.

$$\sum_{n}^{i}\left(\frac{current\ value\ of\ investment_i}{investee\ company's\ enterprise\ value_i} x\ investee\ company's\ scope(x)\ GHG\ emissions_i\right)$$

Exhibit 46 PAI 1 formula GHG emissions calculation

Using JIM input and output data, the formula can be rephrased as follow:

$$\left(\begin{array}{c}\text{Outstanding}\\ \text{amount (€)}\end{array}\right) / \left(\left(\begin{array}{c}\text{Total}\\ \text{debt (€)}\end{array}\right) + \left(\begin{array}{c}\text{Total}\\ \text{equity (€)}\end{array}\right)\right) \text{ x } \left(\begin{array}{c}\text{GHG emissions}\\ \text{scope 1, 2 OR 3}\end{array}\right) = \left(\begin{array}{c}\text{GHG emissions}\\ \text{(PAI 1)}\end{array}\right)$$

Exhibit 47 PAI 1 formula GHG emissions calculation with JIM inputs

[39] https://www.eiopa.europa.eu/publications/principal-adverse-impact-and-product-templates-sustainable-finance-disclosure-regulation_en#details

Development financial institutions and other investors sometimes invest indirectly through financial intermediaries. The JIM combines data on capital invested by financial institutions with economic modelling and statistics to provide insights into the enabled impacts at end-beneficiaries. The GHG emission of financial institutions are estimated using the finance enabling module in JIM, this is reflected in the scope 3 effects.

5.3.2 PAI 2: Carbon Footprint

The carbon footprint corresponds to attributed emissions of an investee company (see PAI 1) expressed as tonnes of CO2eq (scope 1, 2 and 3 emissions) per million EUR invested.

The carbon footprint is calculated using the formula required by SFDR. It is calculated by taking the ratio of the current investment value and the enterprise value of the investee company. This ratio is then multiplied by the sum of the attributed scope 1, 2, and 3 GHG emissions of the investee company. Finally, this product is divided by the total current value of all investments, all of which are measured in million euros.

The current value of all investments is equal to the current outstanding amount of the portfolio. For listed companies enterprise value is used to calculate the “fair share” or “attributed amount”. For non-listed companies, the sum of total debt and equity (or total assets) can be used instead.

According to the SFDR regulation, PAI 2 should be calculated as follow:

$$\frac{\sum_n^i \left(\frac{current\ value\ of\ investment_i}{investee\ company's enterprise\ value_i} x\ investee\ company' scope\ 1, 2\ and\ 3\ GHG\ emissions_i\right)}{current\ value\ of\ all\ investments\ (€M)}$$

Exhibit 48 PAI 2 formula

Using JIM input and output data, the formula can be rephrased as follow:

$$\frac{\left(\text{Outstanding amount (€)}\right) / \left(\left(\text{Total debt (€)}\right) + \left(\text{Total equity (€)}\right)\right) \text{ x } \left(\text{GHG emissions scope 1, 2 and 3}\right)}{\left(\text{Total portfolio outstanding (€M)}\right)} = \left(\text{Carbon footprint (PAI 2)}\right)$$

Exhibit 49 PAI 2 formula with JIM input data

5.3.3 PAI 3: GHG Intensity

Unattributed amount of GHG emissions expressed in tCO2eq divided by the investee company’s revenue in million EUR. The GHG intensity of investee companies is calculated using the formula required by SFDR.

$$\sum_n^i \left(\frac{current\ value\ of\ investment_i}{current\ value\ of\ all\ investments\ (€M)} x \frac{investee\ company's\ scope\ 1, 2\ and\ 3\ GHG\ emissions_i}{investee\ company's\ €M\ revenue_i}\right)$$

Exhibit 50 PAI 3 formula

Through this formula we calculate the contribution of each investment to the portfolio’s total value, and then multiply it by the investee company’s GHG intensity. The intensity corresponds to a company’s environmental efficiency, given its GHG emissions and revenue.

Translated to JIM inputs, the formula would look like the following:

$$\left(\frac{\text{Outstanding amount (€)}}{\text{Total portfolio outstanding (M€)}} \right) \times \left(\frac{\text{GHG emissions client}}{\text{Revenue (€)}} \right) = \left(\text{GHG intensity (PAI 3)} \right)$$

Exhibit 51 PAI 3 formula with JIM input data

5.3.4 PAI 4: Exposure to companies active in the fossil fuel sector

Companies active in the fossil fuel sector means companies that derive any revenues from exploration, mining, extraction, production, processing, storage, refining or distribution, including transportation, storage, and trade, of fossil fuels. Sectors active in fossil fuel can be seen in Annex 6.

