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Guidance Document on typical approaches for estimating emission reductions from IKI project activities

Transport Sector

Version 1.0 (February 2024)

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Table of Contents

Figures

Tables

Boxes

List of Abbreviations

AFOLU	Agriculture/Forestry/Other Land Use
ASI	Avoid, Shift, and Improve
BAU	Business-as-Usual
BE	Baseline emissions
BEB	Battery electric buses
BRT	Bus Rapid Transit
CDM	Clean Development Mechanism
CO_2e	Carbon dioxide equivalents
CNG	Compressed natural gas
EF	Emission factor
ER	Emission reductions
EVs	Electric vehicles
GHG	Greenhouse gas emissions
GHGP	GHG Protocol
GS	Gold Standard
ICEVs	Internal combustion engine vehicles
IKI	International Climate Initiative
LPG	Liquefied petroleum gas
MRTS	Mass Rapid Transit System
PKM	Passenger kilometres
PE	Project emissions
PT	Public transport
SI 1	Standard Indicator 1
TtW	Tank-to-Wheel
VCS	Verified Carbon Standard
WtW	Well-to-Wheel

1 Introduction and purpose

The International Climate Initiative (IKI) has been using Standard Indicators since 2015 to assess the effects and results of its portfolio. In 2021, these indicators were revised to provide more precise information on IKI results and improve the data quality. Since 2022, all new IKI projects are required to use this revised set of Standard Indicators[1].

An important change relates to Standard Indicator 1 - Mitigation (SI 1 - Mitigation) with stricter requirements for IKI projects. SI 1 - Mitigation measures the degree to which IKI project activities contribute to reducing greenhouse gas emissions (GHG) during project implementation, i.e. projects must transparently present assumptions and parameters for target and actual values in metric tonnes of CO_2 equivalents (CO_2e).

IKI projects have the potential to lead to GHG reduction or the enhancement of carbon stocks in various sectors. To support IKI projects to identify typical approaches for estimating emission reductions, the IKI Standard Indicator Helpdesk provides several guidance documents for the most relevant sectors / mitigation areas: Energy, Agriculture/Forestry/Other Land Use (AFOLU), Buildings and Transport.

This Guidance Document on **Transport** presents typical approaches for estimating emission reductions from IKI project activities in the transport sector. Through the fictitious project "Public bus fleet electrification", the methodological approach for an e-mobility project is explained in detail and further guidance for IKI implementing organisations is provided. Moreover, calculations to assess the emission reductions of modal shift measures in urban passenger transport and of modal shift measures of cargo are briefly presented. This Guidance covers the following points:

(1) Common understanding of direct and indirect mitigation,
(2) typical emission sources for emission reduction activities / measures in the target sector,
(3) typical baseline and project scenario (and leakage, if applicable),
(4) calculation of emission reductions, illustrated with sample calculations using the IKI Excel Template, and
(5) relevant default values and reference sources are provided, incl. tips for helpful resources and other tools in the respective sector.

This Guidance Document complements the Guidelines on Project Planning and Monitoring in the International Climate Initiative - Version 2. In the Guidelines the guidance sheet on Standard Indicator 1 - Mitigation (Section 6.2.1) includes helpful methodological guidance on estimating projects' direct or indirect GHG emissions reductions. Additional guidelines and online seminars regarding the estimation of GHG reductions / carbon stock enhancements are available on the IKI Website. Further helpful information on mitigation estimation can be found in the Mitigation Action Facility Mitigation Guideline (2023)[2], which has also been used for this document.

[1] IKI Monitoring and Evaluation (M&E) Unit (2023): Guidelines on Project Planning and Monitoring in the International Climate Initiative. Version 2; Chapter 6.1 of the IKI Project Planning and Monitoring Guidelines (2023) for general reporting requirements Retrieved from here.

[2] Mitigation Action Facility (2023): Mitigation Action Facility Mitigation Guideline (Outline & Proposal Phase). Retrieved from here, and Mitigation Action Facility (2023): Mitigation Guideline for the Project Concept Phase. Retrieved from here.

2 IKI understanding of direct and indirect mitigation

Within SI 1 - Mitigation, the IKI differentiates between direct and indirect GHG mitigation, which need to be reported quantitatively in tonnes of CO_2e. In addition, the Standard Indicator also captures qualitative information related to potential long-term mitigation impacts of enhanced policy frameworks.

Box 1: Differentiation between direct and indirect GHG mitigation

Direct mitigation: GHG emission reduction / carbon stock enhancement through financing of mitigation measures

Direct GHG emission reduction / carbon stock enhancement refers to the amount of CO_2e reduced, avoided, or sequestered immediately through mitigation measures that are (partly) financed by the IKI project or measures.

Indirect mitigation: GHG emission reduction / carbon stock enhancement through technical support of mitigation measures

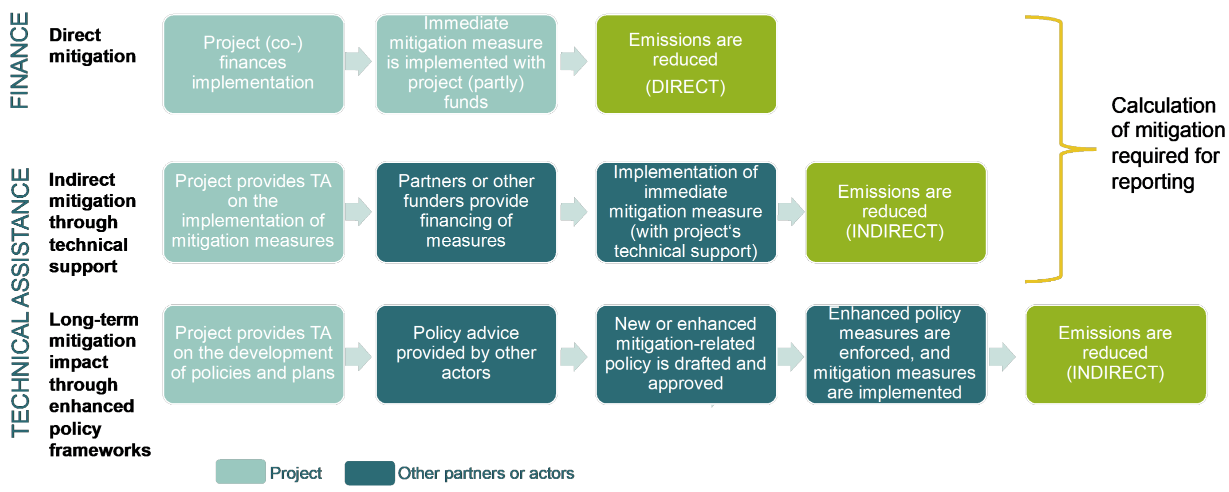
Indirect GHG emission reduction / carbon stock enhancement refers to an amount of CO_2e reduced, avoided, or sequestered with the help of IKI-funded technical assistance or capacity development measures. This includes cases where a physical mitigation measure was financed by an actor other than the IKI (e.g. a city government in a partner country) but where the IKI delivers crucial technical implementation support.

Enhanced policy frameworks: Long-term mitigation impact through enhanced policy frameworks

This category captures substantial contributions of IKI projects to new or improved policies, strategies or plans that are expected to lead to substantial long-term mitigation impacts in the future if they are fully implemented. In order to report on this category, projects need to plausibly contribute to an improvement in policy frameworks that increases the potential long-term mitigation impact of the policy. This can be achieved through more ambitious but realistic targets or through increasing the feasibility of implementing the policy framework.

