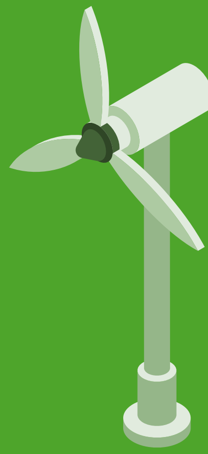
IDB GHG

ACCOUNTING MANUAL

Version 1.0/ February 2021

IDB



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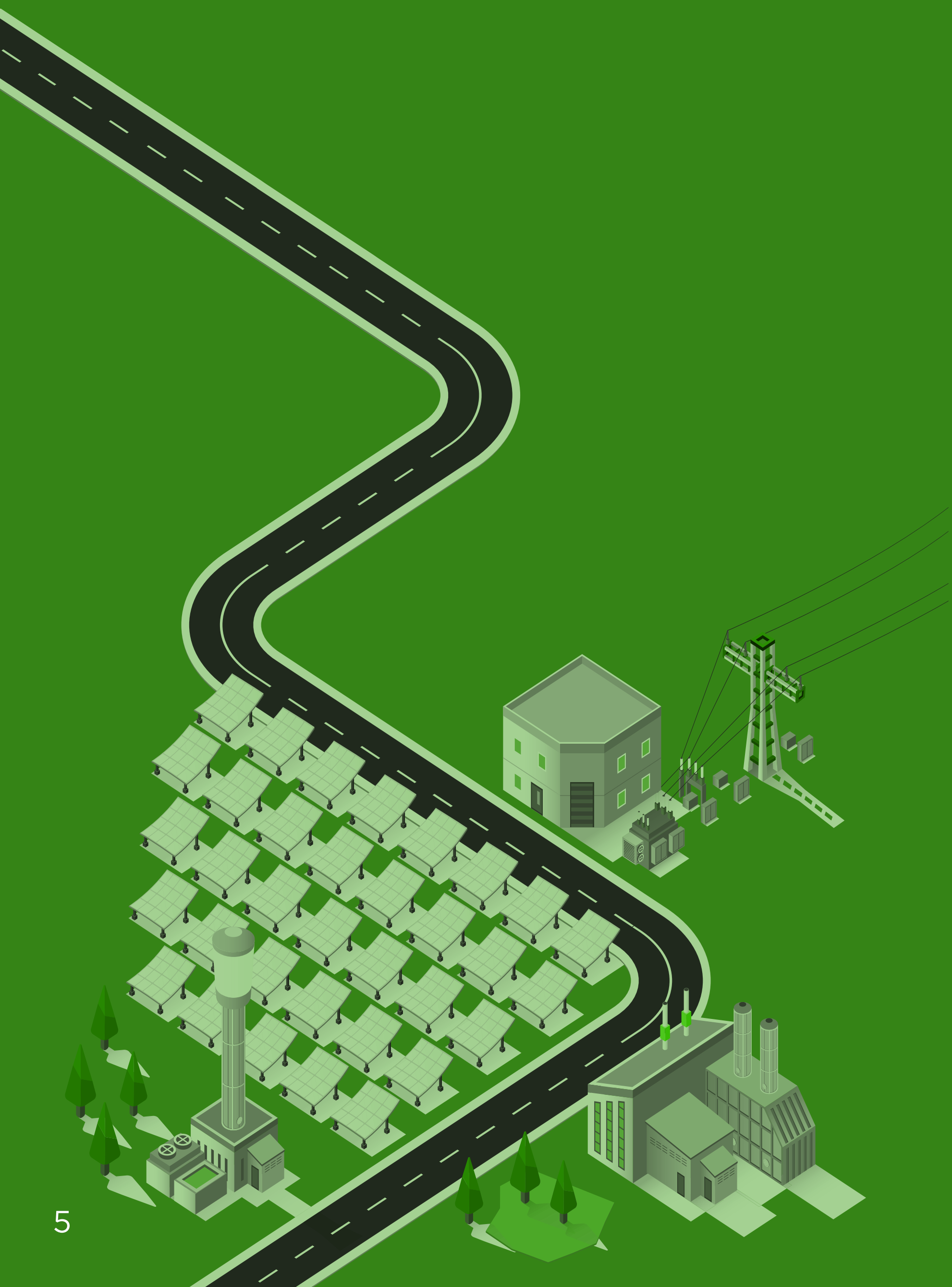
https://www.iadb.org/

Contents

1. Acronyms

ADB	Asian Development Bank
CDM	Clean Development Mechanism
CO_2	Carbon Dioxide
DOC	Degradable Organic Carbon
DOE	Department of Energy
EE	Energy Efficiency
EF	Emission Factor
EPA	Environmental Protection Agency
ESPF	Environmental and Social Policy Framework
FGD	Flue Gas Desulfurization
GCF	Green Climate Fund
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GJ	Gigajoules
GWP	Global Warming Potential
Ha	Hectares
HHV	High Heating Value
IDB	InterAmerican Development Bank Group
IEA	International Energy Agency
IFI	International Finance Institutions
IPCC	Intergovernmental Panel on Climate Change
Km	Kilometer
kWh	Kilowatt Hour
LHV	Low Heating Value
LTO	Landing and Takeoff
MDBs	Multinational Development Banks
MWh	Megawatt Hour
RE	Renewable Energy
ROW	Right of way
tCO2e	Metric tons (tonnes) of carbon dioxide equivalent

2. Introduction

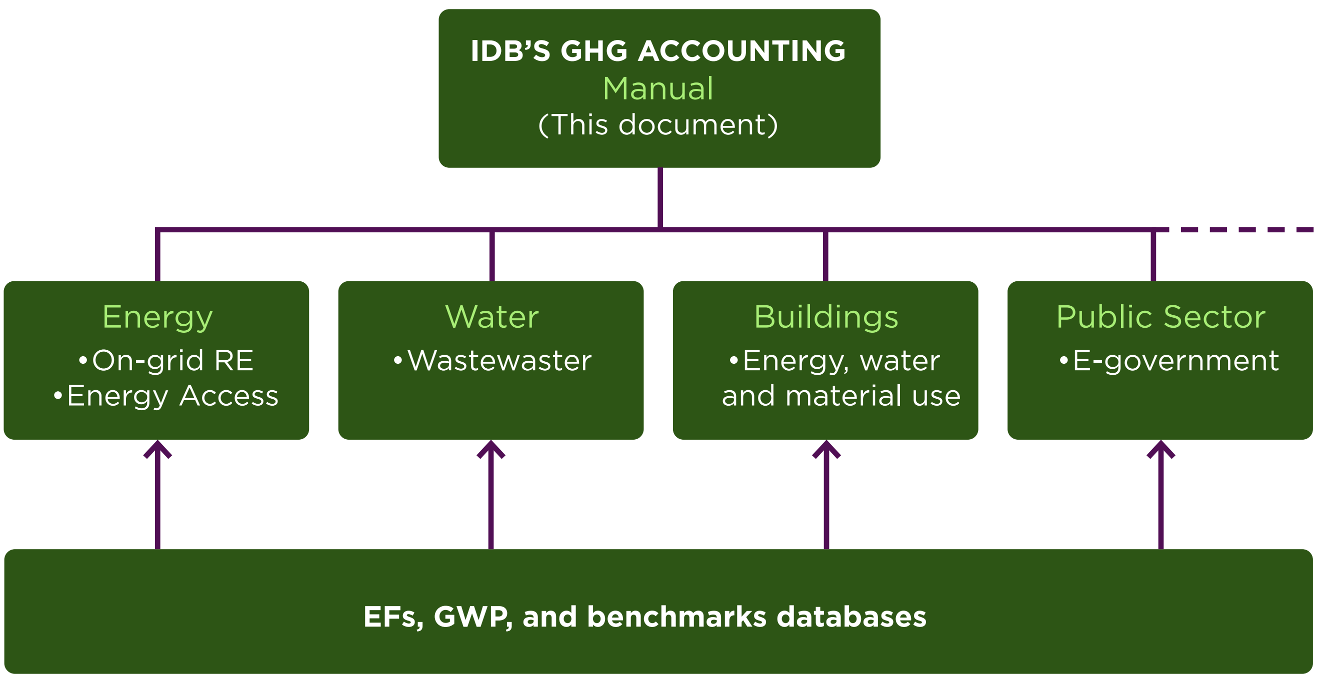


2. Introduction

This document provides guidance to IDB personnel, IDB project teams, executing agencies and external consultants[1] on how to estimate the impacts on Green House Gas (GHG) emissions of IDB projects. The guidance is intended for use during the project design phase (ex-ante)[2] and is applicable, in principle, to a broad set of operation types (direct investments, investment through financial intermediaries, policy-based loans, etc.).

The document is designed as an 'umbrella document' for a broader set of guidance documents, tools and databases, that can be used, along with this document, when assessing project's GHG emissions (see illustration below). This guidance, as well as the sector-specific manuals and tools will be revised, expanded and developed on an on-going basis, as needed[3].

Figure 1. IDB's Guidance documents and tools



GHG accounting practices have evolved over decades, resulting in the creation of methodologies and protocols that are widely established, along with databases and tools that practitioners can use when estimating GHG emissions. The goal of this document, therefore, is to provide high-level guidance, and references to existing methodologies and databases, which project teams can use as needed. For relevant project types (sectors) IDB finances, the document also describes some of the tools that teams can use to characterize the GHG impact of their projects, collect relevant activity data, establish baselines (or benchmarks) and estimate projects' GHG emission and impacts.

1 For simplicity, the remainder of the document will refer to "project teams" in lieu of "project teams, implementing agencies and external consultants"

2 Whereas some of the guidelines provided below may also be useful when project teams are assessing ex-post the impact of implemented projects, this document is not intended for such use and would provide incomplete guidance in such cases

3 This document updates and integrates technical note TN-455, which includes a methodology for the calculation of GHG impact, based on directive B.11 of the Bank's Environment and Safeguards Compliance Policy (OP-703). OP-703 mandates the calculation and reporting of GHG emissions for operations that are expected to produce significant amounts of emissions, and requires that all direct investment projects with emissions, or emissions savings, exceeding 25 Kilotons of CO2-equivalents (CO2e) per annum, provide annual GHG emissions updates.

The document is structured as follows:

Section 1: provides background and context on GHG accounting and discusses key questions GHG accounting can address. This section also discusses some of the international standards that have been developed to answer these questions and the guiding principles articulated in these standards. This section covers 'bigger picture' elements of GHG accounting and discusses key terminology used by the GHG accounting community. Readers already familiar with these standards can skip section 1 and proceed to section 2.

Section 2: describes the steps that are typically taken when estimating the GHG emissions of a project. The goal of this section is to provide a 'how to' guidance to readers who are planning to estimate project-level GHG emission but lack prior experience.

Section 3: describes specific processes and tools available to, and used by, the IDB to estimate and report GHG emissions. Project teams can refer to this section, when looking for tools that may apply to specific project they are working on.