The SFDR formula to calculate PAI 4 is the following:

$$\sum_{n}^{i} \left(\frac{current\ value\ of\ investments\ exposed\ to\ fossil\ fuels_i}{current\ value\ of\ all\ investments\ (€M)} \right)$$

Exhibit 52 PAI 4 formula

Which, using JIM inputs, translates to:

$$\left(\frac{\text{Outstanding amount if sector exposed to fossil fuels (€)}}{\text{Total portfolio outstanding (M€)}} \right) = \left(\text{Fossil fuel exposure (PAI 4)} \right)$$

Exhibit 53 PAI 4 formula with JIM input data

5.3.5 PAI 5: Shares of non-renewable energy consumption and production

This indicator corresponds to the shares of non-renewable energy consumption and production over total energy consumed or produced per investee companies. They are expressed as percentages of the total energy sources consumed or produced.

PAI 5: Share of non-renewable energy production

Data on energy production is typically readily available from the investee companies, together with the power technology type produced. The latter allows us to distinguish between renewable and non-renewable energy. The following formula shows how this aspect of PAI 5 can be calculated:

$$\frac{Non-renewable\ energy\ produced}{Total\ energy\ produced} \times 100$$

Exhibit 54 PAI 5 formula for energy production

PAI 5: share of non-renewable energy consumed

PAI 5 related to energy consumption is calculated for both direct effects from the investee and direct financed effects via the finance enabling module. In practice, the share of non-renewable energy consumed can be quantified through the following formula:

$$\frac{Non-renewable\ energy\ consumed}{Total\ energy\ consumed} \times 100$$

Exhibit 55 PAI 5 formula for energy production

GTAP data on energy consumption (see Section 5.2) is used for this calculation. Tracking of non-renewable energy specifically is made possible thanks to GTAP's electricity technology types' breakdown. This statistic data can be complemented using observed data from JIM users. Some financial institutions are able to, using monitoring and reporting systems, track part of their investees' renewable energy consumption. While the investees' may consume more renewable energy than what was tracked by the FI, it can't be precisely quantified in its entirety. Consequently, some calculations are necessary to estimate this additional "unclear" renewable energy consumption, using country and sector average data.

The analysis also delved into the realm of electricity consumption, involving the aggregation of data and subsequent division by total energy consumption per sector, revealing the proportion of energy consumed in the form of electricity. Additionally, this approach was extended to renewable electricity consumption data, allowing for the determination of the share of electricity consumption that is derived from renewable sources.

<u>Calculation of PAI 5: share of non-renewable energy consumed, if not optional input was provided:</u>

1. Converting the client input from KWh to GWh to align with the statistic data's unit.
2. Applying the right energy intensities given the client' sector and country of activity, to estimate client-level renewable and total energy consumption.
3. Dividing client-level renewable and total energy consumption data to get the share of renewable energy consumed.
4. Estimating the renewable and total electricity consumed by multiplying total energy (step 2) by the renewable and total electricity shares in total energy respectively.
5. Estimating the total non-renewable energy consumed by subtracting the total energy consumed by the total renewable electricity consumed.
6. Calculating PAI 5 by dividing the total non-renewable energy by the total energy consumed.

PAI 5 will be calculated for both direct "backward" and "finance enabled" effects, excluding "supply chain." For portfolio-level insights the total non-renewable energy consumed is divided by the total energy consumed, across all sectors and countries.

Depending on the optional inputs provided by the user, the calculation method may vary. For instance, if renewable electricity consumed is provided, it is assumed to not fully capture the renewable electricity (due to monitoring limitations for instance). In this specific case an adjustment is necessary:

- Provided renewable electricity is deducted from total electricity consumed and the difference is assumed to be a mix of non-renewable and "non-reported" renewable electricity.
- This "unclear" electricity is multiplied by the share of renewable electricity in total electricity to estimate the amount of "non-reported" renewable electricity consumed.
- This newly quantified "non-reported" renewable electricity is added to the provided renewable electricity to get the total renewable electricity, which is in turn used in step 5 above.

5.3.6 PAI 6: Energy consumption intensity per high impact climate sector

This indicator is set forth by the SFDR as the energy consumed in GWh per million EUR of revenue of investee companies, per high impact climate sector. The "high impact climate sectors" refer to the sectors listed in Sections A to H and Section L of Annex I to Regulation (EC) No 1893/2006 of the European Parliament and of the Council (see Annex 7).

The following formula reflects how this PAI can be estimated, per high impact climate sector:

$$\frac{Total\ energy\ consumption\ (in\ GWh)}{Total\ revenue\ of\ investee\ companies\ (in\ mEUR)}$$

Exhibit 56 PAI 6 formula

The total energy consumption is quantified using GTAP data and can be retrieved from the PAI 5 calculation process. The revenue data is provided by the users. Energy consumption is then divided by the revenue figure. These intensities are only calculated for the so called “high impact climate sectors”, listed in Annex 7.

PAI 6 is calculated for both direct “backward” and “finance enabled” effects, but it excludes “supply chain.” For portfolio-level insights, the previous activities remain unchanged with one exception: the intensities must be calculated using total energy and output data aggregated for all the portfolio’s companies.

6 Data sources

The JIM combines national statistics and client financials to derive results.

6.1 National statistics

Statistics are derived from internationally recognised sources to ensure the reproducibility of results. However, statistics can still be poor in the sense that they are incomplete or lacking validity and reliability.[40] This is a well-known problem, especially in Africa. Although the JIM uses best-available statistics, there is no guarantee that statistics are of sufficient quality. Users should be aware of these limitations and only use the JIM when no observable data is available.