Figure 1 illustrates simplified causal chains for each of the categories. Further details and examples for each category of mitigation action can be found in the SI 1-Indicator Guidance Sheet in Guidelines on Project Planning and Monitoring in the International Climate Initiative - Version 2.

Figure 1: Simplified causal chain for reporting categories in SI 1



IKI projects can only report on the Standard Indicator, if the contributions to mitigation fall within any of the three reporting categories defined above: direct / indirect mitigation / potential future GHG emission reductions/carbon stock enhancement through enhanced policy frameworks. Projects should indicate whether and how they contribute to direct and/or indirect mitigation and shall provide separate estimates for these in the respective sheets for Standard Indicator 1 in the **IKI Standard Indicator Report (Excel Tool)** available here on the IKI website. Regarding the long-term mitigation impact through enhanced policy frameworks, projects are not asked to calculate projected future emissions reductions / carbon stock enhancements resulting from policy implementation. Projects are expected to name the policy frameworks they address and explain how they contribute to strengthening the mitigation potential of these policies.

The following chapters focus on the estimation of emission reductions which can be used for direct and indirect mitigation.

3 Typical emission sources and emission reduction activities in the transport sector

Motorised transport on land, sea and air remains dependent on internal combustion engines that generally run on gasoline, diesel, and other fossil fuels. From 1990 to 2022, transport emissions grew at an annual average rate of 1.7%, faster than any other end-use sector except for industry (which grew at a similar rate). Today, transport accounts for more than a third of CO_2 emissions from end-use sectors.[3] Addressing emissions from transport is crucial for GHG mitigation strategies across many countries, as the sector represents the largest energy consuming sector in 40% of countries worldwide.[4]

Most transportation-related emissions come from road vehicles such as passenger cars and freight trucks. These vehicles produced almost 6 gigatons of CO_2 worldwide in 2021, accounting for roughly three-quarters of transportation sector emissions that year.[5] Trucks and buses are responsible for more than 35% of direct CO_2 emissions from road transport although they represent fewer than 8% of vehicles (excluding two- and three-wheelers). Increases in electric bus deployment, and recent stringent CO_2 standards in the European Union and United States will help to enable the rapid electrification required to decarbonise the sector. In 2022, nearly 66,000 electric buses and 60,000 medium- and heavy-duty trucks were sold worldwide, representing about 4.5% of all bus sales and 1.2% of truck sales worldwide.[6] Aviation and international shipping accounted for about 2% of global energy-related CO_2 emissions, respectively, in 2022.[7]

Key levers to cut transportation-related carbon emissions can be categorised into *Avoid, Shift*, and *Improve* (ASI) measures.[8] The aim of the ASI approach is to promote alternative mobility solutions and to develop sustainable transport systems. *Avoid* measures aim to minimise unnecessary motorised trips, *Shift* measures entail, inter alia, the shift from private vehicles to public transport, shared mobility, walking and cycling, electrified road-rail freight, and cargo bikes for last-mile deliveries. Finally, the increased adoption of clean technologies like battery electric vehicles (EVs) is a typical example for an *Improve* measure.

Applying ASI measures through integrated and inter-modal approaches is key to unleashing the full benefits of sustainable, low carbon transport. From the promotion of public transportation systems to the adoption of cleaner and more efficient vehicle technologies – ASI activities can involve both public and private / commercial sectors.[9]

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[3] J. Teter, F. Voswinkel (2023): Transport – Energy System – IEA. Retrieved from here.

[4] Jaramillo, P. et al (2022): Transport in IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved from here.

[5] Statista Research Department (2023): Transport emissions worldwide – statistics & facts. Retrieved from here.

[6] IEA (2023): Global EV Outlook 2023, Trends in electric heavy-duty vehicles. Retrieved from here.

[7] IEA (2023): International Shipping. Retrieved from here.

[8] GIZ (2019): Sustainable Urban Transport Avoid-Shift-Improve (A-S-I). Retrieved from here.

[9] Mitigation Action Facility (2023): Mitigation Action Facility Mitigation Guideline for the Project Concept Phase (p.15), Retrieved from here.

Some of the most common ASI measures in the transport sector are listed below:

- **Avoid** and reduce the need for motorised travel via a transport-oriented and compact development of cities
- **Shift** to more sustainable modes by
    - Promotion of public transportation systems, e.g.
        - Investment in infrastructure
        - Affordable fares
        - Improved accessibility
        - High quality of service (safe, reliable, and comfortable)
        - Dedicated bus lanes or tram tracks
        - Public awareness campaigns
    - Shift away from personal vehicles by, e.g.,
        - Improvements in cycling infrastructure
        - Design of pedestrian-friendly infrastructure
        - Promotion of car-sharing services and ride-sharing platforms
        - Adjustment of parking regulations
    - Shift away from road to more environmentally sound modes of transport, i.e. promotion of the use of intermodal transport systems, such as using a combination of road, rail and water
- **Improve** transport modes by adopting cleaner and more efficient vehicle technologies, e.g.
    - Electric Vehicles
    - Hybrid vehicles
    - Vehicles powered by alternative fuels like hydrogen
    - Extension of renewable energy charging infrastructure
    - Improvements in engine efficiency
    - Energy efficient technologies in aviation and maritime sectors such as electric ground support equipment

4 How to assess the results from mitigation actions

4.1 Basic formula to estimate emission reductions

In order to assess the impact of mitigation efforts, it is essential to compare the GHG emissions resulting from a proposed action against a baseline. This involves analysing the energy use and fuel consumption both before and after the implementation of the project.

The calculation of emission reductions achieved by the project may vary according to the project type and underlying mitigation measures to be implemented. In general, the assessment of the mitigation impact, measured in terms of reduction of tCO_2e, is based on comparing the level of GHG emissions before **(baseline scenario)** and after implementing the project's mitigation activity **(mitigation or project scenario),** considering any **leakage emissions**. The calculation procedure for determining GHG emission reductions generally follows a standardised approach: The achieved emissions reductions from a project and/ or mitigation activity are typically calculated as the **difference between baseline emissions and emissions after project implementation**, considering any potential leakage.[10]

$$ER_y = BE_y - PE_y - LE_y \qquad \text{Equation (1)}$$

Where:

ER_y	=	Emission reductions in year y (tCO_2)
BE_y	=	Baseline emissions in year y (tCO_2)
PE_y	=	Project emissions in year y (tCO_2)
LE_y	=	Leakage emissions in year y (tCO_2)

To accurately determine the required parameters and data for the calculation in Equation (1), it is necessary to identify the emission sources and GHGs associated with each technology. Established carbon market methodologies and standards can be used as a reference to identify technology-specific emission sources and GHGs associated with the baseline and project scenario (see below).

4.2 Suitable methodological approaches

To calculate the associated emission reductions (ER), a suitable methodological approach should be determined. It is advisable to make use of approved and recognised methodologies, e.g. sourced from the Clean Development Mechanism (CDM), the Global Environment Facility (GEF), the Gold Standard (GS), GHG Protocol (GHGP), Verified Carbon Standard (VCS).

[10] Mitigation Action Facility (2023): Mitigation Action Facility Mitigation Guideline for the Project Concept Phase (pp. 14-15). Retrieved from here.