3. GHG accounting: rationale, standards and principles

3. GHG accounting: rationale, standards and principles

3.1 Rationale for GHG accounting

There are multiple reasons why it may be valuable to estimate and analyze projects' related GHG emissions. Among others:

- GHG metrics may provide useful information about a project's impact and compatibility with desired sustainable development goals, such as a project's alignment with Paris Agreement goals (see box below)[4]. Such information may lead to changes in a project's design to minimize GHG emissions, maximize GHG emissions reductions or increase carbon sequestration.
- With project types that potentially have significant GHG impact, the quantification of this impact may facilitate a risk assessment and decision-making during the due diligence process.
- Specific disclosure requirements may be in place for highly emissive projects. For example, the current and proposed Environmental and Social Policy Framework (ESPF) of the Bank's require that borrowers quantify and report GHG emissions annually, when projects are expected to produce, or currently produce, more than tCO_2e 25,000 per year[5].
- For some project types (e.g. hydropower, geothermal, bioenergy or wastewater projects) a GHG assessment is required to demonstrate net emission reductions and establish if the project contributes to IDB's targets for climate mitigation financing, as defined by the joint MDB methodology for climate finance tracking [6].
- If a project team seeks to access co-funding from concessionary climate mitigation funds, or through carbon markets, a GHG assessment is required.
- GHG emissions estimates can be combined with a shadow price of carbon and used in the economic analysis to assess a project more holistically
- Along with other IFIs, IDB committed to:
    - estimate the GHG emissions of projects likely to generate significant emissions and
    - publicly report, annually, estimated emission reductions/avoidance from projects approved during the prior year[7].
- Stakeholders, internal and external, including funds such as the Green Climate Fund, are seeking additional disclosure of GHG data from IDB (and MDBs/IFIs at large)

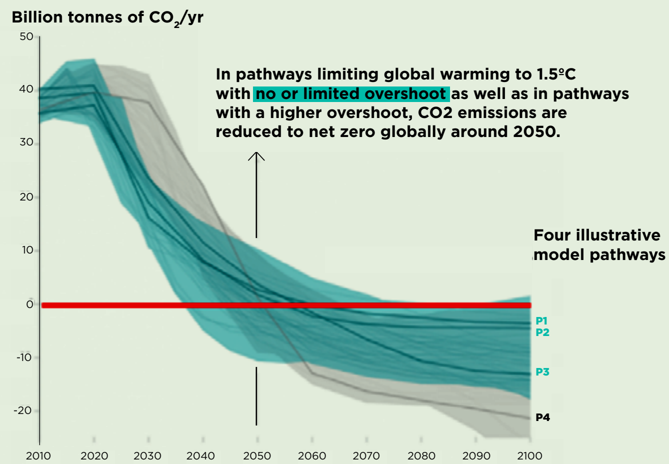
In approaching project-level GHG accounting it is important that project teams reflect on the goals they desire to achieve (or are asked to achieve) with the GHG emissions estimate. **Clear goals can guide the work of project teams and can help them navigate and use available standards, guidelines and methodologies, as well as assess mitigation and decarbonization opportunities and risks.** Section 4, below discussed in more detail how goals may affect the choice of GHG accounting methodology or calculation approaches.

Paris Agreement & Decarbonization pathways[8]

On 12 December 2015, in Paris, parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached a landmark agreement to combat climate, committing to limit the increase in the global temperature to well below 2°C above pre-industrial level and to seek to contain the increase to 1.5°C[9].

Achieving these goals will require reaching zero net carbon emissions, globally, between years 2050 and 2075, as illustrated by the figure below, which shows the results of scenario analysis with various possible pathways to limit global warming and achieve the objectives of the Paris Agreement.

Global total net CO_2 emissions



The analyzes of possible decarbonization pathways show that full decarbonization is technically achievable and comes with economic opportunities. Decarbonization can be achieved with action on five fronts:

1. Decarbonizing the production of electricity, using renewable power.
2. Undertaking massive electrification, e.g. using electric vehicles and electric boilers, and, where not possible, switching to cleaner fuels, e.g. hydrogen or biofuels.
3. Increasing the share of public and nonmotorized transportation in total mobility.
4. Preserving and increasing natural carbon sinks, e.g. with climate smart agriculture, reforestation or ecosystems restoration.
5. Improving efficiency and adopting a circular economy in all sectors, particularly in energy and food consumption, for example switching to less carbon-intensive building materials (e.g. sustainably sourced timber instead of cement produced with emissive technologies) and diets (e.g. reducing beef consumption).

All member borrowing countries in the IDB region are parties to the UNFCCC and have signed the Paris Agreement. As parties to the agreement, countries have developed National Determined Contributions (NDCs) in which they have laid out their short-term commitments to undertake mitigation actions. Some countries have also articulated Long Term Strategies (LTS), in which they have articulated their approach to achieving full decarbonization.

8 For more in-depth analyses of decarbonization pathways, see to Vogt-Schilb, Adrien and Hallegatte, Stephane *Climate Policies and Nationally Determined Contributions: Reconciling the Needed Ambition with the Political Economy*, available on-line at https://publications.iadb.org/en/climate-policies-and-nationally-determined-contributions-reconciling-needed-ambition-political and Fay, Marianne et. Ali. *Decarbonizing development: three steps to a zero-carbon future (Vol. 2): main report (English)*, available on-line at http://documents.worldbank.org/curated/en/148661468191348755/main-report

9 Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework

3.2 Standards, guidelines and databases

IDB's approach to GHG accounting builds on established GHG standards and guidelines and on approaches and databases that have been developed over the years by the GHG accounting community and by International Financial Institutions. **These approaches and methodologies, some of which are listed below, should be considered by IDB's teams, when developing methodologies to assess the potential impact on GHG emissions of their projects**.

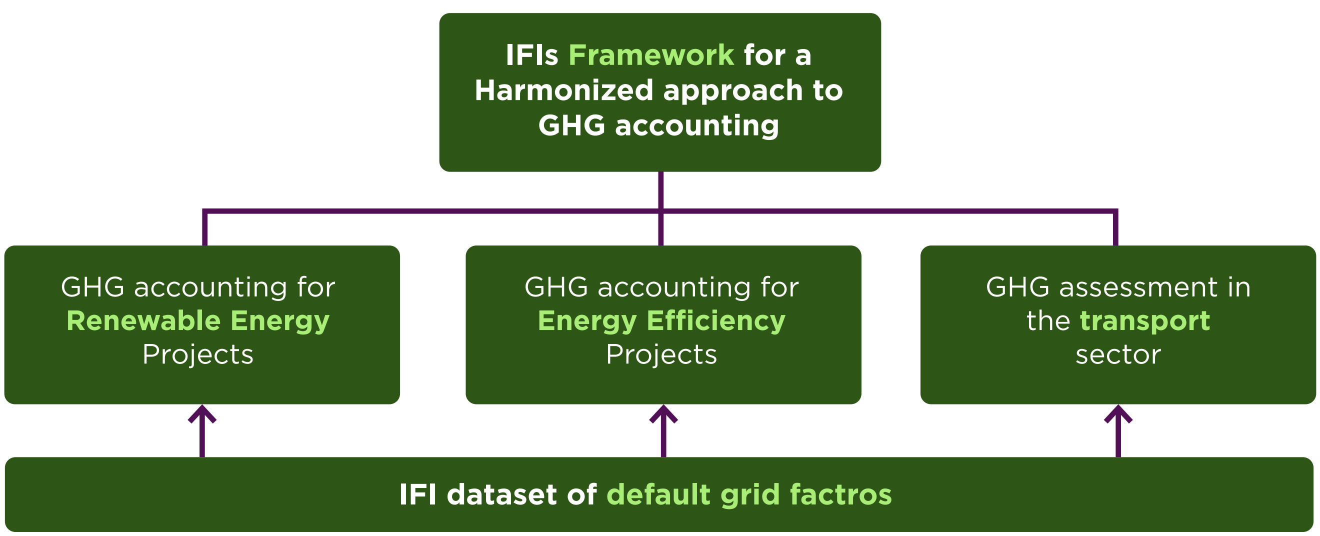
International protocols for GHG accounting

The International Panel on Climate Change (**IPCC**) has developed **Guidelines for National Greenhouse Gas Inventories**, which include estimation methodologies for all sectors of the economy, along with recommendation for the choice of activity data and emission factors[10]. Whereas the guidelines were developed for national GHG inventories, IPCC's approaches and parameters underpin many programs, tools and types of GHG emissions estimates. An important initiative that builds on the IPCC work is the **Greenhouse Gas Protocol**[11], which has brought together businesses and NGOs, to develop standards and guidelines for corporations/organizations, cities, value chains, products as well to assess projects and policies. Assessing the impact on GHG emissions of a project is also the focus of the methodologies developed for the **Clean Development Mechanism**, one of the flexibility mechanisms of the Kyoto Protocol[12].

In addition to using established international protocols, IDB works with other International Finance Institutions (IFIs), in a technical working group (TWG) on GHG accounting. The goal of the TWG is to develop harmonized methodologies, designed to ensure consistency and compatibility across IFIs, establish good practice standards and facilitate information sharing and learning. These harmonized methodologies provide guidance that builds on established approaches but are more specific to the business of IFIs and more directly apply to IDB's operations.

The picture below shows the key documents developed by the IFI's TWG on GHG accounting.

Figure 2. Documents developed by the IFI TWG on GHG accounting



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10 See the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, available on-line at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/ and the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, available on-line at https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html

11 The GHG Protocol is led by a NGO (the World Resources Institute) and a coalition of businesses, the World Business Council for Sustainable Development (WBCSD) and convenes private and public sector organizations, along with NGOs civil society organizations at large, to developed a global standards and frameworks that may be used, on a voluntary basis, by private public sector institutions.

12 Additional information about CDM methodologies can be found on-line at https://cdm.unfccc.int/methodologies/index.html

The International Financial Institutions framework for a harmonized approach to greenhouse gas accounting[13] provides general guidance, spelling out the minimum requirements IFIs agreed to meet, as well as their commitment to increase consistency and compatibility across IFIs, facilitate information exchange and establish good practice standards. The **sector specific methodologies on Renewable Energy, Energy Efficiency and Transport**[14] integrate the framework document with sector-specific guidance, to help project teams address some of the questions they may encounter when estimating the GHG impact of projects in a specific sector. **These documents should be consulted and used by project teams when assessing GHG impacts of projects**.

The IFI dataset of default Grid Emissions Factors[15] is a database that contains electricity grid emission factors for all the countries in the world and that IFIs can use with projects that affect supply or demand of grid electricity[16]. **For grid connected projects, IDB Project teams should use the Harmonized Grid Emissions Factors Dataset, unless more accurate project-specific emission factors are available or must be estimated because of the nature of the project being financed**.

In addition to the documents and tools discussed above, the IFIs cooperate on an on-going basis through the IFIs technical working group (TWG) meetings, discussions and working documents on GHG accounting. The TWG updates and integrates existing methodologies and tools, develops new ones and is a forum where IFIs discuss project-specific questions of general relevance for the group. Through the TWG, IFIs compare approaches and develop shared solutions to new or complex GHG accounting problems. **Project teams are encouraged to visit the TWG web page (https://unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting) and to connect to the TWG with specific questions, as needed, through one of IDB's focal points for the IFIs TWG**[17].

13 The IFI's Framework for a harmonized approach to greenhouse gas accounting is available at https://unfccc.int/sites/default/files/resource/International%20Financial%20Institution%20Framework%20for%20a%20Harmonised_rev.pdf

14 These documents are available at: https://unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting/ifi-twg-list-of-methodologies

15 The Harmonized Grid Emissions Factor Dataset is available at: https://unfccc.int/sites/default/files/resource/Harmonized_Grid_Emission_factor_data_set.pdf Grid emission factors for Central and South American countries are also summarized in *Appendix 2: IFI's Default Emissions Factors (DEFs)*

16 For a description of the methodology used by the IFIs to estimate the Default Grid Emission Factors, see annex 2

17 At the time of writing IFI TWG focal points include Marco Buttazzoni, CCS (mbuttazzoni@iadb.org) and Roberto Leal, ESG (robertole@iadb.org)

3.3 GHG accounting principles

The GHG accounting community has articulated key accounting principles that are widely used as a guide when defining accounting methodologies or calculation approaches and when facing new and ambiguous situations. They are listed below:

Table 1: Principles of GHG accounting

Principle	Description
Relevance	The GHG analysis should contain information that users of the data (including both internal and external users), need for an informed decision-making. The analysis must reflect appropriate GHG emissions sources, sinks and removals, data and methodologies.
Completeness	The GHG analysis must include all relevant emissions and removals within the chosen assessment boundary.
Consistency	Data must be compiled and analysed in a manner that ensures information is comparable over time and across similar projects. Consistent use of accounting approaches, assessment boundary, quantification methods is important to enable meaningful comparisons.
Transparency	Suitable GHG assessment information must be disclosed in a clear, factual, neutral and understandable manner, to allow intended users to make decisions with reasonable confidence. Information needs to be amenable to internal review and external verification to attest to its credibility. Specific information exclusions or inclusions need to be identified, disclosed and justified. Independent third-party external verification is a good way to ensure transparency.
Accuracy	GHG assessment data must be sufficiently precise to enable users to make decisions with reasonable assurance that the assessment output is credible. Data biases and uncertainties must be reduced as far as practicable. Measurements, estimates and calculations should not over- or underestimate emissions.
Conservativeness	In cases of uncertainty, it is preferred not to underestimate emissions and over-estimate emission reductions.