6.1.1 GTAP

The Global Trade Analysis Project (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.[41] GTAP has made major efforts since the mid-1980s to make the disparate sources comparable and present users with a consistent set of economic facts.

Table 6 provides an overview of the GTAP data used in JIM, including the database's source data, geographical and sectoral coverage of the data and reference year.

GTAP releases an updated dataset every 2-4 years. Once updated data is available, this will be included in the JIM. The JIM version 3.0 uses the GTAP 11A database.

On the one hand, the significant geographical and sectoral scope of the GTAP database and harmonisation efforts of GTAP make the database well-suited for economic simulation models like the JIM.[42] Compared to other databases for IO tables such as WIOD and EORA, GTAP has the best coverage of geographies and sectors.[43] On the other hand, GTAP also has a few disadvantages:

- *Outdated data:* the reference year of GTAP is a few years off, and the original datasets in GTAP are often even further behind.
- *Limited environmental data:* GTAP does not have datasets on water and land use for example.
- *Missing individual country tables:* some countries are part of a GTAP "rest" table, which limits the reliability of results for these countries.

We keep on exploring other datasets to complement and/or replace GTAP data if they have better data available.

[40] Kinyondo, A. and Pelizzo R. (2018). "Poor Quality of Data in Africa: What Are the Issues". Politics & Policy. Vol 46, Issue 6.; https://onlinelibrary.wiley.com/doi/abs/10.1111/polp.12277

[41] For more detail on the IO tables per country see: https://www.gtap.agecon.purdue.edu/databases/regions.aspx?version=10.211

[42] https://www.gtap.agecon.purdue.edu/databases/v10/index.aspx

[43] World Input-Output Tables (WIOD) covers 43 countries and 56 sectors. EORA covers 190 countries and 26 sectors.

Table 6: GTAP data used in JIM[44]

Data	Description	Source data	Geographies	Economic sectors	Reference year
SAMs (EVFB, VDFB, VMFB, EVFP, VDFP, VMFP, PTAX, VDPB, VMPB, VDPP, VMPP, VDGB, VMGB, VDGP, VMGP, VXSB, VFOB, VCIF, VMSB, VDIB, VDIP, VMIB, VMIP, EVOS, VST)	Firms' domestic purchases, household domestic purchases, firms' imports, firms' expenses on endowments (i.e. land, unskilled labour, skilled labour, capital, natural resources), taxes	National statistical institutes data is harmonised using UN COMTRADE, WBDI, OECD and FAO data	93 countries	76 sectors	2017
CO_2 emissions (MDF & MIF)	CO_2 emitted in current production in the combustion of domestic and imported fossil fuels (i.e. coal, oil, gas, petroleum and coke, gas manufacture and distribution)	Energy volume data International Energy Agency (IEA)	93 countries	76 sectors	2017
Non-CO_2 emissions	Methane (CH_4), nitrous oxide (N_2O) and 15 fluorinated gases (F-gases) emitted	Emissions Database for Global Atmospheric Research (EDGAR) (for non-agricultural activities) and FAOSTAT (for agricultural activities).[45]	93 countries	76 sectors	2017
Energy products usage	Usage of energy products (coal, crude oil, petroleum, natural gas, X electricity-based energies, distributed gas), both for power-related purposes and non-power-related purposes.	Energy volume data International Energy Agency (IEA	93 countries	76 sectors	2017

[44] Aguiar, A., Chepeliev, M., Corong, E., McDougall, R., & van der Mensbrugghe, 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

[45] EDGAR is a joint project of the European Commission DG Joint Research Centre and the Netherlands Environmental Assessment Agency. https://www.gtap.agecon.purdue.edu/resources/download/7813.pdf

6.1.2 ILOSTAT

ILOSTAT is the world's leading source on labour statistics. ILOSTAT is hosted by the International Labour Organisation's Department of Statistics. The database contains national labour force statistics as well as modelled estimates of labour market indicators worldwide. The latter are produced for countries and years for which country-reported data are unavailable using econometric models. This has resulted in a balanced panel dataset of aggregates for every year, with consistent country coverage. The JIM uses these ILO modelled estimates.

On the one hand, the efforts of the ILO to produce harmonised indicators from country-reported microdata has greatly increased the comparability of the data, which makes the dataset well-suited for the JIM. On the other hand, the modelling reduced the reliability of the data. The quality of data may be improved by accessing microdata directly. We will further explore this (together with ILO) in the future.

6.1.3 World Bank Development Indicators Databank

The WBDI databank is the primary World Bank collection of development indicators. They are compiled from officially recognised international sources. The data are the most current and accurate global development data available, and include national, regional and global estimates.

The wide coverage of the database in terms of indicators, geographies and years, makes WBDI a useful data source to complement the other JIM data sources.