Any necessary simplifications of these methods should be considered and applied as required and feasible. This guidance is in line with the general principles of these recognised methodologies.

Box 2: Source for identifying applicable methodological approach for the transport sector

To identify suitable methodological approaches and useful default / reference values,

- check other projects that estimated emission reduction from same / similar activities and potentially provided excel calculation sheets as reference, e.g.
  - CDM Project Search, VERRA / VCS Project Registry, Gold Standard Project Registry
- consult existing methodologies, e.g.
  - the CDM Methodology Booklet
- consult and use simplified tools for the estimation, if existing. For example:
  - MobiliseYourCity Emissions Calculator - Changing Transport developed to help countries and cities to calculate transport GHG emissions.
  - Vehicle Energy Consumption Calculation Tool - VECTO developed by the European Commission to determine CO_2 emissions from heavy duty vehicles.
  - Transport Emissions Evaluation Model for Projects - TEEMP developed to estimate emissions for GEF transportation projects.
  - GHG Protocol Calculation Tool and Guidance with the calculation tool "GHG Emissions from Transport or Mobile Sources".
- make use of default values and reasonable assumption source from references, e.g.
  - IPCC Report Chapter 10 Transport
  - CDM TOOL33 Methodological tool: Default values for common parameters
  - Harmonized IFI Default Grid Factors 2021 v3.2.

Several small-scale CDM methodologies provide a good orientation for the calculation approaches of numerous transport sector projects. For a complete list of CDM methodologies, please consult CDM: Approved SSC methodologies (unfccc.int).

Table 1: Selected CDM methodologies for transport project activities

Methodology / Tool	Description	Project activity example
AMS-III.C.: Emission reductions by electric and hybrid vehicles	This methodology applies to project activities introducing new electric and/or hybrid vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation.	Project activity accelerates the introduction and operation of electric vehicles.
AMS-III.S.: Introduction of low-emission vehicles/technologies to commercial vehicle fleets	This methodology is for project activities introducing low-GHG emitting vehicles for commercial passenger (including public transportation), material and freight transport, operating in comparable traffic conditions and on similar terrain. Retrofitting of existing vehicles (e.g. switching from high GHG intensive to low GHG intensive fossil fuel) is also included.	Project activity accelerates the introduction and operation of new less-GHG-emitting vehicles (e.g. compressed natural gas (CNG), liquefied petroleum gas (LPG), electric or hybrid) for commercial passengers and freight transport, operating on routes with comparable conditions.

Methodology / Tool	Description	Project activity example
AMS-III.U.: Cable cars for Mass Rapid Transit System (MRTS)	This category comprises cable cars substituting traditional road-based transport trips.	Project activity contributes to construction and operation of cable cars for urban transport of passengers substituting traditional road-based transport trips.
AMS-III.BC.: Emission reductions through improved efficiency of vehicle fleets	This methodology is for project activities that improve the efficiency of vehicle fleets (e.g. fleets of trucks, buses, cars, taxis or motorized tricycles), resulting in reduced fuel usage and GHG emissions.	Project activity enables improvement of the operational efficiency of a taxi fleet.
AMS-III.BN.: Efficient operation of public transportation	This methodology applies to project activities that implement measures that improve the efficiency of operation of public transportation by buses, such as use of Intelligent Transportation System measures and/or improve bus routes (e.g. re-design of routes, implementation of priority bus lanes that are not part of a Bus Rapid Transit (BRT) system, use of high quality pavement, construction of viaducts/tunnels, express service connecting only high demand stops during peak hours).	Project activity allows use of Intelligent Transportation System measures which result in more efficient operation of the buses.
AMS-III.BQ.: Hydrogen fuel cell vehicles	This methodology applies to project activities introducing hydrogen fuel cell vehicles for passenger and freight transportation.	Project activity allows introduction and/ or (increased) operation of hydrogen fuel cell vehicles.

Source: Adopted from UNFCCC (2022): CDM Methodology Booklet and linked methodologies in the table

4.3 Project boundary

The project boundary encompasses all GHG emissions that are under the control of the project or significantly and reasonably linked to project activities. The specific project boundary will vary depending on the interventions and technologies used, and it can pertain to either operational control or geographical delineation, i.e. spatial extent. If defining the project boundary proves challenging, the project should refer to approved methodologies (e.g. CDM or GHG Protocol) that are applicable to the specific project case for a detailed determination of the project boundary.

4.4 Baseline scenario, project scenario, and leakage emissions

To measure the impacts of GHG emissions, it is essential to define a baseline scenario and project scenario. For each mitigation action it is required to determine both the baseline and project scenarios.

The **baseline scenario** serves as the reference case for the project, representing a hypothetical description of what would likely have happened in the absence of the project to deliver a product or service similar to the project's outcome. It is used to estimate baseline emissions. There are three generic possibilities for the baseline scenario and related emissions that would occur without the proposed project, according to the Clean Development Mechanism (CDM) and GHG Protocol[11]:

1. **Business-as-Usual (BAU):** This refers to the continuation of existing activities, technologies, or practices that offer the same type, quality, and quantity of product or service as the project. BAU results in emissions based on current or historical data, as applicable.
2. **Benchmark Approach:** In this approach, the focus is on current activities, technologies, or practices that provide a product or service similar to the project. Only activities undertaken in the previous five years, under similar social, economic, environmental, and technological conditions, and demonstrating top 20 percent performance in low emissions, are considered. For example, in the transport sector, the benchmark approach would cover the top 20% of vehicles registered in the last 5 years with regards to their emission factors, i.e. average emissions per km. Adopting the benchmark approach facilitates the identification of technical parameters for establishing the baseline scenario and estimating baseline emissions.
3. **Economically Attractive Alternatives:** This approach considers emissions from an activity, technology, or practice that represents an economically attractive alternative option when compared to the project. It takes into account investment barriers and assesses alternative activities, technologies, or practices within a specific geographical area and time frame that can provide a similar product or service as the project. An example could be activities in the transport sector, where certain vehicle types (e.g. private transport or ICE minibuses) are more economically appealing than low-emission alternative such as electric vehicle (EVs) or battery electric buses (BEB) and are expected to increase over the project period and beyond.

When establishing the baseline, pinpoint the scenario that most accurately reflects the potential situation in which the project would not be implemented. The baseline represents the hypothetical situation in the absence of the project, and the baseline emissions are the expected emissions during the assessment period without the project. When in doubt about the most realistic baseline scenario, projects should apply a conservative approach to avoid overestimating the effects of IKI projects. Under a project that replaces conventional combustion engine buses with e-buses in the city's public transportation fleet, e-buses will be purchased and deployed and charging infrastructure strategically installed throughout the city. The baseline scenario is characterized by the continued operation of conventional combustion engine buses in the city's public transportation system.