Project teams should use the GHG accounting principles to interpret existing GHG accounting methodologies and calculation approaches, and whenever facing complex decisions during the GHG emissions estimation process.

3.4 Gross (or absolute) emissions, performance indicators and net emissions

As outlined in section 3.1, information about a project's impact on GHG emissions may be used to answer a variety of questions and different types of GHG figures should be selected or estimated, depending on the question in hand.

Estimates of **gross (or absolute) emissions, as the name suggest, provide information on the GHG emissions a project is expected to produce** (assuming these estimates are done ex-ante during project development). **They are crucial to gauge a project's contribution to global warming overall**. Emissions can be generated during the project's construction, or during its operations and may include direct emissions, from emission sources used by the project , as well as indirect emissions, from sources that provide services or products to the project (for a discussion on emission sources please refer to section

4.2 below). Typically, as for guidance from the IFI's TWG on GHG accounting, projects estimate (and report) annual GHG emissions in metric tons of carbon dioxide equivalent (tCO_2e) for a representative year, assuming the project is completed and operating at normal capacity. The IDB requires projects to report GHG emissions back to the Bank, if they produce significant gross emissions. Specifically, the Bank's current and proposed ESPF establishes that, when projects are expected to produce, or currently produce, more than tCO_2e 25,000 per year , the Borrower shall quantify and report to the bank, on an annual basis, direct as well as indirect emissions associated with the project[18]. Moreover, the ESG team may advise borrowers to report GHG emissions also in cases where such emissions are, or are expected to be, less than tCO_2e 25,000 per year, but the emissions are deemed significant to project risk[19]. In these cases, the metric can be used as a baseline to assess potential future GHG reductions.

Table 2: Definition of Global Warming Potential (GWP)

Global Warming Potential (GWP)

As different greenhouse gases affect the climate system differently, when calculating or reporting the emissions of a given gas, a Global Warming Potential (GWP) is used to adjust for the energy the emissions will absorb. Specifically, the GWP is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given time-period, relative to the emissions of 1 ton of carbon dioxide (CO2). Typically, the time-period used for the reporting of GHG emissions, and for the selection of the appropriate GWP, is 100 years (GWP_{100}). By and large GHG accounting practitioners use GWP tables compiled by the IPCC and published in IPCC's assessment reports. GWP values have changed over time, to reflect the increasing scientific understanding of the different greenhouse gases and of their effect on the climate system[20].

Estimates about a project's gross emissions are a useful data point about a project, and about IDB's investments. Taken in isolation, however, gross GHG emissions data are difficult to interpret: What does it mean that a project emits 5,000 tCO_2e per year? Or 150,000 tCO_2e per year? Additional contextual information is critical to assess the project's merit or compatibility with decarbonization strategies. **GHG performance indicators relate a project's emissions to non-GHG project metrics and create an intensity rather than an absolute figure** (e.g. $kgCO_2e$/unit, for manufacturing; $kgCO_2$/kWh, for electricity generation; gCO_2/pkm for transportation; tCO_2/ha for land use, etc.) [21]. **By comparing the value of a performance indicator over time, or with the value of similar projects, one can gain a better understanding of the project's relative performance, especially when the comparison is with best-in-class projects.** So, while absolute figures provide insights regarding a project's total climate change impact, intensity figures add context and allow to factor out, for instance, size of production or changes in absolute emissions due to economic growth or decline. In this respect, GHG performance indicators provide a (more) meaningful method for comparing projects in the same sector. **These indicators are also useful to assess the compatibility of a project with long term decarbonization goals, at country or sector level (i.e. full decarbonization), or to track the progress made by a given sector or country**. The example below shows how a performance indicator can be used along with a performance threshold to assess if a project can be deemed 'sustainable (in the eyes of the EU commission in this case).

18 Indirect emissions refer to Scope 2 emissions. See: https://www.iadb.org/en/mpas & http://www.iadb.org/document.cfm?id=665902

19 ESG might suggest to clients to include GHG accounting in their annual monitoring whenever the location or scope of the project is deemed sensitive or fragile. For example the installation of a polluting project in the amazon forest or in a country with low GHG contributions.

20 The following link shows the GWP_{100} published by IPCC in the second (SAR), fourth (AR4) and fifth (AR%) assessment reports https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

21 Another strategy used to provide context to GHG emissions data, especially with a public of non-experts, is to make a comparison with a phenomenon that is better known by the audience. A common approach is to estimate: for gross emissions, the number of cars that would generate similar GHG emissions or, for net emission reductions, the number of cars that, if removed from the road, would achieve similar emission reductions.

Table 3. Example of GHG performance indicators in use

Example: GHG Performance Indicators in use - The EU Taxonomy for Sustainable Finance[22]

To help steer capital flows towards activities and investments that contribute to achieving the EU's long term decarbonizations goals, the EU Commission has created a Technical Expert Group (TEG) on Sustainable Finance, comprised of public and private sectors stakeholders and experts, with a mandate to *develop recommendations for technical screening criteria regarding economic activities that make a substantive contribution to climate change mitigation or adaptation, while avoiding significant harm to other environmental objectives.*

Over a period of over a year, between 2018 and 2019 the TEG developed a Taxonomy and technical screening criteria, to help define:

- Activities that are already low carbon
- Activities that contribute to a transition to a net-zero emissions economy in 2050 but are not currently close to a net-zero carbon emissions level
- Activities that enable low carbon performance or enable substantial emissions reductions

The technical screening criteria have three components:

a. **Principles:** The underlying rationale for how the activity will result in a substantial contribution and/or avoidance of significant harm to the environmental objective in question.

b. **Metrics:** The method(s) by which the environmental performance of the economic activity will be measured, including defining the boundary for this measurement.

c. **Thresholds:** Qualitative or quantitative conditions which must be met to enable the performance of the activity in a way that is considered environmentally sustainable.

In several sectors, **GHG performance indicators are used as a metric to assess eligibility**, as illustrated by the examples below

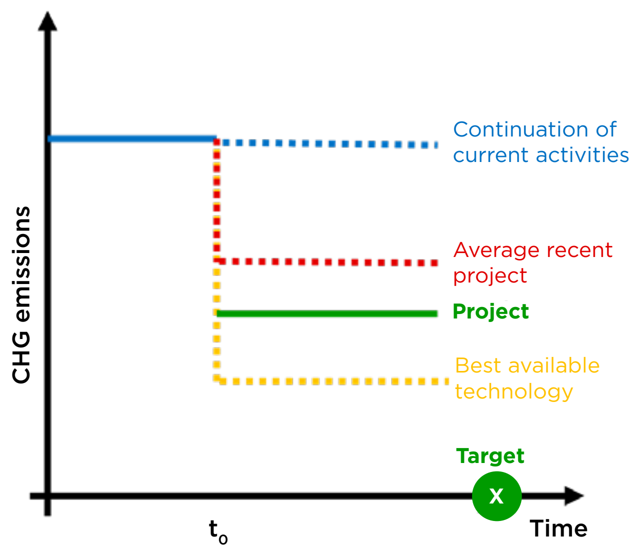
Sector	Threshold for eligibility using GHG performance indicators
Construction and operation of electricity generation facilities that produce electricity from solar PV, concentrated solar power, wind power, ocean energy, hydropower, geothermal, gas combustion.	Facilities operating at life cycle emissions lower than 100 gCO_2e/kWh, declining to 0 gCO_2e/kWh by 2050 (threshold to be reduced every 5 years)
Production of heat from gas combustion.	Facilities operating at less than 30 g CO_2e/kWh(th), declining to 0 g CO_2e/kHh(th) by 2050 (threshold to be reduced every 5 years)
Passenger rail transport and other public transport.	Zero emissions rail or other public transport is eligible Other rail or public transport are eligible if direct emissions are below 50 g CO_2e/pkm until 2025 (non-eligible thereafter)
Passenger car and light commercial vehicles.	Zero emissions vehicles are eligible Other vehicles are eligible if direct emissions are below 50 g CO_2e/km until 2025 (non-eligible thereafter)
Water collection treatment and supply.	Option 1 – average system consumption (including any abstraction, treatment and distribution) of 5 kWh per cubic meter billed Option 2 – the Energy efficiency of the water supply system is increased substantially by decreasing average energy consumption or water leakage by at least 20%

A specific comparison that is often made between the gross emissions of the project and the gross

emission of a scenario without the project, also called 'baseline emissions'. The difference between project and baseline emissions is called **net GHG emission** (expressed in tCO_2e), and net emissions estimates **may be useful to gain insight about the change made by a project**.

The estimation of net emissions requires project teams to select a 'without project' scenario against which to compare the project. Different scenarios can, in principle be selected, as shown by figure below. Target emissions can also be used for the comparison.

Figure 3. Comparison of project emissions and choice of scenarios



Baseline Scenario (and baseline emissions)
A hypothetical description of what would occur in the absence of the project – for example

- A continuation of the situation before the projects
- The most likely system that would deliver the same service delivered by the project in a similar timeframe

Target
An Emissions level that should be achieved within a specified timeframe to achieve a desired goal

E.g. to respond to the urgent treat of climate change on the basis of the best available scientific knowledge

The choice of alternative scenario, against which the projects is compared, plays a critical role in determining the type of information project teams can gain from the net GHG emissions figure, as different questions can be answered with different comparisons, as highlighted by the table below.

Table 4. Choice of comparison scenario and questions answerable

Baseline scenario chosen	Question answered
Continuation of current activities	Have we improved compared to the past?
Average recent projects	Have we improved compared to other common projects in this sector?
Best available technology	Are we performing as well as we can, given available technology?
Target	Are we on track to achieve our (decarbonization) goals?

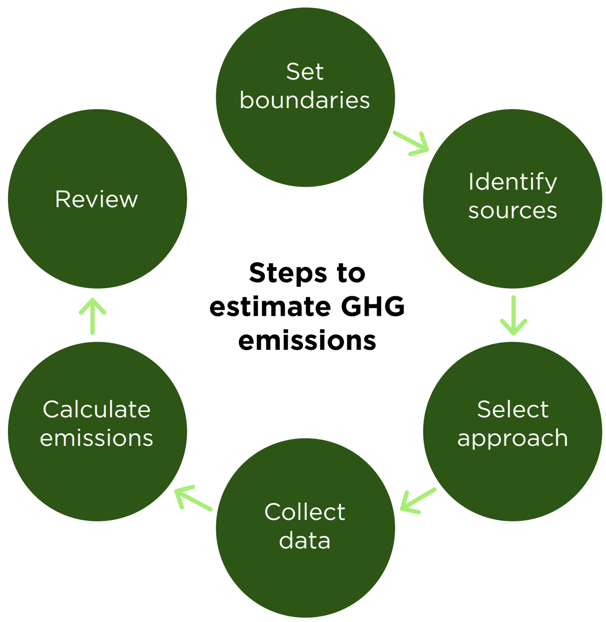
Gross emissions, GHG performance indicators and net GHG emissions data provide different perspectives about a project, its strengths and weaknesses, its impact on GHG emissions and its contribution towards (full) decarbonization goals. In practice, however, the estimates of gross GHG emissions, climate performance indicators and net GHG emission rely in similar estimation steps.

4. Steps to estimate the GHG emissions of a project

4. Steps to estimate the GHG emissions of a project

Project teams are recommended to follow the steps outlined in the picture below when assessing the GHG impact of a project.