6.1.4 International Energy Agency

The IEA is an autonomous inter-governmental organisation within the OECD that provides data and analyses on energy related issues surrounding economics and international policy. It has an Energy Data Centre which provides an authoritative and comprehensive source of global energy data. The IEA collects, assesses and disseminates energy statistics on supply and demand, compiled into energy balances.

6.1.5 Energy Information Administration

The Energy Information Administration (EIA) offers official energy statistics from the United States (US) government. It collects, analyses, and disseminates independent and impartial energy information. The EIA data is used in the JIM only when IEA data is not available.

The EIA database complements the IEA data. While the net electricity consumption is available for countries worldwide, the net capacity factors are only based on US power producers. The level is representativeness of the data for all countries worldwide is therefore limited.

6.1.6 Outliers management

Over the last few years, with the increasing amount of data collected from ILO and GTAP (multiple years and an improved geographic coverage), slight discrepancies and inconsistencies in the data were flagged. To systematically spot and handle those outliers, we performed a statistical analysis (applied a threshold at the 99th percentile).

The data at our disposal can be split into two main samples: 12,152 observations for the GHG intensities (76 sectors and 160 countries), and 2,212 observations for the employment intensities (14 sectors and 158 countries). As both samples are grouped close to 0, and negative values are theoretically not realistic (e.g. negative productivity), we focused our analysis on the upper-tail of the distribution, i.e. highest values with a low occurrence probability. Furthermore, to account to the economic specificities of each sector, we performed our analysis per sector. We used the percentiles as an outlier detection method per sector and applied a threshold at the 99th

percentile, meaning that values above the 99th percentile are identified as outliers. By doing so, 142 GHG intensities and 28 employment intensities were set aside.

To prevent data gaps, as each sector/country pair is necessary for the JIM's coverage, we replaced the identified outliers by the corresponding subregional intensity, allowing more conservative results.

6.2 Client financials

The client financials need to be inserted by investors themselves. Ideally data is derived by investors from audited financial statements of their clients on an annual basis. The data inputs for the JIM per type of client are explained in detail in the user guide. The model distinguishes between required data (without these inputs the model does not run) and optional data (inputs that improve the model calculations). The more optional data is provided, the higher the confidence level of the results (see Section 8).

Getting reliable year-on-year financial data for hundreds of businesses is a challenging process, particularly if they are held through financial intermediaries (e.g. private equity funds). It is therefore key that organisations have data quality assurance processes in place to discover and correct data inconsistencies and anomalies. The JIM does not take any responsibility for the quality of the client input data.

However, to help users, the JIM conducts a data validation screening on:

- *Labelling errors*: errors in the labelling of input data that prevent the model from running (e.g. errors in the spelling of country names). Due to these errors the model is not able to identify the appropriate national statistics for the model. Labelling errors need to be resolved before the model can provide results.
- *Value errors*: possible errors in the values of input data. These do not prevent the model from running but may reduce the reliability of results. Users are advised to verify the values in case a "value error" pops up. The model runs the following value checks:
    - Payments to supplier organisations and individuals: local < revenue.
    - Payments to supplier organisations and individuals: total < revenue.
    - Payments to supplier organisations and individuals: local < Payments to supplier organisations and individuals: total.
    - Payment to government < revenue.
    - Net income < revenue.
    - Permanent employee wages: total < revenue.
    - Direct employment – operations & maintenance – third party hires < Direct employment – operations & maintenance.
    - Direct employment – operations & maintenance – female < Direct employment – operations & maintenance.
    - Direct employment – operations & maintenance – female third-party hires < Direct employment – operations & maintenance – third party hires.

- Direct employment – operations & maintenance – female third-party hires < Direct employment – operations & maintenance.
- Direct employment – construction phase – female < Direct employment – construction phase.
- Revenue ≥ (Payments to supplier organisations and individuals: total + Payment to government + Net income + Permanent employee wages: total).

7 Reliability of results

Results should be interpreted as directionally correct estimates. They are calculated on an individual investment basis and subsequently aggregated for analysis and reporting purposes. As the model is based on country and sector averages, it is likely that modelled individual company results differ from real practices due to unique company characteristics. But in the aggregate, companies are expected to reflect these averages more closely. As a result, accuracy increases for a larger number of companies.

The level of confidence in the results is a mapping that depends on the degree of modelling used, input data provided and availability of macro-economic statistics. Confidence levels are rated on a five-level scale, with five being the highest level of confidence and one being the lowest. Direct results, for which no modelling is involved, are assumed to be accurate and therefore given a five-score confidence level. For supply chain impacts, power enabling and finance enabling impacts, results receive four, three, two or one scores depending on the availability of country-specific macro-economic statistics and input data. See more details on the reliability of results in table 7.