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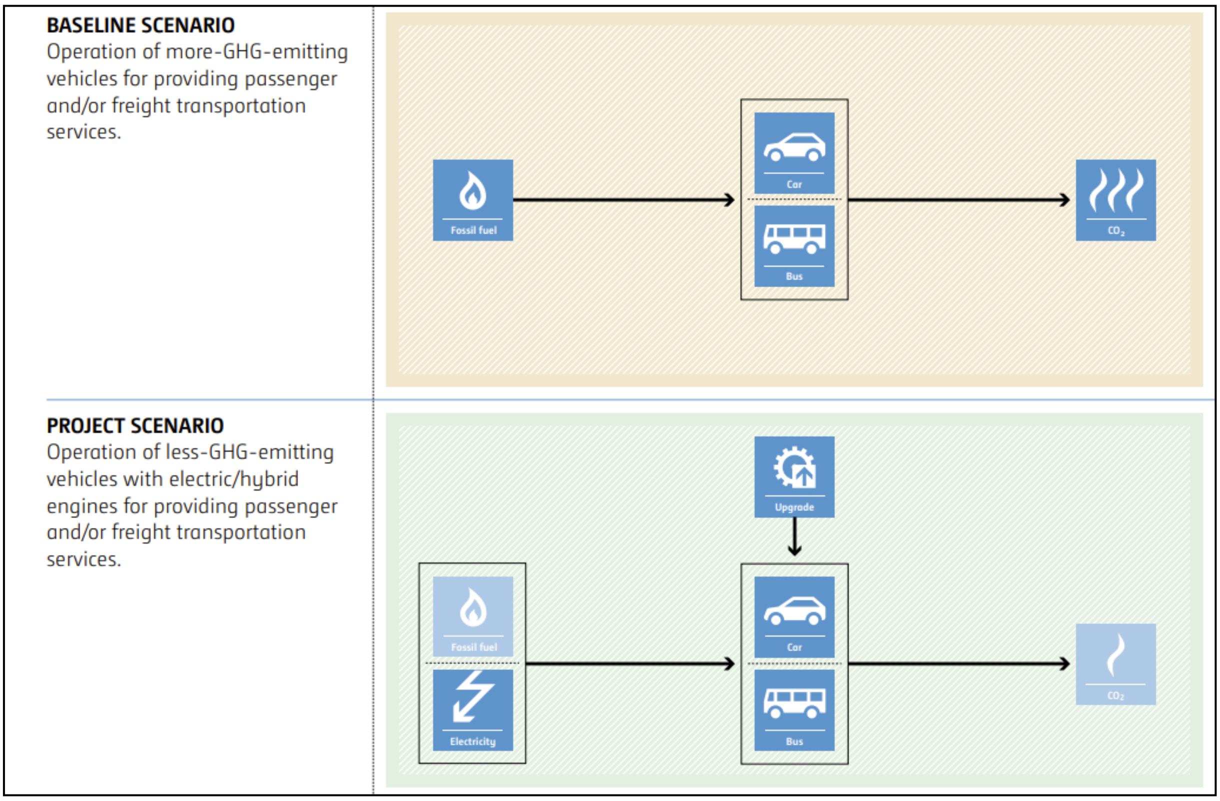
[11] Mitigation Action Facility (2023): Mitigation Action Facility Mitigation Guideline for the Project Concept Phase (p. 9). Retrieved from here.

The **project scenario** describes the expected outcome of the project. It includes all relevant mitigation activities implemented in the project and accounts for the emissions that are produced through these mitigation activities. It is important to consider the expected lifetime of a project measure or technology in order to correctly assess the project's mitigation impact throughout its lifetime. The technical lifetime is defined as the total time (in years or hours of operation) for which the equipment is technically designed to operate from its first commissioning (see, e.g., Mitigation Action Facility Mitigation Guideline). While some technologies are rather short-lived (e.g. the battery of an electric vehicle usually has to be replaced after a couple of years), others have a long lifespan (solar panels, e.g. can produce electricity for 25-30 years). A thorough assessment thus requires the calculation of a project's mitigation impact throughout its entire lifetime in addition to the mitigation impact during project duration.

Leakage emissions refer to the additional emissions that occur outside the boundaries of the mitigation action project as a result of implementing that project. For example, this may happen when equipment replaced by the mitigation project continues to be used outside the project boundaries, leading to increased emissions. Common instances in the transport sector include internal combustion engine vehicles (ICEVs) that are replaced by the mitigation project but then utilised elsewhere. If leakage emissions are a significant and relevant source of emissions, they should be addressed comprehensively and subtracted from the baseline emissions.

Figure 2: Typical baseline and project scenario for emission reduction by EV introduction



Source: UNFCCC (2022): CDM Methodology Booklet, p. 208.

5 Sample calculations of emission reductions

5.1 Electrification of road transport

This chapter illustrates the calculation of emission reductions for typical e-mobility projects. To estimate the mitigation potential of EV introduction, the general approach of the CDM methodology "Emission reductions by electric and hybrid vehicles (AMS-III.C)"[12] can be used. An introduction to the project example can be found in the following box. The detailed calculations can be found in IKI SI1_Transport Example on the IKI Website.

Example: Public bus fleet electrification

The aim of the project "Public bus fleet electrification" is to accelerate electric vehicle deployment through financial and technical assistance. Since the project finances the purchase of battery electric buses (BEBs), it mitigates GHG emissions directly. In the **baseline scenario**[13]**,** the use of internal combustion engine vehicles (ICEVs), more precisely, the use of Diesel EURO IV buses, continues to prevail due to existing barriers, such as high up-front cost, missing infrastructure, and lack of confidence in the technology, in the project region. Hence, the baseline emissions are calculated based on the emissions of the Diesel EURO IV buses.

Under the **project scenario**, the pilot project will replace the purchase of 10 GHG-intensive standard diesel buses with the purchase of 10 battery electric buses. The project covers the total investment costs for the purchase of 10 BEBs as well as the infrastructure required for the operation of the BEBs. The technology lifetime of a BEB is assumed to be 16 years, the lifespan of the battery 8 years. The project duration is 5 years, from January 2021 until December 2025.

There is **no leakage** expected from the project activities since the project will replace the purchase of new ICEVs.

5.1.1 Project boundary

Typically for e-mobility projects, the project boundary comprises:

a) The vehicles of the project;
b) The geographic boundaries where the project activity vehicles are operated;
c) The providers of the charging service to the project activity vehicles, including the charging equipment and stations of the project activities vehicle, electric supply sources (e.g. the national grid) and other ancillary facilities.

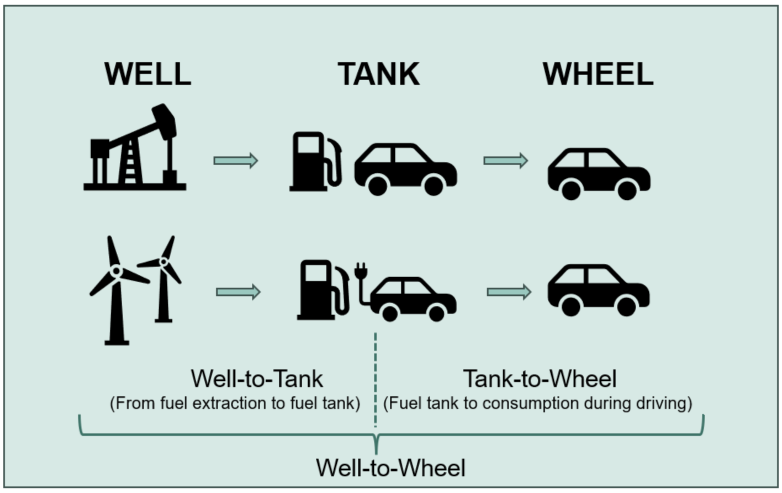
[12] UNFCCC: Small-scale CDM Methodology "Emission reduction by electric and hybrid vehicles" (AMS-III.C). Retrieved from here.