Figure 4. Steps to estimate GHG emissions



4.1. Define project boundaries

- **The project boundaries used to estimate GHG emissions should be consistently with those used for the economic analysis**
- **The project boundaries should include primary and significantly secondary impacts**

IFIs Framework for a Harmonized Approach to Greenhouse Gas Accounting defines the project boundary for GHG accounting as including *all activities, facilities or infrastructure that the IFI is financing*. In recent (2019) meetings, IFIs have further elaborated on this definition by calling assessment boundaries the *physical delineation or geographical area that includes sources affected directly or indirectly by an investment project.*

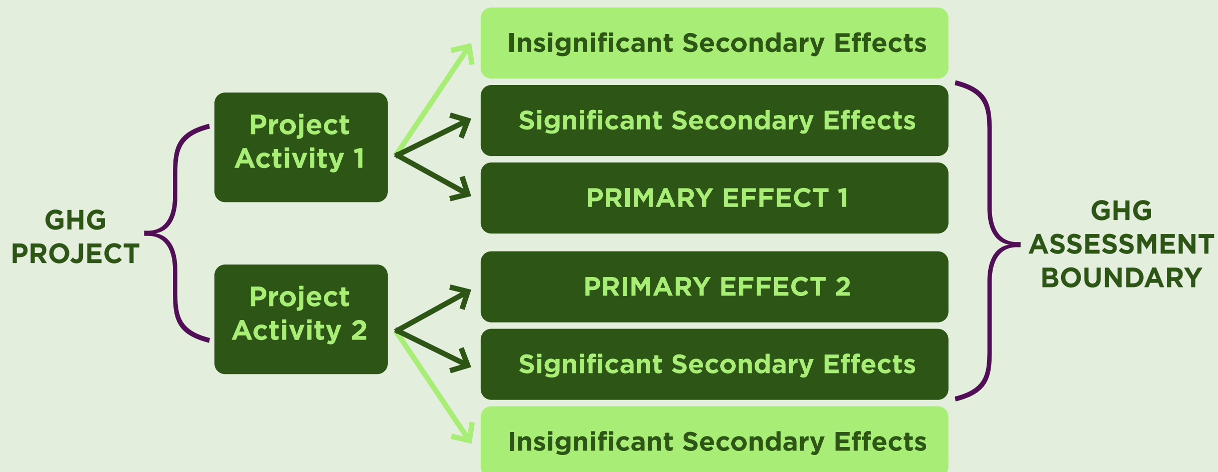
Selecting the boundaries to assess the GHG impact of a project is therefore like selecting the boundaries for a project's economic analysis and used to calculate the values of results matrix indicators. Teams can therefore focus on identifying the activities that affect GHG emissions within the boundaries established for the economic analysis. In other words. **the boundaries for the assessment of the GHG impact of a project, should be consistent and map into the boundaries used in the project's economic analysis**.

For activities that affect GHG emission, project teams should identify primary and secondary impacts. Primary impacts are always considered within the assessment boundary, while secondary project impacts are only considered when deemed 'significant'.

"The GHG Protocol for Project Accounting" [23] provides useful guidance on how to establish an assessment's boundaries when estimating net GHG emission and is a useful reference for project's boundaries setting in general.

Table 5. Selecting project boundaries, primary and secondary effects

Project boundaries – Approach of The GHG Protocol for Project Accounting
The GHG Protocol for Project Accounting requires the identification of different project's activities and of the primary and secondary project effects of those activities. The protocol recommends including primary and significant secondary effects in the assessment boundary



GHG Effects
GHG effects are changes in GHG emissions, removals, or storage caused by a project activity. There are two types of GHG effects: primary effects and secondary effects.

Primary effect
A primary effect is the intended change caused by a project activity in GHG emissions, removals, or storage associated with a GHG source or sink. Each project activity will generally have only one primary effect. The primary effect is defined as a change relative to baseline emissions.

Secondary effect
A secondary effect is an unintended change caused by a project activity in GHG emissions, removals, or storage associated with a GHG source or sink. Secondary effects are typically small relative to a project activity's primary effect. In some cases, however, they may undermine or negate the primary effect. Secondary effects are classified into two categories:

- One-time effects—Changes in GHG emissions associated with the construction, installation, and establishment or the decommissioning and termination of the project activity.
- Upstream and downstream effects—Recurring changes in GHG emissions associated with inputs to the project activity (upstream) or products from the project activity (downstream), relative to baseline emissions.

Some upstream and downstream effects may involve market responses to the changes in supply and/or demand for project activity inputs or products. Only significant secondary effects, however, need to be monitored and quantified under the Project Protocol. Whether a secondary effect is considered significant depends on its magnitude relative to its associated primary effect and on circumstances surrounding the associated project activity.

The example below shows primary and secondary effects of a hypothetical wastewater project

Table 6. Example of primary and secondary effects

Example: Wastewater project

A project finances the construction of a sewerage network and wastewater treatment plant in a city where such systems do not exist, and where households use latrines or septic tanks. The project leads to the replacement of latrines and septic tanks (which emit CH_4[24]) with the sewerage network and wastewater treatment plant (which do not emit CH_4 but use electricity and therefore emit GHGs indirectly). This is the intended effect of the project and is considered the primary effect for the purpose of GHG accounting.

The wastewater treatment plant also creates new jobs, which lead to additional traffic due to commuting to and from the plant. This is an unintended (albeit predictable) effect of the project. It is therefore considered a secondary effect. Compared to the primary effect, the emissions from commuting are small and this secondary effect can be considered insignificant.

4.2 Identify emission sources

- **Consult the guidelines by the IFI TWG on GHG Accounting and the overview table below**
- **Distinguish between and calculate emissions separately by Scope (1, 2, where material also 3)**

Estimating the GHG impact of a project requires the identification of the sources of GHG emissions of the project. **The GHG accounting community differentiates between direct and indirect emissions. Direct emissions are also called 'scope 1' emissions. Indirect emissions are divided in scope 2 and scope 3 emissions**.

From the perspective of a project, scope 1 emissions are from sources owned or controlled by the project, and they may occur either during project construction or during project operation. For example, if a project finances the construction of a gas power plant, the emission from bulldozers or from the forest cleared during construction are considered scope 1 emissions and so are emissions from the use of fossil fuels in the power plant during operations.

Scope 2 emissions are those indirectly caused by the project through electricity (or heat) consumption. These typically take place during a project's operation. For example, if a project finances the construction of a metro line, the emissions associated with the electricity used by the metro are considered scope 2 emissions for the metro line[25].

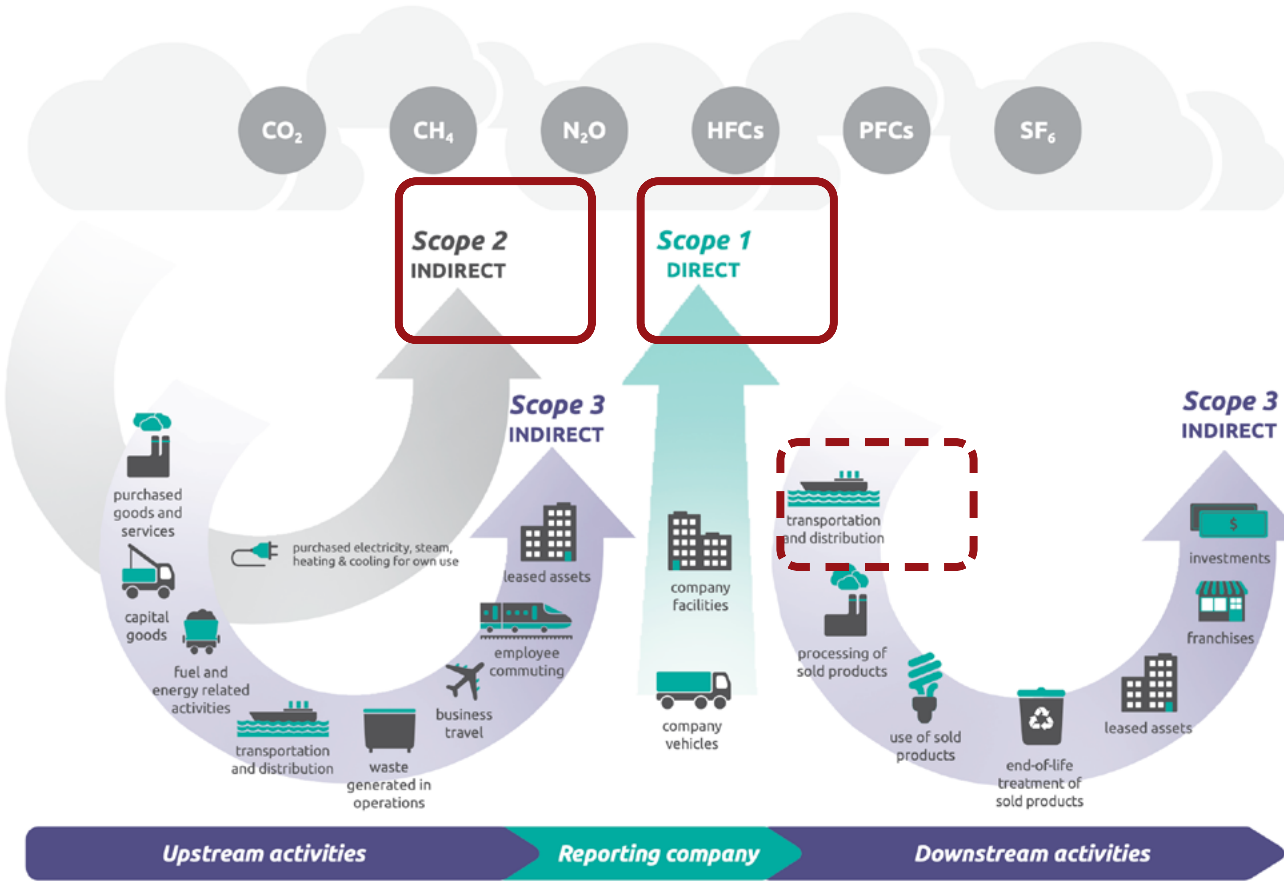
Scope 1 and scope 2 emissions are typically included in GHG emissions estimates.

The final category, scope 3 emissions, includes indirect emissions from all other GHG sources that can be linked with a project. This category is broad, and scope 3 emissions are therefore included in GHG assessments only when deemed relevant. The construction of a gas power plant, for example, may lead to scope 3 emissions from workers who commute to work. However, these emissions are extremely small when compared to the emissions of the power plant, don't make any material difference in the overall estimate and are typically excluded from the analysis. On the other hand, a new road construction project leads to substantial emission from the vehicles that use the road, while the construction of a Bus Rapid System (BRT) may result in reduced private vehicle traffic and fewer emissions. In these cases, scope 3 emissions from the vehicles ought to be included in the analysis.

24 IPCC's 5th assessment report estimates that, over a time-period of 100 years, CH_4 – methane - is 28 times more potent than CO_2 as a heat-trapping gas (CH_4 has a GWP_{100} of 28).

25 These emissions are the direct, or scope 1, emissions for the power plants that generate the electricity

Figure 5. GHG sources and scopes



Source: Greenhouse Gas Protocol.

The IFIs TWG on GHG accounting builds on the general practices of the GHG accounting community and recommends estimating scope 1 and scope 2 emissions, while scope 3 emissions can generally be excluded from the analysis. With some project types, however, the IFIs TWG on GHG accounting recommends the inclusion of some types on scope 3 emissions. The tables below provide a (non-exhaustive) overview of the GHG emission sources typically relevant for different types of projects.

Table 7. Project types and sources included in the GHG emissions estimates by scope

Type of project	Scope 1	Scope 2	Scope 3
Power production with fossil fuels	Combustion of fossil fuels		Upstream emission from fossil fuel extraction or processing
Power production - PV, wind, ocean energy			Upstream emissions from materials used during manufacturing
Power production - biofuels	Non-CO2 emissions from combustion (biofuels)		Upstream emission for biofuels production
Power production – hydropower and geothermal	Fugitive emissions when present		Life cycle[26] emissions from materials
Electricity transmission line	Change in land use Combustion of fossil fuel in construction equipment		Life cycle emissions of material used during construction
Road construction	Change in land use Combustion of fossil fuel in construction equipment		Combustion of fossil fuel in vehicles using road Life cycle emissions of material used during construction
Metro rail, railways, BRT	Combustion of fossil fuel in construction equipment Combustion of fossil fuel by vehicles during operations	Electricity use during operations	Life cycle emissions of material used during construction. (for net emissions) Combustion of fossil fuel in vehicles that would be used in absence of the projects.
Airport construction (similar categories apply to port/harbor construction)	Combustion of fossil fuel in construction equipment	Electricity use during operations	Combustion of fuel in airplanes using airport Life cycle emissions of material used during construction
Landfill	Combustion of fossil fuel in construction equipment Methane emission during operations		Fossil fuel used to transport waste
Wastewater treatment plant	Combustion of fossil fuel in construction equipment Methane and N_2O emissions during operations	Electricity use during operations	Life cycle emissions of material used during construction (for net emissions) Methane and N_2O emissions from households in absence of wastewater treatment plant
Potable water systems	Combustion of fossil fuel in construction equipment	Electricity use during operations	Life cycle emissions of material used during construction
Hospital, school, housing, or other building type	Combustion of fossil fuel in construction equipment Fossil fuel combustion for heating or cooking during operations	Electricity use during operations	Life cycle emissions of material used during construction
Government services		Electricity used to provide services	Combustion of fuels for travel by citizens using public services Life cycle emissions of paper used
Forestry and land conservation	Above and below ground carbon flows in project area		Above and below ground carbon flows outside the project area if caused by project's interventions

26 Life-cycle assessment (LCA, also known as life-cycle analysis, ecobalance, and cradle-to-grave analysis) is a technique to assess environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.