Table 7: Reliability of results

Impact	**Confidence level max.**	**Confidence level reductions**	**Rationale**
Direct	5	-1 no optional inputs (if relevant) -1 no real data -1 no country statistics (if no real data provided) -1 fiscal year different from 2017-2019	The confidence level is highest (5) when no modelling is needed, and all (required & optional) real data is provided. If no real data is provided and estimations are necessary, the confidence level of results reduces. Furthermore, if only GTAP regional statistics are available to make estimations, the level of uncertainty increases further, and the confidence level drops. Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases.
Supply chain	4	-1 no optional inputs -1 no country statistics -1 if "World" region -1 fiscal year different from 2017-2019	Supply chain impacts are always estimated, except Scope 2 GHG emissions, which reduces the maximum confidence level to 4. Furthermore, if no optional inputs are provided and no GTAP country statistics are available, the level of uncertainty increases, and the confidence level drops. Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases.
Induced	3	-1 no optional inputs -1 no country statistics -1 fiscal year different from 2017-2019	Induced impacts are always estimated. As an additional layer of assumptions is needed compared to supply chain impacts (on household consumption patterns), the maximum confidence level is reduced to 3. Furthermore, if no optional inputs are provided and no country statistics are available, the level of uncertainty increases, and the confidence level drops. Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases.
Finance enabling	2	-1 no country statistics -1 fiscal year different from 2017-2019	Finance enabling impacts are always estimated. As financial intermediary client data is not available, additional assumptions must be made to convert capital into additional company revenues. This reduces the confidence level to 2. Furthermore, if no country statistics are available, the level of uncertainty increases, and the confidence level drops. Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases.
Power enabling	2	-1 no power production data -1 fiscal year different from 2017-2019	Power enabling impacts are always estimated. As no data is available on the users of power, additional assumptions have to be made to convert power production into additional company revenues. This reduces the confidence level to 2. Furthermore, if no power production data are available, the level of uncertainty increases, and the confidence level drops. Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases.

Appendix

Appendix 1: Coverage SAMs in JIM

Sectors			
1	Paddy rice	39	Metal products
2	Wheat	40	Computer, electronic and optical products
3	Cereal grains nec	41	Electrical equipment
4	Vegetables, fruit, nuts	42	Machinery and equipment nec
5	Oil seeds	43	Motor vehicles and parts
6	Sugar cane, sugar beet	44	Transport equipment nec
7	Plant-based fibers	45	Manufactures nec
8	Crops nec	46	Transmission and distribution
9	Bovine cattle, sheep and goats, horses	47	Nuclear base load
10	Animal products nec	48	Coal base load
11	Raw milk	49	Gas base load
12	Wool, silk-worm cocoons	50	Wind base load
13	Forestry	51	Hydro base load
14	Fishing	52	Oil base load
15	Coal	53	Other base load
16	Oil	54	Gas peak load
17	Natural gas extraction	55	Hydro peak load
18	Other Extraction	56	Oil peak load
19	Bovine meat products	57	Solar peak load
20	Meat products nec	58	Gas manufacturing, distribution
21	Vegetable oils and fats	59	Water
22	Dairy products	60	Construction[46]
23	Processed rice	61	Trade
24	Sugar	62	Accommodation, Food and service activities
25	Food products nec	63	Transport nec
26	Beverages and tobacco products	64	Water transport
27	Textiles	65	Air transport
28	Wearing apparel	66	Warehousing and support activities
29	Leather products	67	Communication
30	Wood products	68	Financial services nec
31	Paper products, publishing	69	Insurance
32	Petroleum, coal products	70	Real estate activities
33	Chemical products	71	Business services nec
34	Basic pharmaceutical products	72	Recreational and other services

[46] Sector 60 construction returns 0 emissions for scope 1 non-CO2 because the emissions are negligible find more here: Estimating the amount of CO2 emissions that the construction industry can influence - Supporting material for the Low Carbon Construction IGT Report - Autumn 2010 (publishing.service.gov.uk)

35	Rubber and plastic products	73	Public Administration and defence
36	Mineral products nec	74	Education
37	Ferrous metals	75	Human health and social work activities
38	Metals nec	76	Dwellings

Countries that can be run in the JIM[47]			
1	**Afghanistan**	87	Libya
2	Aland Islands	88	**Madagascar**
3	**Albania**	89	**Malawi**
4	**Algeria**	90	**Malaysia**
5	Angola	91	Maldives
6	Anguilla	92	**Mali**
7	**Argentina**	93	Marshall Islands
8	**Armenia**	94	Martinique
9	**Azerbaijan**	95	Mauritania
10	**Bangladesh**	96	**Mauritius**
11	**Belarus**	97	Mayotte
12	Belize	98	**Mexico**
13	**Benin**	99	Micronesia, Federated States of
14	Bhutan	100	Moldova, Republic of
15	**Bolivia**	101	**Mongolia**
16	Bonaire, Sint Eustatius, Saba	102	Montenegro
17	Bosnia and Herzegovina	103	Montserrat
18	**Botswana**	104	**Morocco**
19	Bouvet Island	105	**Mozambique**
20	**Brazil**	106	Myanmar
21	British Indian Ocean Territory	107	**Namibia**
22	**Bulgaria**	108	Nauru
23	**Burkina Faso**	109	**Nepal**
24	Burundi	110	**Nicaragua**
25	Cabo Verde	111	**Niger**
26	**Cambodia**	112	**Nigeria**
27	**Cameroon**	113	Niue
28	**Central African Republic**	114	Norfolk Island
29	**Chad**	115	North Macedonia
30	**Chile**	116	**Pakistan**
31	**China**	117	**Panama**
32	Christmas Island	118	Papua New Guinea
33	Cocos Islands	119	**Paraguay**
34	**Colombia**	120	**Peru**
35	**Comoros**	121	**Philippines**
36	**Congo, The DRC**	122	Pitcairn
37	**Congo-Brazzaville**	123	Reunion
38	Cook Islands	124	**Romania**

[47] Countries in bold have their own IO table.