[13] In many cases the "business-as-usual scenario".

Example: Public bus fleet electrification

The project accounts for the reduction of GHG emissions of the financed BEBs in the project country as a result of replacing diesel buses. The Well-to-Wheel (WtW) emission impacts during the usage phase of both EVs and ICEVs are considered.

Figure 3: Emission sources during vehicle usage phase



Source: Own illustration

5.1.2 Baseline, project, and leakage emissions

In general, **baseline emissions** for e-mobility and hybrid vehicle projects are calculated based on the unit of service provided by the project vehicles (travelled distance) times the emission factor for the baseline vehicle to provide the same unit of service as per the equation below:

$$BE_y = \sum_i EF_{BL,km,i,y} * DD_{i,y} * N_{i,y} * 10^{-6} \quad \text{Equation (2)}$$

Where

BE_y	=	Baseline emissions in year y (t CO_2).
$EF_{BL,km,i,y}$	=	WtW emission factor per kilometre for baseline vehicle category *i* in year *y* (g CO_2/km)
$DD_{i,y}$	=	Annual average distance travelled by project vehicle in category *i* in year *y* (km)
$N_{i,y}$	=	Number of operational project vehicles in category *i* in year *y*

Emissions to be included in the WtW emission factor of the baseline vehicle per kilometre in decreasing priority (inclusion is dependent on data availability):

1. The direct emissions energy (i.e. the use of fuel, known as "Tank-to-Wheel", TtW); and
2. The indirect emissions energy (i.e. the fuel production phase, known as "Well-to-Tank", WtT).

Project emissions include the electricity consumption associated with the operation of project vehicles and are calculated using distance travelled by project vehicles:

$$PE_y = \sum_i EF_{PJ,km,i,y} * DD_{i,y} * N_{i,y} * 10^{-6} \qquad \text{Equation (3)}$$

Where

PE_y	=	Total project emissions in year *y* (t CO_2).
$EF_{PJ,km,i,y}$	=	WtW emission factor per kilometre for project vehicle category *i* in year *y* (g CO_2/km)
$DD_{i,y}$	=	Annual average distance travelled by project vehicle in category *i* in year *y* (km)
$N_{i.y}$	=	Number of operational project vehicles in category *i* in year *y*

Emissions to be included in the WtW emission factor of the EV per kilometre are the same as for the baseline vehicle. However, since EVs do not produce emissions at the tailpipe, the TtW emissions for an EV are zero and thus the WtT emissions equal the WtW emissions.

Note that, if data is available, including the following emission sources would be best practice (in descending priority):

1. The direct emissions energy (Tank to Wheel, TtW);
2. The indirect emissions energy (Well to Tank, WtT);
3. Emissions caused by the vehicle production (and battery manufacturing, for EVs); and
4. End of life, i.e. emissions associated with decommissioning and dismantling of the vehicle.

There is no leakage expected from the project activities if the project will replace the purchase of new ICEVs. **Leakage emissions** should be considered in cases where a baseline ICEV replaced by the project will be further operated outside of the project boundary.

Example: Public bus fleet electrification

The **baseline emissions** are calculated by multiplying the number of project vehicles with the annual average distance travelled by a project vehicle with the ICEV's WtW emission factor per kilometre.

The **project emissions** are calculated using the same approach, just replacing the ICEV's WtW emission factor with the EV's WtW emission factor.

There is **no leakage** expected from the project activities since the project will replace the purchase of new ICEVs.

Key parameters required for the calculation

For calculating the emission reduction from e-mobility projects, such as the sample case, the following parameters are required. Potential default values are listed in Table 3 (see Section 6 below).

Table 2: Parameters to estimate example case's emission reduction

Parameter	Unit	Source
Number of EVs operated under the project	No.	Project data
Annual average distance driven by project vehicles	km	Project data
EV energy consumption	kWh/km	Energy consumption of full electric vehicles - EV Database (ev-database.org)
Grid emission factor	tCO_2e/kWh	Harmonized IFI Default Grid Factors 2021 v3.2
ICEV WtW emission factor	gCO_2e/km	Calculated based on data from manufacturer (e.g. fuel consumption/ 100km) and fuel specific characteristics (e.g. $kgCO_2e$/liter), see IPCC Emission Factor Database

5.2 Modal shift to public transport

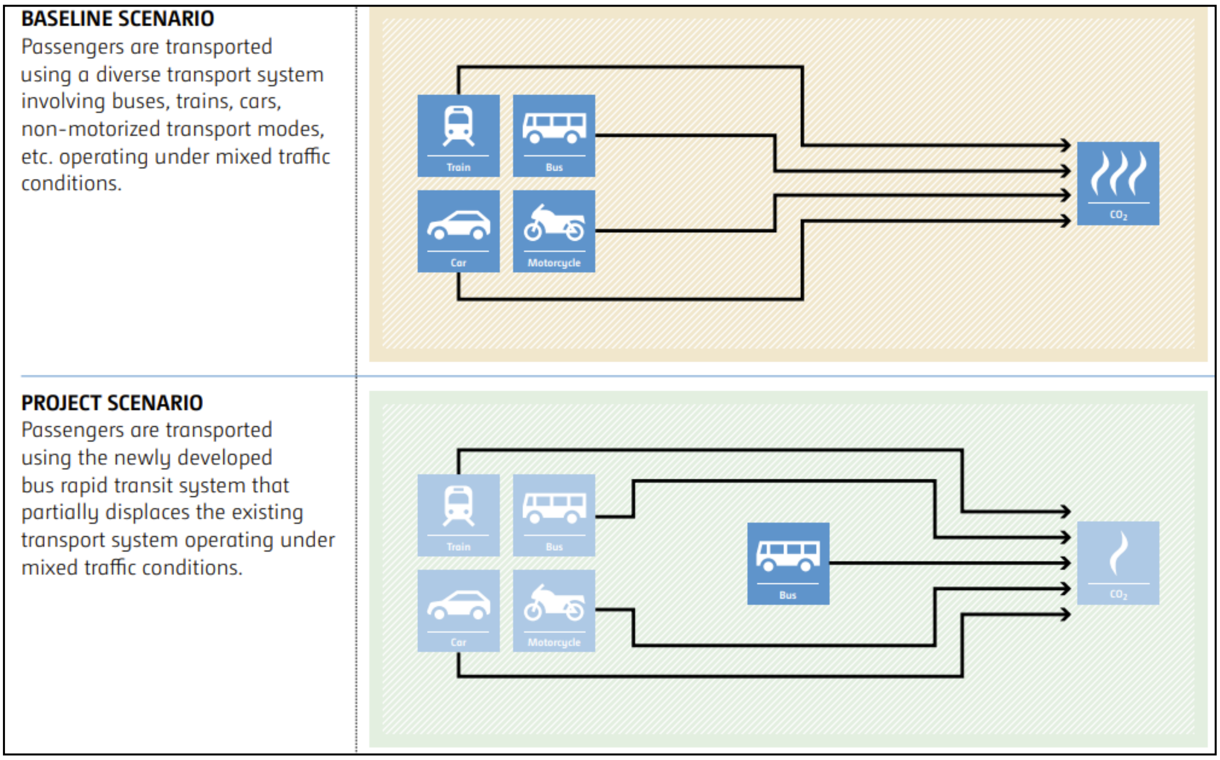
The modal shift to public transport (PT) is another key measure to reduce emissions in the transport sector. Modal shifts can be achieved with urban (re)development and investments in new vehicles and infrastructure, linked with integrated urban land use and transport planning. Emission reductions are due to an increased number of PT users with PT having a lower emission factor per passenger-kilometre than cars, taxis or motorcycles.