When analyzing and reporting projects' emissions, **project teams are recommended to follow the guidelines of the IFIs TWG on GHG accounting and to refer to the table above. Teams are also recommended to estimate and report emissions separately by scope**. Emission data broken down by scope add useful information about the project and its consistency with decarbonization efforts: Investments in (infrastructure) projects that consume fossil fuels during operations and have a long life time, lock-in scope 1 emissions for a the entire life time of the project, and generating emissions during such a long period of time may be incompatible with long term decarbonization goals. On the other hand projects that lock-in scope 2 emission from electricity consumption for a long period of time, may still be compatible with long term decarbonization goals, if renewable energy sources are increasingly used in electricity production and there is a goal to fully decarbonize the electricity grid (this is a common element of a decarbonization strategy).

4.3 Select and implement an estimation approach

- **GHG emissions estimates rely on a basic formula that multiplies an activity data by a GHG emission factor**
- **Project teams can use established methodologies and default parameters and emission factors (from IPCC, IFIs and others) if project specific data is not available**
- **The activity data used for the GHG estimate shoul be consistent with the data used i the economic analysis**

The steps of selecting an estimation approach, collecting relevant activity data and applying the data to the selected approach are tightly connected.

For guidance on the selection of an estimation approach, project teams are advised to use the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[27], which were refined in 2019[28], and the IFIs sector specific guidelines (for net calculations such as in renewable energy, energy efficiency and transportation projects) [29].

Depending on the project type, additional and more specific methodologies may also be found among the methodologies approved by the Clean Development Mechanisms (CDM)[30], the Voluntary Carbon Standard[31] or similar programs. Typically, the goal of these programs has been the 'creation' of carbon credits to be traded in carbon markets. These methodologies are primarily intended for use after project implementation, for an ex-post assessment of project impact, and their requirements are typically more stringent than what is appropriate for an organization such as IDB (for example, all projects are mandated to undergo third-party verification, which is not a practical approach for IDB). IDB teams can best take advantage of the methodologies offered by these programs by using them selectively, for example to identify an estimation approach (i.e. a formula to estimate GHG emissions), a default activity parameter or an emission factors that apply to their project.

IDB uses several calculation tools that are built on these methodologies and that are described in section 5 below.

All GHG emission estimates are grounded on a relatively simple set of formulas as shown below. In most projects, the complexity stems from collecting the activity data or identifying the emission factors needed for the analysis. **GHG emissions are typically expressed in metric tons (tonnes) of CO_2 equivalents (tCO_2e)**, and the units of emission factors are therefore in $kgCO_2e$ or tCO_2e per unit of activity data.

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27 The 2006 IPCC Guidelines for national level GHG inventories are available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/

28 The 2019 refinement of the 2006 methodologies is available at: https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html

29 The IFIs methodologies are available at: https://unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting/ifi-twg-list-of-methodologies

30 The CDM methodologies are available at: https://cdm.unfccc.int/methodologies/index.html

31 Voluntary carbon standard methodologies are available at: https://verra.org/

Type	Description	Generic formula
Gross emissions	Project-related (gross) GHG emissions	Project activity data * Emission factor
GHG Performance indicators	Relates or compares project related gross emissions with a project variable	(Project activity data * Emission factor) / chosen project variable
Net emission reductions	Compares project related gross emissions with the emissions of an alternative scenario or baseline	(Baseline activity data * Emission factor) - (Project activity data * Emission factor)

The activity data used in the GHG emissions estimates should be the same data used in the economic analysis and teams are encouraged to integrate the GHG assessment within the economic analysis as much as possible.

A good reference for emission factors and other parameters that may be useful to estimate project's GHG emissions are IPCC's Guidelines (the 2006 Guidelines for National Greenhouse Gas Inventories, and their 2019 refinement). The guidelines cover a broad set of economic activities and offer, among others, tier 1 (i.e. high-level) calculation approaches and default parameters, for various activity data and emission factors.

For projects that affect electricity consumption or production, IDB Project teams are recommended to use the IFIs Harmonized Grid Emissions Factors Dataset[32]. As mentioned above, this database contains country-level grid emission factors that can be used for IDB projects whenever detailed project data is not called for.

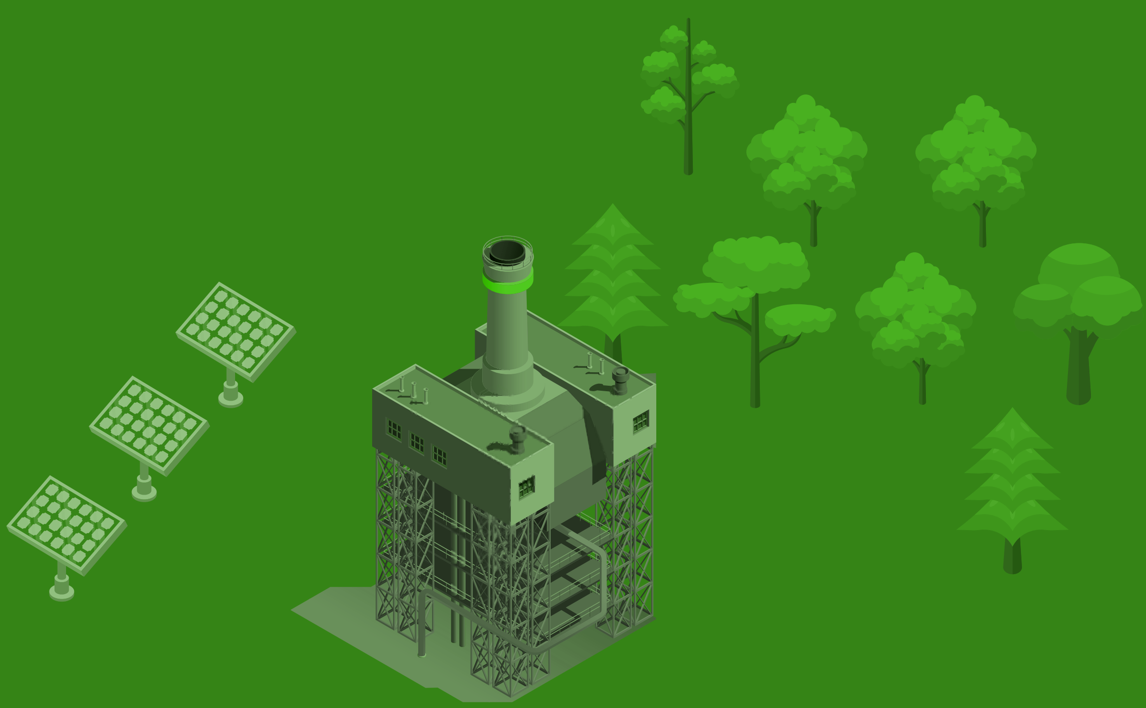
4.4 Review

- **Always incude a review step for the GHG emissions estimates**
- **Ensure that reviewers are independent and were not involvd in the intial estimation effort**

In GHG accounting, it is good practice to include a review process, ideally performed by someone who was not directly involved in the initial GHG emission calculations. The independent review process probes the logic and approach used in the calculation, along with key assumptions and activity data. It often uncovers small, and sometimes large, errors and it always improves the estimate, while increasing the level of knowledge of the teams involved with the project.

IDB project teams are recommended to include an independent review step for the GHG emissions estimates. Within IDB Both CCS and ESG have GHG experts that can support project teams, CCS can provide broad support on GHG accounting while ESG focuses on project's gross GHG emissions and associated compliance risks. GHG specialists from CCS and ESG can be contacted through the email: GHG_IDB@iadb.org.

5. IDB's processes and tools for GHG estimation



5. IDB's processes and tools for GHG estimation

5.1 IDB's GHG tools

The table below provides an overview of the tools IDB uses to estimate the GHG emissions associated with projects being approved. Most of the calculation tools were initially developed in 2012 with the support of the GIZ and are built around methodologies from the IPCC, along with calculation parameters from a variety of sources such as: the International Energy Agency (IEA), Climate Neutral network, Asian Development Bank (ADB), The US Environmental Protection Agency (US EPA), the GHG Protocol, World Resources Institute (WRI), The climate registry, the United States Department of Agriculture (USDA) amongst others. The tools are available for IDB staff in the Greenhouse Gas - Intranet page created in Sharepoint[33]. The GHG Accounting group, in TEAMS is also a useful source of inputs and advise.

These workbooks estimate emissions from the sources generally associated with each project type and can be customized for individual projects by replacing the default factors provided in the tool with project specific factors[34].

Table 8. GHG emission calculation tools

Project type	Gross GHG emissions from construction	Gross GHG emissions from operations	Net GHG emissions vs. baseline
Fossil fuel power plants	✓	✓	for EE operations
Energy sector - Renewable Energy	✓	✓	✓
Energy sector - transmission line development	✓	✓	
Biofuels (agricultural activities)	✓	✓	✓
Transport: BRT construction	✓	✓	lighting retrofits only
Transport sector: canal	✓	✓	
Transport sector: road construction	✓	✓	✓ (scope 3 based on change in average speed, traffic volumes and VKT saved)
Transport sector: airport construction	✓	✓	
Urban development housing	✓	✓	lighting retrofits only
Waste and sanitation	✓	✓	✓
Water sanitation	✓	✓	✓
E-government		✓	✓
Forestry			✓
All (IDB Invest) sectors - Carbon Emissions Estimation Tool	✓	✓	

The sections below provide additional details about these worksheets, along with information about guidance documents and external tools relevant for different project types. The descriptions are intended as an overview, while additional information is typically available within the tools or in accompanying

documentation[35]. The tools profiled below represent a partial list of tools used by IDB and are a small portion of the tools available to project teams to estimate project-level GHG emissions. This information will be regularly reviewed and updated as needed and made available to teams that want to estimate the GHG emission impacts of their projects.

5.1.1 Electricity supply

IDB/ESG developed four calculation tools for the electricity sectors, as described in the table below.

Project type	Description of calculation tool
Fossil fuel power plant	This model estimates CO_2, CH_4, and N_2O emissions from the combustion of fossil fuels in electric generation plants. The calculation uses data on the location, type and amount of fuel consumed along with fuel characteristics parameters and allows for adjustments for non-oxidized carbon. The fuel data that underpin the calculation are the critical input required for the estimate. The tool provides default values to characterize fuels (e.g. heat content and GHG emission factors) along with the option to overwrite such values and use project-specific parameters, if available, to better represent the fuel characteristics of a specific region, country or project.
Renewable energy	This tool can be used for solar, wind and hydropower projects (bioenergy projects are analyzed with a separate tool). The tool can be used to estimate gross emissions (from construction) as well as net emission reductions from the displacement of fossil fuel generation with renewable energy. Default operational emissions are assumed to be zero and are compared with baseline emissions (grid emissions) to estimate net GHG emission reductions. For grid-connected systems, default grid EFs are provided in the tool and using factors from the database developed by the IFIs TWG on GHG accounting.
Transmission line development	This model was primarily developed to estimate emissions related to the construction of transmission lines and stemming from the clearing of forested areas (or other changes in land use caused by the project), the combustion of fossil fuels by equipment employed in construction and the life cycle emissions of the materials used. Emissions associated with electricity consumption due to line losses during operations can also be estimated with this tool[36].
Biofuels	This tool can be used to estimate GHG emissions from agricultural activities associated with the production of biofuels. The tool includes estimation modules for: cultivation of soils, fuel use by farm vehicles and equipment, fertilizer application, lime application, crop burning, and fossil fuel use for onsite stationary combustion.