39	**Costa Rica**	125	**Russia**
40	**Côte d'Ivoire**	126	**Rwanda**
41	Cuba	127	Saint Barthélemy
42	Djibouti	128	Saint Lucia
43	Dominica	129	Saint Vincent and the Grenadines
44	**Dominican Republic**	130	Samoa
45	East Timor	131	São Tomé and Príncipe
46	**Ecuador**	132	**Senegal**
47	**Egypt**	133	**Serbia**
48	**El Salvador**	134	Seychelles
49	**Equatorial Guinea**	135	Sierra Leone
50	Eritrea	136	Solomon Islands
51	**Eswatini**	137	Somalia
52	**Ethiopia**	138	**South Africa**
53	Falkland Islands	139	South Georgia and South S.S.
54	Fiji	140	South Sudan
55	French Guiana	141	**Sri Lanka**
56	French Southern Territories	142	St. Helena
57	**Gabon**	143	St. Pierre and Miquelon
58	Gambia	144	**State of Palestine**
59	**Georgia**	145	**Sudan**
60	**Ghana**	146	Suriname
61	Grenada	147	Svalbard and Jan Mayen Islands
62	Guadeloupe	148	**Syrian Arab Republic**
63	**Guatemala**	149	**Tajikistan**
64	**Guinea**	150	**Tanzania, United Republic of**
65	Guinea-Bissau	151	**Thailand**
66	Guyana	152	**Togo**
67	**Haiti**	153	Tokelau
68	Heard and Mc Donald Islands	154	Tonga
69	Holy See	155	**Tunisia**
70	**Honduras**	156	**Turkey**
71	**India**	157	Turkmenistan
72	**Indonesia**	158	Tuvalu
73	**Iran (Islamic Republic of)**	159	U.S. Minor Islands
74	**Iraq**	160	**Uganda**
75	**Jamaica**	161	**Ukraine**
76	Jersey	162	**Uruguay**
77	**Jordan**	163	**Uzbekistan**
78	**Kazakhstan**	164	Vanuatu
79	**Kenya**	165	**Venezuela**
80	Kiribati	166	**Vietnam**
81	Korea, D.P.R.O.	167	Wallis and Futuna Islands
82	**Kyrgyzstan**	168	Yemen
83	**Laos**	169	**Zambia**
84	**Lebanon**	170	**Zimbabwe**
85	Lesotho		
86	Liberia		

Regions		Countries used to derive regional intensities[48]
1	World	Includes all countries included in Africa, Americas, Asia, Europe and Oceania, plus British Indian Ocean Territory, French Southern Territories, Bouvet Island, Antarctica
2	Africa	Includes all countries included in Northern Africa, Eastern Africa, Middle Africa, Southern Africa and Western Africa
3	Northern Africa	Algeria, Egypt, Morocco, Sudan, Tunisia and Rest of Northern Africa
4	Eastern Africa	Comoros, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Uganda, Tanzania, Zambia, Zimbabwe and Rest of Eastern Africa
5	Middle Africa	Cameroon, Central African Republic, Chad, Congo, Democratic republic of Congo, Equatorial Guinea, Gabon and Rest of South and Central Africa
6	Southern Africa	Botswana, Eswatini, Namibia, South Africa and Rest of Southern Africa
7	Western Africa	Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Mali, Niger, Nigeria, Senegal, Togo and Rest of Western Africa
8	Caribbean	Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago and Rest of Caribbean
9	Central America	Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and Rest of Central America
10	South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela and Rest of South America
11	Asia	Includes all countries included in Central Asia, Eastern Asia, South-eastern Asia, Southern Asia, and Western Asia
12	Central Asia	Kazakhstan, Kyrgyz Republic, Tajikistan, Uzbekistan and Rest of former Soviet Union
13	South-eastern Asia	Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Vietnam and Rest of South-eastern Asia

[48] There could be slight deviations from UN Geoscheme. As GTAP does not have individual tables for all countries, some countries are in "rest tables" that cover multiple regions. The rest tables are allocated to the region applicable to most of the countries included. Countries in bold have their own IO table, the rest of countries use regional averages for impact estimation.