5.2.1 Project boundary

The geographic boundary is, in accordance with the CDM methodology for Mass Rapid Transit Systems ACM0016, the larger urban zone of the city in which the project takes place. It is based on the origins and destinations of passengers using the project system. The project boundary also includes the power plants connected physically to the electricity system that supply power to the project. This is reflected in the grid emission factors.

Under the baseline scenario passengers are transported using a diverse transport system involving buses, trains, cars, non-motorized transport modes, etc. operating under mixed traffic conditions. In the project scenario passengers are motivated to shift modes and are now transported using the enhanced public transport service, e.g. e-buses.

Figure 4: Typical baseline and project scenario for emission reduction by BRT projects



Source: UNFCCC (2022): CDM Methodology Booklet, p. 65.

5.2.2 Baseline, project, and leakage emissions

The methodological approach to determine vehicle emissions is based on the UNFCCC CDM methodological tool Baseline emissions for modal shift measures in urban passenger transport.[14] Baseline emissions from urban passenger transport are calculated based on the number of passengers transported under a project activity and the average emission factor per baseline mode of transport from which project passengers are shifted.

A Well-to-Wheel (WtW) approach is used to **determine the emission factor per passenger kilometre (PKM) for each relevant baseline and project vehicle category** (see chapter 5.1 for more information). The equation used to calculate the relevant emission factors is given by:

$$EF_{KM,i,y} = \left[\sum_{n}\left[SFC_{i,n,y} * NCV_{i,n} * EF_{CO2,n} + SEC_{i,y} * EF_{CO2,y}\right] * \frac{N_{i,n,y}}{N_{i,y}}\right] \quad \text{Equation (4)}$$

Where:

$EF_{KM,i,y}$	=	WtW emission factor per km of vehicle category *i* in year *y* (g CO_2/km)
$SFC_{i,n,y}$	=	Specific fuel consumption of vehicle category *i* using fuel type *n* in year *y* (mass or volume units of fuel/km)
$NCV_{i,n}$	=	Net calorific value of fuel *n* used in vehicle category *i* (MJ/mass or volume units of fuel)
$EF_{CO2,n}$	=	WtW emission factor for fuel type *n* (g CO_2/MJ)
$SEC_{i,y}$	=	Specific electricity consumption of vehicle category *i* using electricity in year *y* (kWh/km)
$EF_{CO2,y}$	=	WtW emission factor for electricity in year *y* (g CO_2/kWh)
$N_{i,y}$	=	Number of vehicles of category *i* in year *y* (units)[15]
$N_{i,n,y}$	=	Number of vehicles in vehicle category *i* using fuel type *n* in year *y* (units)
N	=	Fuel types used by vehicle category *i* in year *y*
I	=	Road-based vehicle categories (passenger car, bus, motorcycle, etc.)
Y	=	Most recent calendar year for which data is available

The emission factor per PKM results from the emission factor per kilometre divided by the occupation rate per vehicle category:

[14] UNFCCC: Small-scale CDM Methodology tool "Baseline emissions for modal shift measures in urban passenger transport" (Tool 18). Retrieved from here.

[15] Alternatively, the number of vehicle-kilometres of vehicle category i driven in year y (VKM) could be used, if the same information is available for $N_{i,n,y.}$ i.e. Number of vehicle-kilometres of vehicle category *i* using fuel type *n* driven in year y (VKM).

$$EF_{PKM,i} = \frac{EF_{KM,i}}{OC_i} \qquad \text{Equation (5)}$$

Where:

$EF_{PKM,i}$	=	WtW emission factor per passenger-kilometre of vehicle category *i* (g CO_2/PKM)
$EF_{KM,i}$	=	WtW emission factor per kilometre of vehicle category *i* (g CO_2/km)
OC_i	=	Average occupancy rate of vehicle category *i* (passengers)

The emission factor per PKM of public transport can be determined following the same approach as for the baseline vehicle categories (see Equations 4 and 5 above).

To determine **emission reductions** from a modal shift project, the additional PKM travelled by public transport due to the project must be known. Multiplying the additional PKM travelled by public transport with the difference between the emission factors of public and baseline vehicles delivers the project's emission reductions.

$$ER_{PT} = \sum_i (s_i * (EF_{PKM,i} - EF_{PKM,PT})) * AP_{PT} * TD_{PT} \qquad \text{Equation (6)}$$

Where:

ER_{PT}	=	Emission reduction due to increased usage of public transport (tCO_2e)
S_i	=	Share of additional PT passengers which would have used vehicle category *i* (%)
$EF_{PKM,i}$	=	WtW emission factor per passenger-kilometre of baseline vehicle category *i* (gCO_2e/pkm)
$EF_{PKM,PT}$	=	WtW emission factor per passenger-kilometre of public transport (gCO_2e/pkm)
AP_{PT}	=	Additional passengers on public transport (million passengers)
TD_{PT}	=	Average trip distance of public transport user (km)
i	=	Baseline vehicle category (cars, taxis, motorcycles)

Leakage emissions should be considered when they are a significant and relevant source of emissions. Leakage emissions in a modal sift project can occur if a baseline vehicle replaced by public transport will be further operated outside of the project boundary. This could be the case if, e.g., a family's car is used for routes which were not taken by car in the baseline scenario because in the baseline scenario the car was used for trips which are covered by public transportation in the project scenario.

Example calculation: Modal shift from car to public transport (diesel bus)

The project finances the purchase and operation of public transport buses and awareness campaigns to motivate people to use public transportation services. The project uses survey data to assess how many passengers will shift from cars to bus as a result of increased public transport services.

Key parameters required for the calculation

For calculating the emission reduction from modal split projects, such as the sample case, the following parameters are required. Potential default values are listed in 5 (see Section 6 below).

Table 3: Parameters to estimate passenger modal shift emission reduction

Parameter	Value and Unit	Source
WtW EF per pkm cars	164 gCO_2/pkm	Calculation: EF car per km / average occupancy rate cars = 230 gCO_2/km / 1.4 passengers
WtW EF per pkm public transport	34 gCO_2/pkm	Calculation: EF car per bus / average occupancy rate cars = 918 gCO_2/km / 27 passengers
Average trip distance	6 km	Survey or data from public transportation service provider
Ridership on public transport per year	1,000,000 passengers	Data from public transportation service provider
Projected additional ridership due to project measures	10%	Survey or data from public transportation service provider

$$ER = 1 * \left(164 \frac{gCO2}{pkm} - 34 \frac{gCO2}{pkm}\right) * 1{,}000{,}000 \frac{passengers}{year} * 0.1 * 6km * 10^{-6} = 78 \frac{tCO2}{year}$$

Data on (changes in) travel behavior: One way to gather data on passengers' travel behavior before and after the modal shift project would be to conduct surveys or interviews with passengers. If direct data on passengers' travel behavior is unavailable, proxy data from sources like public transportation authorities can be used. Existing studies or research that have assessed the emissions impact of similar modal shift projects in other locations might provide some insights and data for estimation as well. While less precise, qualitative assessments based on expert opinions and educated assumptions can be used if no adequate quantitative data is available.