To support the work of project teams working on electricity supply projects, CCS has developed the following guidelines:

- IDB guidelines for grid connected renewable energy projects
- IDB guidelines for energy access operations

These documents provide guidance (form example on the choice of project boundaries, baseline emissions and grid emission factors) project teams can use to integrate a GHG emission estimation in the economic analysis models and in project documents prepared during project design.

35 TN-455 for example describes the assumptions used in IDB -ESG models. Some of these assumptions have since being update and relevant notes have been added in the calculation tools

36 Transmission system losses occur as electricity moves from one point to another in the transmission system, also knowns as fugitive emissions

5.1.2 Transport sector

Teams working on projects in the transportation sectors typically use traffic models to simulate travel behaviors with and without the project and to estimate expected project's impacts. Typically, these models estimate km traveled, average speeds and fuel consumption by type of vehicle. They often have the capability to simulate vehicle-related GHG emissions associated with the project (gross emissions), to compare project emissions with baseline emission (net emissions) and to use project data and model outputs to produce a variety of indicators (e.g. gCO_2/passenger km). To estimate GHG emissions and indicators, project teams are advised to use the GHG emissions estimation tools of their traffic models, whenever possible. In many cases this simply requires activating and using calculation modules already present in the traffic model and already populated with project data. CCS experts can assist project teams with this work or can act as external reviewers with project teams that desire a second opinion on existing estimates.

Transportation projects may also produce significant GHG emissions during the construction phase. IDB has developed tools to estimate construction-related emissions for a variety of project types.

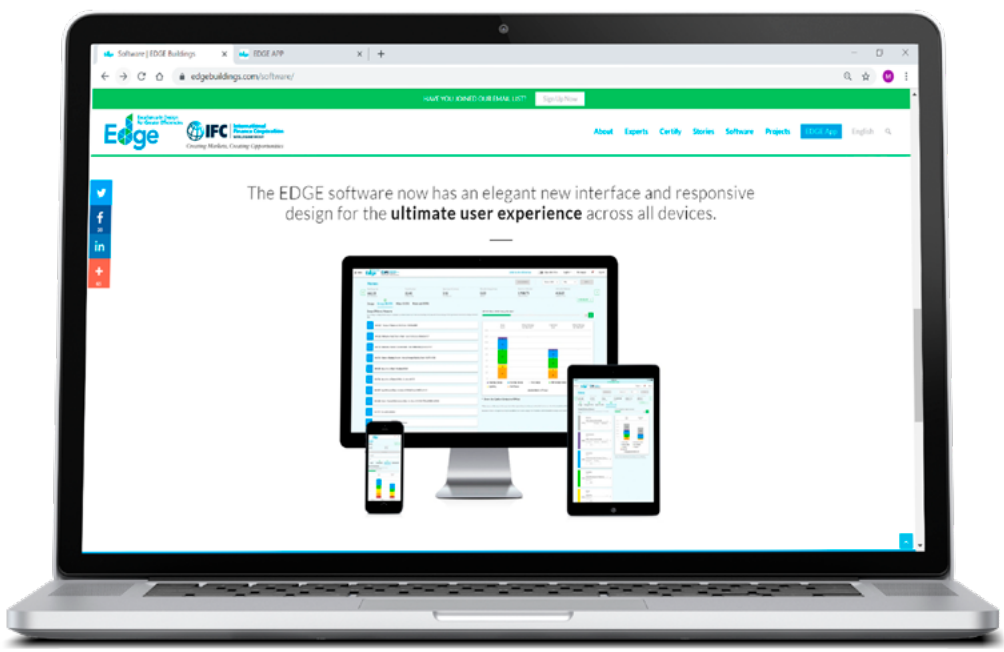
Project type	Description of calculation tool
BRT construction	This calculation tool estimates construction-related emissions, including emissions from land use change, energy used by equipment deployed during construction and (life cycle emission estimates) materials used for buildings and road construction.
Road construction	The tool estimates emissions from road construction projects modeling emissions from land use change, fossil fuel use during construction (from machinery) and construction materials (using Life Cycle Emissions estimates). The methodology to estimate emissions from land use change considers the type land being cleared and the tool includes default emission factors for various types of land cover as well as for fuels and materials typically used during construction. For emission from operations, the tool includes a module to calculate emissions from electricity used by streetlights or other electric road lighting or signage. Finally, the tool includes a basic module to estimate scope 3 emissions from vehicles expected to use the road. The traffic models used to plan road construction can typically provide a completer and more accurate estimate and are generally preferable to using this tool. The tool, however, could be used for preliminary estimates during early stages of project design.
Canal construction	The tool estimates emissions from land use change during construction as well as operational emission from fuel used by the tugboat fleet during canal operations, using data on the quantity and type of fossil fuel consumed. The tool also includes a module to estimate emissions from additional ship traffic enabled by the canal expansion, which is considered an indirect Scope 3 emission source, included in the tool because of the significance of this source with canal expansion projects.
Airport construction	This tool was built to estimate construction emissions from land clearing and paving and operational emissions from purchased electricity. The methodology estimates emissions from land use change using data on the type and area being cleared and a default emission factors for various types of land cover.

5.1.3 Urban development and housing/buildings

IDB finances building developments for a variety of uses, including housing, hospitals, schools, public building, etc. With both brownfield and greenfield developments, a variety of choices affect project's initial capital investment (CAPEX) and operational costs (OPEX) as well as the GHG emission associated with construction (e.g. through choice of materials) and building operations (e.g. through design or choice of insulation and equipment). A growing number of IDB teams analyze the potential costs and GHG impact of building construction or renovation, with the analytical software tool provided by the EDGE (*Excellence in Design for Greater Efficiencies*) initiative. The EDGE tool helps teams determine *cost-effective options for designing green, low GHG, buildings within a local climate context* and can be used, if desired, to pursue EDGE certification, which requires a project to use 20 percent less energy, 20 percent less water, and 20 percent less embodied energy in materials than a base case building. A screenshot of the home page for the EDGE tool is reproduced below[37].

Besides software and standard the EDGE 'ecosystem' includes a variety of supporting support materials and training modules that project teams can access as needed. Some of the training courses offered by the EDGE initiative are in Spanish[38].

Figure 6. EDGE tool home page



As well as using EDGE, project teams can also use the IDB model for buildings, which is described below

Project type	Description of calculation tool
Housing	This calculation tool estimates GHG emissions from housing and urban developments by modeling emissions from land clearing, fossil fuel combustion and materials used during construction. The tool includes a module to estimate emissions during operations from fossil fuel, electricity and water usage.

The estimate of the GHG emissions impact of urban development projects, at neighborhood or larger scale, is typically more complex than estimating emission from the construction of an individual building,

as such projects may affect a variety of GHG emission sources, including in buildings, transport (e.g. if the urban development affects transport modes), water supply, waste management, wastewater management and land use (e.g. if a park is converted into buildings or a lot is converted to park). Estimating the overall impact is complicated because of the interactions between different interventions within the project and between the project and the broader urban context in which it is located. IDB does not have a tool of choice or template to assess the GHG impact of these types of projects[39]. Teams involved in urban development projects are advised to estimate GHG emissions using ad-hoc approaches that combine a variety of tools and can best model their project.

5.1.4 Water, sanitation water and wastewater

IDB has developed two tools to assess the impact on GHG emissions of water and water sanitation projects, as described below.

Project type	Description of calculation tool
Solid waste	The calculation tool estimates construction and operational emissions for incinerator and landfills operations, also considering emissions associated with waste transport. Emissions from incineration are estimated using data on the volume and type of material incinerated. The disposal of solid waste in landfills typically leads to the production of methane from the anaerobic decomposition of waste. This methane may or may not be recovered and used. The tool estimates emissions from landfills from the mass of waste landfilled, waste composition parameters, default or custom factors for the amount of organic carbon in different types of waste, emission factors (differentiated by type of climate) and methane recovery rates. The method used assumes that all potential CH_4 is released from waste in the year the waste is disposed of [40]. The calculation tool estimates emissions from fuel use during transportation of waste considering the type and amount of fuel used, or vehicle type and miles traveled.
Wastewater and water supply	This tool calculates GHG emissions from wastewater treatment facilities, which are produced during the aerobic or anaerobic treatment process of organic matter in the wastewater. Fugitive emissions from the nitrogen content, and the combustion of captured digester gas can also be estimated with the tool. Wastewater treatment facilities may be energy intensive and the tool includes a module to estimate Scope 2 emissions from purchased electricity, which is based on annual electricity consumption and either country specific emission factors or user-defined, project specific, emission factors. When anaerobic digestion occurs and methane is collected and used, the tool estimates digester gas data from the plant or using population data. This estimate is based on default factors or user-defined, project specific, factors for: percent methane in the digester gas, combustion efficiency, heat content, and CO_2, CH_4 and N_2O emission factors for methane combustions. Critical inputs in this tool include population served by different types of wastewater management systems and average Biological Oxygen Demand (BOD) produced per person. This tool includes modules to estimate emissions associated with the collection treatment and distribution of potable water. Typically, these are indirect, scope 2, emissions from electricity consumption. Critical variables in this estimate are population served, water supplied and technology efficiency (average electricity consumption per unit of water). This tool as well includes modules to estimate emissions associated with the transportation of sludges to the landfill site.

To facilitate the collection of the data required to estimate the GHG impact of wastewater projects, CCS

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39 There is an ongoing search for tools that can model these types of projects. To learn more and for up to date information about this effort, teams are advised to contact their Division GHG experts or CCS

40 In landfills decomposition, and associated emissions, take places over several months or years after disposal, where the time required for full decomposition depends on the type of material being decomposed, along with climatic and landfill conditions. The approach used in the tool simplifies the calculation and gives a reasonable estimate of a given year's emissions especially when the amount and composition of the waste disposed is relatively constant over time.

has developed a questionnaire that project teams can use to identify, collect and organize activity data about the project. The questionnaire provides a brief overview of the GHG emissions sources typically present in a wastewater project and includes questions designed to describe the project and collect the activity data needed to estimate baseline emissions (separated for each relevant plan, if relevant) and project-related emissions (also separated for each relevant plan, if relevant). The example below shows the first page of a questionnaire that was used to collect activity data for a 2019 project.

Figure 7. Activity data collection for wastewater projects. Questionnaire example.

Collection of activity data - wastewater questionnaire extract

Project RG-L1131

The information below is based on preliminary data and will be revised after Analysis mission

PART I: General project description

1. Is this a "multiple works" type of project? If yes, then how many wastewater system projects are we including in the sample and how many will be included in the rest of the project?
   - Multiple works
2. Would all investments on wastewater systems manage the same type of treatment technology?
   - The Project will involve 5 cities for $ 80 million. Overall two cities will be used as representative sample, most likely Concordia in Uruguay and Guadaguavchu in Argentina. There are some similarities between cities but also differences, for example some have wastewater treatment plants in place (albeit underperforming) while others have partial sewerage coverage but no WWTP
3. If the project finances a series of systems, please list them in the table below, along with the anticipated investment. If part of the project's budget has not yet been allocated, for the unallocated portion indicate "TBD." and use the comment field to add information about the expected similarities or dissimilarities between TBD investments and known investments (please provide your best input, granted that a medium to high level of uncertainty is expected about TBD investment).

Plant/investment name	Expected investment (US$)	Expected completion date	Comments
Concordia	About $20 million	Representative project	The city has sewerage network but no WWTP
Guadaguavchu	About $ 20 million	Representative project	The city has a aerobic WWTP but the plant is inadequate for the needs of the city and the lagoons emit CH4
Colon			Provincial government has studies
Concepcion de Uruguay			
San Jose			

4. For each financed plant please provide a brief verbal description of the baseline scenario (the situation without the project) and the expected situation with the project (it can be as simple as "*for baseline 5,500 beneficiaries in 2,000 households not served by sewage systems and using septic tanks and latrines and project scenario*")

5.1.5 E-government/digitalization

E-government projects, and projects that change government (or business) operations in general, may affect GHG emissions by changing:

1. The level of travel required from citizens needing a service
2. The amount of paper used to provide a given service to a citizen
3. The electricity consumption required to provide services digitally
4. (if a significant volume of services is provided digitally rather than in person) The floor space required in public buildings to provide the services

IDB has developed a calculation tool that models changes in the first three variables listed above to estimate the impact on GHG emissions of e-government project and, in general, of projects that change how (public) services are delivered and lead to a reduction in travel or material (e.g. paper) use. Whereas the uncertainties associated to these types of estimates is high, the model nevertheless helps teams analyze potential project's emissions and the drivers that affect those emissions. This can be useful to refine project design and ensure that desired GHG emission outcomes are achieved.