14	Southern Asia	Afghanistan, Bangladesh, India, Iran, Nepal, Pakistan, Sri Lanka, Rest of Southern Asia
15	Melanesia, Micronesia, Polynesia	Rest of Oceania
16	Eastern Europe	Belarus, Bulgaria, Czechia, Hungary, Poland, Romania, Russia, Slovakia, Ukraine, and Rest of Eastern Europe

Appendix 2: Sector mappings

ISIC sectors		GTAP sector
A	Agriculture; forestry and fishing	1 2 3 4 5 6 7 8 9 10 11 12 13 14
B	Mining and quarrying	15 16 17 18
C	Manufacturing	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
D, E	Utilities	46 47 48 49 50 51 52 53 54 55 56 57 58 59
F	Construction	60
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	61
H, J	Transport; storage and communication	63 64 65 66 67
I	Accommodation and food service activities	62
K	Financial and insurance activities	68 69
L, M, N	Real estate; business and administrative activities	70 71
O	Public administration and defence; compulsory social security	73
P	Education	74
Q	Human health and social work activities	75
R, S, T, U	Other services	72

NACE sectors		GTAP sector
A	Agriculture, forestry and fishing	1 2 3 4 5 6 7 8 9 10 11 12 13 14
B	Mining and quarrying	15 16 17 18
C	Manufacturing	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
D	Electricity, gas, steam and air conditioning supply	46 47 48 49 50 51 52 53 54 55 56 57 58
E	Water supply; sewerage, waste management and remediation activities	59
F	Construction	60
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	61
H	Transportation and storage	63 64 65 66
I	Accommodation and food service activities	62
J	Information and communication	67
K	Financial and insurance activities	68 69
L	Real estate activities	70
M	Professional, scientific and technical activities	71
N	Administrative and support service activities	71
O	Public administration and defence; compulsory social security	73

P	Education	74
Q	Human health and social work activities	75
R	Arts, entertainment and recreation	72
S	Other service activities	72
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	72
U	Activities of extraterritorial organisations and bodies	73

GICS Sector	GTAP Sector
Energy Equipment & Services	16 17
Oil, Gas & Consumable Fuels	15 16 17 18 32
Chemicals	32 33 35
Construction Materials	18 36
Containers & Packaging	30 31 35 36 39
Metals & Mining	18 37 38 39
Paper & Forest Products	13 30 31
Aerospace & Defense	39 44 45 73
Building Products	35 36 39 42
Construction & Engineering	60 71
Electrical Equipment	36 39 41
Industrial Conglomerates	68
Machinery	39 42 43 44 45
Trading Companies & Distributors	61 71
Commercial Services & Supplies	31 45 66 71
Professional Services	71
Air Freight & Logistics	65
Passenger Airlines	65
Marine Transportation	64
Ground Transportation	63
Transportation Infrastructure	63
Automobile Components	35 43
Automobiles	43
Household Durables	27 35 40 41 60
Leisure Products	27 29 45
Textiles, Apparel & Luxury Goods	27 28 29
Hotels, Restaurants & Leisure	62
Diversified Consumer Services	71
Distributors	61
Broadline Retail	61
Specialty Retail	61
Consumer Staples Distribution & Retail	61
Beverages	26
Food Products	1 2 3 4 5 6 7 8 9 10 11 12 14 19 20 21 22 23 24 25 61 71

Tobacco	26
Household Products	27 33
Personal Care Products	33
Health Care Equipment & Supplies	40 45
Health Care Providers & Services	61 71 75
Health Care Technology	71
Biotechnology	71
Pharmaceuticals	34
Life Sciences Tools & Services	34
Banks	68
Financial Services	68
Consumer Finance	68
Capital Markets	68
Mortgage Real Estate Investment Trusts (REITs)	68
Insurance	69
IT Services	67 71
Software	71
Communications Equipment	40 41
Technology Hardware, Storage & Peripherals	40
Electronic Equipment, Instruments & Components	40
Semiconductors & Semiconductor Equipment	40
Diversified Telecommunication Services	67
Wireless Telecommunication Services	67
Media	31 71
Entertainment	72
Interactive Media & Services	72
Electric Utilities	46 47 48 49 50 51 52 53 54 55 56 57
Gas Utilities	58
Multi-Utilities	46 47 48 49 50 51 52 53 54 55 56 57 58 59
Water Utilities	59
Independent Power and Renewable Electricity Producers	46 47 48 49 50 51 52 53 54 55 56 57
Diversified REITs (New Name)	70
Industrial REITs (New)	70
Hotel & Resort REITs (New)	62 70
Office REITs (New)	70
Health Care REITs (New)	70
Residential REITs (New)	70
Retail REITs (New)	70
Specialized REITs (New)	70
Real Estate Management & Development	70

Appendix 3: Definition of Micro, Small & Medium Enterprises (MSMEs)

IFC MSME Definition		**MSME Loan Size Proxy (USD)**		
Indicators	Employees	Total Assets	Annual Sales	Loan Size at Origination
Micro enterprise	<10	<100,000	<100,000	<10,000
Small enterprise	10 – 49	100,000 - < 3m	100,000 - < $3m	<100,000
Medium enterprise	50 – 300	3m - 15m	3m - 15m	<1 or 2m