5.3 Modal shift of cargo to water or rail transportation

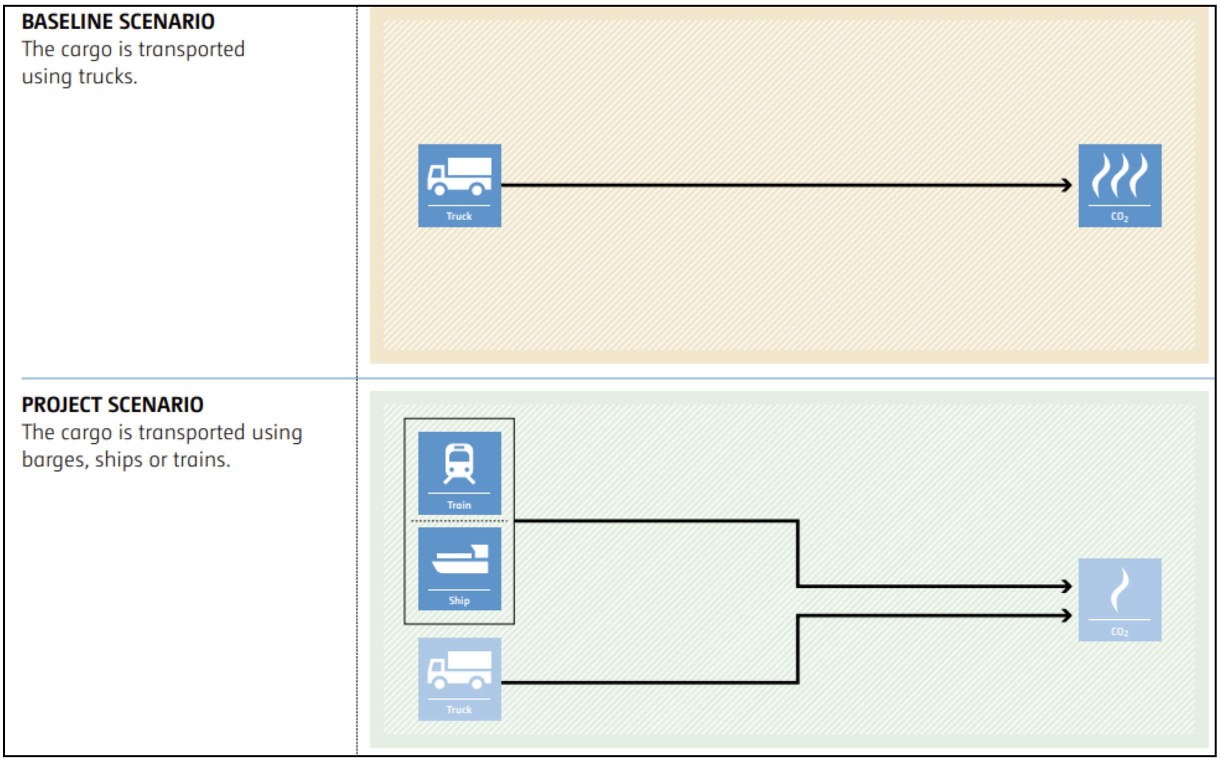
Modal shift of freight from trucks to water or rail decreases CO_2 emissions primarily because water and rail transport are more energy-efficient per ton-mile compared to truck transport. Water and rail transport benefit from economies of scale, allowing them to move large volumes of goods with less energy consumption and emissions per unit than truck transport. CDM AM0090 outlines the methodology for "Modal shift in transportation of cargo from road transportation to water or rail transportation".

5.3.1 Project boundary

The spatial extent of the project boundary encompasses the complete route, from origin to destination, involved in the transportation of the cargo.

Under the baseline scenario, cargo is transported on roads using trucks. In the project scenario, the cargo is transported on water using barges, ships or on rails using trains. Thus, the project activity enables the shift towards a less-carbon-intensive transportation mode.

Figure 5: Typical baseline and project scenario for emission reduction by cargo projects



Source: UNFCCC (2022): CDM Methodology Booklet, p. 112.

5.3.2 Baseline, project, and leakage emissions

The **baseline emissions** from the transportation of the cargo are calculated based on the amount of cargo transported under the project activity, the distance of the baseline trip route (i.e. the distance between origin and destination for transportation of cargo by trucks) and a baseline emission factor in g CO_2 per kilometre and tonne of cargo transported.

The baseline emission factor can be determined through two options:

1) Applying a conservative default emission factor. This option can, for example, be used if the project participants do not have historical records of the fuel consumption in trucks.
2) Calculation of the emission factor based on historical records of the fuel consumption for transportation of cargo by trucks.

Baseline emissions are calculated as follows:

$$BE_y = T_y * AD * EF_{BL} * 10^{-6} \qquad \text{Equation (7)}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2)
T_y	=	Amount of cargo transported by the project transportation mode in year y (tonne)
AD	=	Distance of the baseline trip route (km)
EF_{BL}	=	Baseline emission factor for transportation of cargo (gCO_2 per tonne of cargo and km travelled)

The **project emissions** include the emissions resulting from the consumption of fossil fuel in the ships/barges/trains, the consumption of electricity in trains, and the consumption of fossil fuel in the trucks used for the transportation of cargo in complementary routes under the project activity.

Project emissions are calculated as follows:

$$PE_y = \left(PE_{FC,y} + PE_{EC,y}\right) * F_{RT,PJ,y} + PE_{CR,y} \qquad \text{Equation (8)}$$

Where:

PE_y	=	Project emissions in year y (tCO_2)
$PE_{FC,y}$	=	Project emissions from fossil fuel combustion in the project activity in year y (tCO_2)
$PE_{EC,y}$	=	Project emissions from electricity consumption in the project activity in year y (tCO_2)
$F_{RT,PJ,y}$	=	The factor to account for non-empty return trips in the project scenario in year y (fraction)*[16]
$PE_{CR,y}$	=	Project emissions from transportation of cargo in complementary routes in trucks in year y (tCO_2)

Leakage emissions are negligible and are accounted for as zero.

[16] In cases where project participants can not demonstrate that the project transportation mode carries other cargo in return trips in year y, $F_{RT,PJ,y}$ is 1.

Example calculation: Modal shift of cargo from road to rail

The project finances the switch from road transportation to rail. The type of cargo being transported is agricultural products.

Key parameters required for the calculation

For calculating the emission reduction from modal shift projects, such as the sample case, the following parameters are required. Potential default values are listed in 5 (see Section 6 below).