The calculation tool is flanked by a data collection template that can be used to guide the collection of data about the 'without project' and 'with project' scenarios. The template includes a brief description of how e-government projects affects GHG emissions and tables listing the activity data required for the estimates.

5.1.6 Forestry and agriculture

The analysis of forestry projects, and land use projects in general, may be undertaken using general approaches developed by IPCC to assess carbon stocks and flows (and CH_4 and N_2O emissions) from agriculture, forest and other types of land uses (AFOLU)[41] or specific methodologies developed to estimate the impact of projects that reduce emission from deforestation and forest degradation or invest in forest conservation, sustainable management of forests, or enhancement of forest carbon stocks (collectively called REDD +). Different methodologies are suitable for different project types and IDB has not developed an omni-comprehensive calculation tool for this category. Project teams are advised to familiarize with available methodologies and deploy an approach that best suits their project. Project teams interested in estimating the GHG emissions impact of forestry or agriculture projects are encouraged to connect with the GHG emission experts within their Division or with CCS.

For projects with large scale impact, from direct project interventions or indirect impacts outside the project area, a tool available to IDB teams is an IEEM-ESM modeling platform, 'owned' by the RND Division, which combines Integrated Economic-Environmental Modelling (IEEM) and ecosystem service modeling (ESM).

IEEM is a forward-looking computable general equilibrium framework that enables the analysis of the impact of public policies and investments on standard economic indicators such as GDP, income and employment, but also on wealth and natural capital assets. Spatially explicit ecosystem service modeling (ESM), on the other hand, estimate public policy and investment impacts on land use and associated ecosystem services for which in many cases, markets do not yet exist[42].

By linking an IEEM platform with ESM modules, the IEEM-ESM platform allows project teams to assess policy and investment scenarios in terms of socio-economic variables (e.g. GDP, income and employment), as well as land use land cover (LULC) and ecosystem services. Specifically, the ESM tool can:

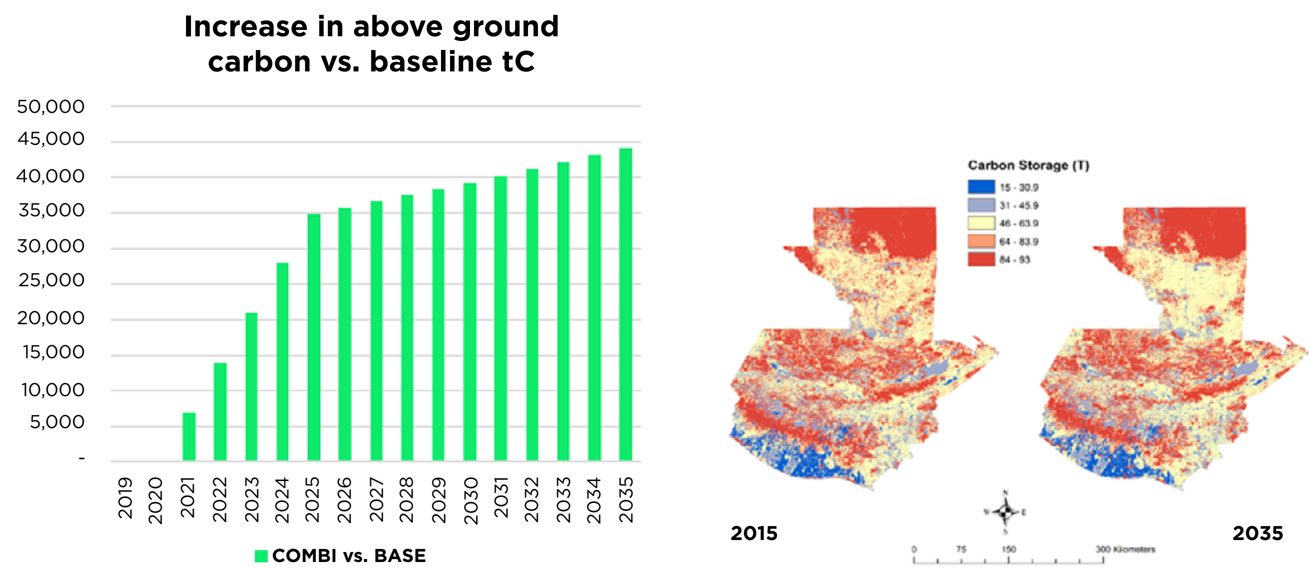
41 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use, available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

42 Many regulating ecosystem services provide benefits to people, though due to missing markets, they do not have a market price. Where these services are not quantified or valued, they are most often not taken into account- explicitly- in decision making.

- Produce LULC maps for the base year and subsequent years for which IEEM is used to evaluate different policy and investment scenarios
- Estimates the impact of land use change on carbon storage and flows[43].

Model results can inform project design and can be readily used in project documentation, as shown by the example below.

Figure 8. Examples from project GU-L1165 on sustainable forest management. Increase in above ground carbon and total aboveground carbon by geographic area for years 2015 and 2035



5.2 Good practices in documenting and presenting GHG assessment results

GHG emissions can be embedded in a project's economic analysis or can be performed independently with separate tools. Regardless of how the analysis is performed, it is useful for project teams to remember some important good practices.

The data used in the GHG assessment should be the same data used in the economic analysis and teams are encouraged to integrate the GHG emission assessment in the economic analysis, as much as possible. **Teams are also encouraged to use a shadow price of carbon for a more holistically estimate of a project's impact**, including its externalities (see appendix 1).

The results of the GHG emissions estimates (project's gross emissions and/or net emissions and/or performance indicators) **should be included, as appropriate, in relevant project documents and systems**, along with references to detailed calculations and documentation.

Guidance for ESG personnel on Inclusion of gross GHG emission estimates in project documentation.

Preferably the gross GHG accounting results performed, ex-ante, during ESG assessment, should be included on the Environmental and Social Assessment (ESA) or in the Environmental and Social Management Report (ESMR). This would further increase transparency in the project design phase, allowing for a better assessment and reporting of project's climate change transition risks[44] and facilitating public reporting. As of 2019, aggregate gross emissions, for the portfolio of projects approved in the year, are reported publicly via the sustainability report.

When documenting and presenting the results of their GHG assessments, project teams are recommended to be as transparent as possible about the calculation methodology, the data and the assumptions used in the calculations.

Transparency is critical to ensure the usability of the GHG emission analysis throughout the project life cycle. Specifically, project teams are strongly recommended to do the following:

- Along with a protected version of the calculation file, include an unprotected/editable version (e.g. excel file) in the project documentation. This facilitates a review, revision and update of the initial analysis during, or after, project implementation.
- In the calculation file:
    - » Explicitly show activity data, emission factors and calculated emissions for both the baseline and the project scenario (when project emissions are zero this is not critical, but may still be useful)
    - » Include labels that are as clear as possible for a user that may not be familiar with the project and, if in doubt, include more granular calculation steps and details. For example, with a GOM (Multiple Works Programs) project, it is advised to transparently show the estimated emissions (gross and/or net) for the representative sample as well as the scaling-up factor (or procedure) used and the resulting projected total impact.
    - » Include 'comment cells' with information on the data sources used and the assumptions made in the calculations, ideally using cells next to the cells where data is used, or assumptions are made. This helps future users when tracking or revising the sources of data.
    - » Explicitly state the units (MWh/year, tCO2/kWh, etc.) of cell, rows or columns. It is recommended to include the unit in a separate cell, rather than in cells with other text (e.g. the label for a column). This make the unit more visible and, if desired, the unit can be used (in other cells) as a 'calculation' input.
    - » Use different colors for different cells, depending on the cell content, to show if cells contain: input data obtained from external sources, assumptions made by the project teams, calculation, data calculated elsewhere in the calculation file
- Include in the project documentation a (short) narrative document (e.g. word document), describing the definitions, assumptions and methodology used to estimate GHG emissions, including references to external documents (project documents and not) whenever relevant

44As pointed out by the Bank of England *Transition risks can occur when moving towards a less polluting, greener economy. Such transitions could mean that some sectors of the economy* [with higher GHG emissions] *face big shifts in asset values or higher costs of doing business. ... One example is energy companies. If government policies were to change in line with the Paris Agreement, then two thirds of the world's known fossil fuel reserves could not be burned. This could lead to changes in the value of investments held by banks and insurance companies in sectors like coal, oil and gas.* Estimating the GHG emissions expected from a proposed investment is critical to understand the risk such emissions represent for the value of the investment.

Table 9. Example of a calculation format that increases transparency

Example of calculation file format

The example below shows a calculation file for a hypothetical PV project in Argentina showing activity data, emission factors and emissions for project and baseline along with estimated emission reductions. The table has a separate column for 'units' and one 'comments' where references to external file and data sources is included. The cells are color coded: blue for inputs, yellow for assumptions, green for calculations, gray for cells that use/report data entered elsewhere in the sheet.

	Units	2020	2025	2030	Comment
Project					
Electricity production	MWh/year	20,000	20,000	20,000	see technical documentation xyz, also used in economic analysis file twr
Project emission factor	tCO2/MWh	-	-	-	assumption (based on emissions from operations)
GHG emissions	tCO2/year	-	-	-	calculation
Baseline					
Electricity production	MWh/year	20,000	20,000	20,000	based on project's electricity production
Grid Emission factor	tCO2/MWh	0.497	0.497	0.497	From IFIs DEFs - CM for intermittent generation, Argentina
GHG emissions	tCO2/year	9,940	9,940	9,940	calculation
Emission reductions					
GHG emissions	tCO2/year	9,940	9,940	9,940	calculation

6. Conclusions and Next steps

6. Conclusions and Next steps

This document provides a general introduction to the approach used within the IDB to estimate GHG emissions during project design. After discussing some of the concepts and standards used by the GHG accounting community, the document illustrated the typical steps required to estimate GHG emissions and described some of the tools available to IDB teams.

This document is part of a set of sector specific documents and on-line resources that CCS and ESG are developing. This document, as well as the associated sector guidelines and tools will be regularly updated, as needed. They are available online, for IDB personnel, in the Greenhouse Gas - Intranet page created in Sharepoint[45].

Project teams are invited to use this document and the additional materials available online and to connect with GHG accounting experts within their Divisions and at CCS and ESG, whenever further guidance is required. The '*GHG Accounting*' group, in TEAMS is also a useful source of inputs and advise.

APPENDIX

7. Appendix 1: IFI's Default Grid Emissions Factors (DEFs)

The methodology deployed by the IFIs assumes that, unless otherwise specified, electricity produced from renewable sources or changes in electricity consumption (positive and negative) from projects, will affect electricity production that would be generated, wholly or partly, from carbon-intensive sources. Building on methodologies developed for the Clean Development Mechanism (CDM), **the IFIs agreed to estimate the GHG emissions of these carbon-intensive sources by combining information about the grid's Operating Margin (OM) and Build Margin (BM)**[46], where:

- **The OM represents the cohort of existing power plants whose operation will be most affected** by the project. i.e. the cohort of existing plants that are most expensive to operate
- **The BM represents the cohort of the prospective/future power plants whose construction and operation could be affected by a project.** BM is based on an assessment of planned and expected new generation capacity.

OM and BM are combined in a Combined Margin (CM), used to estimate baseline emissions. The CM is a weighted average of OM and BM with weights that are different for different types of projects, as shown by the table below[47]:

Table 10. Combined Margin for different categories or projects using different weights for OM and BM

Category or projects	Weight of OM (%)	Weight of BM (%)	Examples of projects
Renewable energy, Intermittent generation	75%	25%	Wind, solar PV
Renewable energy, Firm generation	33%	67%	Hydropower, concentrated solar power, geothermal power, bioenergy projects
Projects increasing the efficiency in the use of electricity	33%	67%	Replacement of old electric motors with new efficient ones
Projects leading to an increase in electricity consumption	33%	67%	wastewater treatment plant, metro system, vehicle electrification in general

The example below illustrates how the combine margin is calculated for renewable energy projects that provide intermittent versus firm energy.