Appendix 4: Mapping of continents to regional data

Continent	Regional data
Africa	Sub-Saharan Africa
Americas	Latin America & Caribbean
Asia	Average of South Asia and East Asia
Europe	Europe
Oceania	Average of Europe and East Asia
World	Average of all regional data

Appendix 5: Energy sources

Energy sources			
1	Coal	9	Hydro base load
2	Oil	10	Oil base load
3	Natural gas	11	Other base load
4	Petroleum and coke products	12	Gas peak load
5	Nuclear base load	13	Hydro peak load
6	Coal base load	14	Oil peak load
7	Gas base load	15	Solar peak load
8	Wind base load	16	Distributed gas

Appendix 6: Sectors active in fossil fuel

Classification	Sector code	Sector name
GTAP	15	Coal
GTAP	16	Oil
GTAP	17	Gas
GTAP	18	Other Extraction
GTAP	46	Electricity: Transmission and distribution
GTAP	48	Coal power baseload
GTAP	49	Gas power baseload
GTAP	52	Oil power baseload
GTAP	53	Other baseload
GTAP	54	Gas power peakload
GTAP	56	Oil power peakload
GTAP	58	Gas manufacture, distribution
GTAP	61	Trade
GICS	GICS-101020	Coal & Consumable Fuels
GICS	GICS-151040	Metals & Mining
GICS	GICS-255040	Specialty Retail
GICS	GICS-551010	Electric Utilities
GICS	GICS-551020	Gas Utilities
ISIC	ISIC-05	Mining of coal and lignite
ISIC	ISIC-0510	Mining of hard coal
ISIC	ISIC-0520	Mining of lignite
ISIC	ISIC-06	Extraction of crude petroleum and natural gas
ISIC	ISIC-0610	Extraction of crude petroleum
ISIC	ISIC-0620	Extraction of natural gas
ISIC	ISIC-0910	Support activities for petroleum and natural gas extraction
ISIC	ISIC-35	Electricity, gas, steam and air conditioning supply
ISIC	ISIC-351	Electric power generation, transmission and distribution
ISIC	ISIC-3510	Electric power generation, transmission and distribution
ISIC	ISIC-352	Manufacture of gas; distribution of gaseous fuels through mains
ISIC	ISIC-3520	Manufacture of gas; distribution of gaseous fuels through mains
ISIC	ISIC-46	Wholesale trade, except of motor vehicles and motorcycles
ISIC	ISIC-466	Other specialized wholesale
ISIC	ISIC-4661	Wholesale of solid, liquid and gaseous fuels and related products
ISIC	ISIC-B	Mining and quarrying
ISIC	ISIC-D	Electricity, gas, steam and air conditioning supply
ISIC	ISIC-G	Wholesale and retail trade; repair of motor vehicles and motorcycles
NACE	NACE-35	Electricity, gas, steam and air conditioning supply
NACE	NACE-35.1	Electric power generation, transmission and distribution
NACE	NACE-35.11	Production of electricity
NACE	NACE-35.2	Manufacture of gas; distribution of gaseous fuels through mains
NACE	NACE-46	Wholesale trade, except of motor vehicles and motorcycles
NACE	NACE-46.7	Other specialised wholesale
NACE	NACE-5	Mining of coal and lignite

NACE	NACE-5.1	Mining of hard coal
NACE	NACE-5.2	Mining of lignite
NACE	NACE-6	Extraction of crude petroleum and natural gas
NACE	NACE-6.1	Extraction of crude petroleum
NACE	NACE-6.2	Extraction of natural gas
NACE	NACE-9	Mining support service activities
NACE	NACE-9.1	Support activities for petroleum and natural gas extraction
NACE	NACE-B	Mining and quarrying
NACE	NACE-B.5.1	Mining of hard coal
NACE	NACE-B.5.2	Mining of lignite
NACE	NACE-B.6.1	Extraction of crude petroleum
NACE	NACE-B.6.2	Extraction of natural gas
NACE	NACE-B.9.1	Support activities for petroleum and natural gas extraction
NACE	NACE-D	Electricity, gas, steam and air conditioning supply
NACE	NACE-D.35.11	Production of electricity
NACE	NACE-D.35.12	Transmission of electricity
NACE	NACE-D.35.13	Distribution of electricity
NACE	NACE-D.35.14	Trade of electricity
NACE	NACE-D.35.21	Manufacture of gas
NACE	NACE-D.35.22	Distribution of gaseous fuels through mains
NACE	NACE-D.35.23	Trade of gas through mains
NACE	NACE-G	Wholesale and retail trade; repair of motor vehicles and motorcycles
NACE	NACE-G.46.71	Wholesale of solid, liquid and gaseous fuels and related products

Appendix 7: High impact climate sectors

NACE rev. 2 sectors	GTAP sectors
Agriculture, forestry and fishing	1 – 14
Mining and quarrying	15 – 18
Manufacturing	19 - 45
Electricity, gas, steam and air conditioning supply	46 – 58
Water supply; sewerage, waste management and remediation activities	59
Construction	60
Wholesale and retail trade; repair of motor vehicles and motorcycles	31
Transportation and storage	63 - 66
Real estate activities	70