Example – calculation of combine margin for intermittent and firm generation

In a country where OM is 0.8 tCO_2e/MWh and BM is 0.4 tCO_2e/MWh

- the CM for a solar PV project (intermittent) is 0.8 * 75% + 0.4 * 25% = 0.7 tCO_2e/MWh
- the CM for a hydropower project (firm) is 0.8 * 33% + 0.4 * 67% = 0.532 tCO_2e/MWh.

For the purpose of promoting greater harmonization, the IFI GHG Accounting TWG (IFI TWG) maintains a common dataset containing Default Emissions Factors (DEFs) for countries and interconnected grids, where applicable[48]. The DEF is based on data from the International Energy Agency (IEA), The Energy Statistics Database for OM calculation and the World Energy Model (WEM), New Policy Scenario (NPS), for BM estimates[49].

For the ex-ante analysis of expected project's impacts on GHG emissions, the emission factors (EFs) in the DEFs represent a reasonable estimate of baseline emissions for grid connection renewable energy and for electricity consumption during initial project years. The fact that the DEFs uses the same approach across countries and the transparency of the methodology used in the calculation of the EFs are two of the strengths of this database, along with the fact that all IFIs are using it.

IDB Project teams are recommended to use grid emission factors from IFI's DEFs when estimating baseline GHG emissions for projects that affect grid electricity production or consumption. Project teams have the option to use project-specific emission factors, if desired, in cases where more specific and accurate data is available about a project's impact on grid's electricity supply or demand, and where the use of a project-specific emission factor would make a significant difference in the ex-ante estimate. If project specific rather than DEFs emission factors are used, project teams are advised to:

- Clearly describe the methodology and sources used to calculate the emission factor
- Include a comparison between the project-specific emission factor used in the estimate and the relevant emission factor form the DEFs
- Coordinate with other project funders (especially if they include other IFIs) to ensure consistent estimates across co-investors

June 2019 emissions factors for Countries in which IDB may finance projects are shown below. The full database of default grid emission factors can be found at the following web address: https://unfccc.int/sites/default/files/resource/Harmonized_Grid_Emission_factor_data_set.pdf.

Table 11. IFIs default grid emission factors, June 2019

	Renewable Energy production		Electricity consumption	
Country	**Firm Energy (e.g., Hydro, Geothermal, Energy Efficiency)**	**Intermittent Energy (e.g., Sola, Wind, Tidal)**	**Energy Efficiency projects**	**New projects leading to increased electric-ity consumption**
	kgCO2e/kWh	*kgCO2e/kWh*	*kgCO2e/kWh*	*kgCO2e/kWh*
Argentina	0,350	0,497	0,350	0,350
Bahamas	0,462	0,669	0,462	0,462
Barbados	0,502	0,684	0,502	0,502
Belize	0,304	0,461	0,304	0,304
Bolivia	0,409	0,529	0,409	0,409
Brazil	0,201	0,296	0,201	0,201
Chile	0,339	0,532	0,339	0,339
Colombia	0,231	0,309	0,231	0,231
Costa Rica	0,145	0,215	0,145	0,145
Dominican Republic	0,460	0,566	0,460	0,460
Ecuador	0,404	0,586	0,404	0,404
El Salvador	0,344	0,491	0,344	0,344
Guatemala	0,402	0,564	0,402	0,402
Guyana	0,607	0,723	0,607	0,607
Haiti	0,703	0,829	0,703	0,703
Honduras	0,473	0,654	0,473	0,473
Jamaica	0,543	0,672	0,543	0,543
Mexico	0,320	0,450	0,320	0,320
Nicaragua	0,429	0,606	0,429	0,429
Panama	0,361	0,551	0,361	0,361
Paraguay	0,043	0,016	0,043	0,043
Peru	0,301	0,424	0,301	0,301
Suriname	0,485	0,741	0,485	0,485
Trinidad and Tobago	0,424	0,561	0,424	0,424
Uruguay	0,158	0,237	0,158	0,158
Venezuela	0,345	0,534	0,345	0,345
Other Latin America				
Latin America Average	0,375	0,515	0,375	0,375
Central America Average	0,347	0,499	0,347	0,347
South America Average	0,323	0,452	0,323	0,323
Caribbean Average	0,516	0,663	0,516	0,516

8. Appendix 2: Shadow price of carbon

The shadow price of carbon is an accounting instrument used to adjusts a project's cost (if the project is a source of GHG emissions) or benefit (if the project is a sink of GHG emissions) to incorporate a hypothetical carbon price into the investment decision. Underlying the use of a shadow price of carbon is an estimate of the expected GHG emissions of the project (in tCO_2e). The emissions estimates are multiplied by the shadow price of carbon (in $/$tCO_2$) to estimate the cost of the project's GHG emissions. If different alternative projects are compared, GHG emissions are estimated for each of the alternatives and a shadow price of carbon is applied to estimate full costs (inclusive of GHG emission costs) and more holistically compared the project alternatives. It has been argued that development banks can use a shadow price of carbon as a tool to raise awareness and promote a shift of investments towards more sustainable projects. Several developments banks currently use a shadow price of carbon to guide (at least some) investment decisions[50].

While IDB does not have a mandatory policy or guideline for the use of a shadow price of carbon, project teams that elect to include a shadow price of carbon in their economic analysis are recommended to use low and high estimates of the carbon price from the *Report of the High-Level Commission on Carbon Prices*[51].

What is the High-Level Commission on Carbon Prices?

The High-Level Commission on Carbon Prices comprises economists, climate change and energy specialists from all over the world and is chaired by Joseph Stiglitz, Nobel Laureate in Economics, and Lord Nicholas Stern. Its goal is to help spur successful implementation of the Paris Agreement.

The Commission was convened by The Carbon Pricing Leadership Coalition (CPLC), a voluntary partnership of national and sub-national governments, businesses, and civil society organizations that agree to advance the carbon pricing agenda. The CPLC secretariat is administered by The World Bank[52].

In 2017 the Commission undertook an extensive research to estimate the carbon price that, if applied globally, would lead to GHG emissions compatible with the goals of the Paris Agreement. The results of this work were published in a report titled: *Report of the High-Level Commission on Carbon Prices*.

The table below summarizes the recommended shadow prices for years 2020, 2030 and 2050. The 2020 and 2030 values are provided by the Report of the High-Level Commission on Carbon Prices, while the 2050 values are extrapolated from 2030 to 2050 using the same growth rate of 2.25% per year that is implicit, in the Report, between 2020 and 2030[53].

Table 12. Shadow price of carbon from High-Level Commission on Carbon Prices

	Shadow price of Carbon	
	Low	High
Year 2020	US $ 40	US $ 80
Year 2030	US $ 50	US $ 100
Year 2050	US $ 78	US $ 156

50 See Cesar Gabriel Espinosa Garcia *Shadow carbon pricing and the role of development bank* 'NAFIN fellowship program working paper 2 n. 2 march 2018 http://www.lse.ac.uk/lacc/publications/PDFs/Cesar-Espinosa-Garcia-WP2-GR.pdf

51 High-Level Commission on Carbon Prices. 2017. Report of the High-Level Commission on Carbon Prices. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO, Available at https://academiccommons.columbia.edu/doi/10.7916/d8-wdsr-wa14/download.

52 More information about the High-Level commission can be found at: https://www.carbonpricingleadership.org/highlevel-economic-commission-1

53 The High-Level Commission report does not prescribe any specific carbon price values beyond 2030

9. Appendix 3: A brief overview of GHG accounting and reporting at IDBG

The IDB has calculated and reported GHG emissions since 2011. From 2011 to 2017 the environmental and social safeguards unit (ESG) calculated both net and gross GHG emissions, contributing emission data for IDB reporting. Starting with the 2018 calculation exercise, the Climate Change and Sustainability (CCS) unit has been supporting project teams with net GHG emissions estimates, with the development and estimate of GHG indicators and with reporting.

As of 2019 the Environmental and Social Safeguards (ESG) division calculates gross GHG emissions for all category A and B projects and are included on the sustainability report. Following the approach outlined in TN-455[5455], which describes the methodology, tools and some of the key parameters used in the calculation. These tools were developed in conjunction with the GIZ. ESG is aiming at increasing transparency about project-related gross emission and is working at including GHG emissions estimates in ESG's project pages[56], targeting, as a start, category A and B projects.

Projects that are expected to produce, or currently produce, more than 25,000 metric tons of CO_2 equivalent per year, are mandated to monitor and report GHG emissions data to the bank .[57] This data is included in the Semi-Annual or Annual Environmental and Social Compliance Report[58]. This requirement was first introduced with OP-703[59] and is reaffirmed with the proposed Environmental and Social Policy Framework (ESPF). In these cases, **the borrower is required to quantify, annually, gross emissions from the project, including direct as well as indirect emissions[60], and in accordance with internationally recognized methodologies and good practice. The Bank can provide a borrower a suitable methodology if the borrower does not have one.**

By and large, net GHG emissions estimate are grounded on the approaches developed by the IFIs TWG on GHG accounting and on the methodologies developed by IPCC and the GHG Protocol. Some of the calculation tools used to estimate gross GHG emission are also used for the estimation of net GHG emissions. For some project types, however, external tools are also used. To guide teams in their GHG emissions assessment, some calculation tools are flanked by activity data collection templates and sector specific guidance documents.

IDB Invest, focusing on private sector operations and projects, uses the IFC's Carbon Emission Estimation Tool (CEET) as a basis for calculating gross GHG emissions. In accordance with IFC Performance Standard 3, IDB Invest requires all clients to calculate both Scope 1 and Scope 2 emissions for projects that are expected to produce, or currently produce, more than 25,000 tonnes of CO2- equivalent annually. If feasible, clients will also supply gross GHG calculations for projects with lower emissions as well as for relevant Scope 3 sources. Responsibility for this issue lies with IDB Invest's Social, Environmental and Governance (SEG) division, which is part of the Risk Management Department, who work closely together with the client along the Environmental and Social due diligence and supervision process.

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54 TN-455 is available on-line at https://publications.iadb.org/publications/english/document/Greenhouse-Gas-Assessment-Emissions-Methodology.pdf

55 Whereas ESG focuses on estimating gross GHG emissions for projects in categories A and B, the guidelines laid out in this document, and the tools discussed in section 5.2, may also help project teams that wish to estimate gross emissions for a Category C project.

56 ESMR or Environmental Impact Assessments.

57 Projects should report back the GHG accounting results in their annual or semi annual supervision/monitoring plan for the agreed period of time defined on the contract.

58 For the latest version of the Semi-Annual Environmental and Social Compliance Report- template see: https://idbg.sharepoint.com/sites/VPS/ESG/ESGForum/SiteAssets/default/E%26S%20Compliance/English-Environmental%20and%20Social%20Compliance%20Report%20WL1.docx-?d=w42962fd9c6e941e79bb606766e4a42fc

59 Whereas ESG focuses on estimating gross GHG emissions for projects in categories A and B, the guidelines laid out in this document, and the tools discussed in section 5.2, may also help project teams that wish to estimate gross emissions for a Category C project.

60 Indirect emissions refer to scope 2, to the off-site generation by others of electricity, and heating and cooling energy used in the project. See: http://www.iadb.org/document.cfm?id=665902 & https://www.iadb.org/en/mpas

Net GHG emissions are estimated by the Climate Advisory Services team, which forms part of the Non-Financial Products (NFP) division. They report figures to donors and other relevant stakeholders on an annual basis.

Aggregate GHG emissions data (expressed in tCO_2e) for projects approved during the year are reported in IDBG's sustainability report[61], typically including information on gross and net GHG emissions. Emissions are reported in metric tons of carbon dioxide equivalent (tCO_2e) for a representative year, assuming the project is complete and operating at normal operating capacity. Emissions from construction are reported as a normalized annual value. This value is constructed by taking the one-time construction emissions and dividing this value by 20 years, which is taken as the average lifespan of a project.

61 https://publications.iadb.org/en/inter-american-development-bank-sustainability-report-2018


IDB