Table 4: Parameters to estimate cargo modal shift emission reduction

Parameter	Value and Unit	Source
Amount of cargo transported in year y	1000 tonnes	Data from transportation service provider
Distance of the transport route	200 km	Data from transportation service provider
Baseline emission factor	83 gCO_2/tonne.km	Default values can be found, e.g., in table 2 in CDM methodology AM0090
Project emission factor	18 gCO_2/tonne.km	National transport data or surveys, e.g. RailFreight.com
Factor to account for non-empty return trips in the project scenario	1	Project participants cannot demonstrate that the train carries other cargo in return trips
Distance of complementary routes in trucks	10 km	Data from transportation service provider

$$\boldsymbol{Baseline\ emissions} =$$

$$1{,}000\ tonnes * 200\ km * 83 \frac{gCO2}{tonne.km} * 10^{-6} = 16.6 \frac{tCO2}{year}$$

$$\boldsymbol{Project\ emissions} =$$

$$1{,}000\ tonnes * (200\ km * 18 \frac{gCO2}{tonne.km} * 1 + 10\ km * \ 83 \frac{gCO2}{tonne.km}) * 10^{-6} = 4.43 \frac{tCO2}{year}$$

$$\boldsymbol{Emission\ reductions} = 16.6 \frac{tCO2}{year} - 9.7 \frac{tCO2}{year} = 12.17 \frac{tCO2}{year}$$

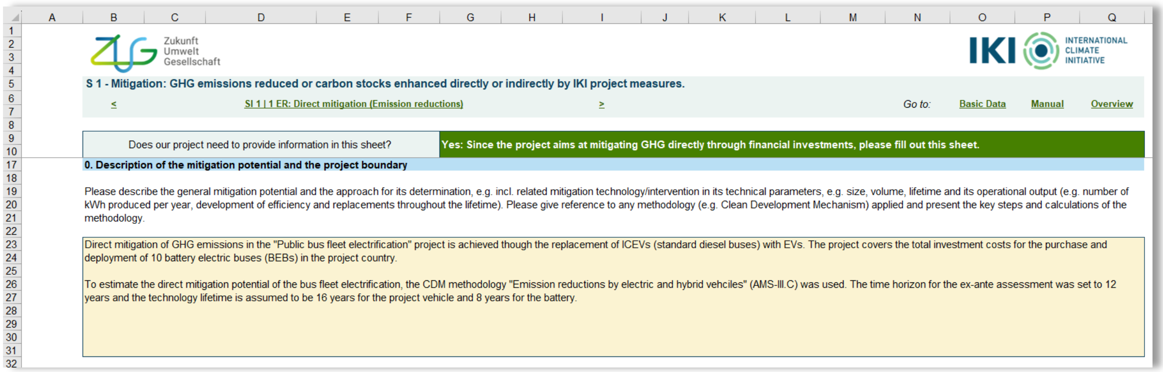
5.4 Mitigation estimation using the IKI Standard Indicator Report (Excel Tool)

IKI projects are required to use the IKI Standard Indicator Report (Excel Tool) to collect project-level data on those IKI Standard Indicators that are relevant to the project. In this subchapter, it is shown how to enter data on the project example in the IKI SI Report (Excel Tool). The filled-in Excel tool illustrating the project example can be accessed on the IKI website.

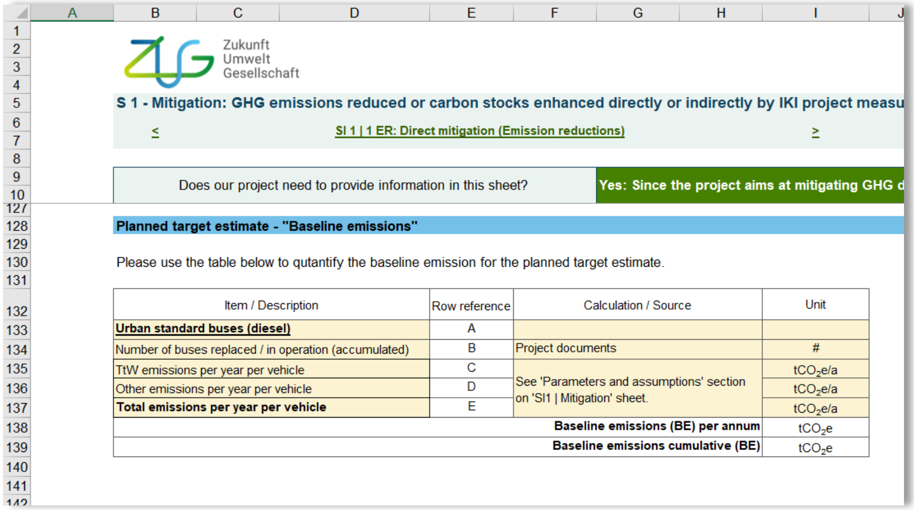
In the IKI SI Report (Excel Tool) any cells where projects should enter data or information are yellow. Instructions on the information that should be provided in the yellow cell can be found in the text above the cell. In some cases, additional explanatory text will appear in a pop-up window, if the cell is selected. The tool leads the user through the different steps required to calculate the project's mitigation effects, as outlined above. There are separate sheets for direct and indirect mitigation. While the calculations for direct and indirect mitigation follow the same structure, this guidance document describes the approach to assess a project's direct mitigation (i.e., sheet SI1 | 1 ER in the Excel Tool).

The following list provides a brief overview of the steps required to calculate the project's direct mitigation:

0) **Project description, scope, and project boundary** (sheet SI1 | 1 ER): In the beginning, users need to narratively describe the project's background, scope and potential mitigation, incl. the approach for its determination and the project boundary.



1) **Parameters and assumptions applied in the estimations / documentation of emissions effects** (sheet SI1 | 1 ER with reference to SI1 | Mitigation): Users need to transparently list all parameters needed to calculate target and achieved values for GHG mitigation. The source and units of the respective parameters should be mentioned, making use of and direct referencing to the table for *Parameters and assumptions applied* in the general information sheet SI1 | Mitigation.



Zukunft Umwelt Gesellschaft

S 1 - Mitigation: GHG emissions reduced or carbon stocks enhanced directly or indirectly by IKI project measu

< SI 1 | 1 ER: Direct mitigation (Emission reductions) >

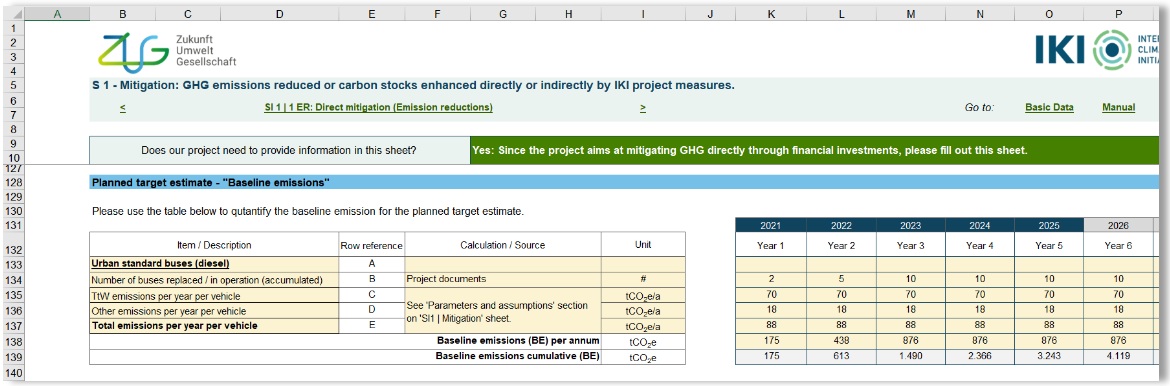
Does our project need to provide information in this sheet? | Yes: Since the project aims at mitigating GHG d

Planned target estimate - "Baseline emissions"

Please use the table below to qutantify the baseline emission for the planned target estimate.

Item / Description	Row reference	Calculation / Source	Unit
Urban standard buses (diesel)	A		
Number of buses replaced / in operation (accumulated)	B	Project documents	#
TtW emissions per year per vehicle	C	See 'Parameters and assumptions' section on 'SI1 | Mitigation' sheet.	tCO_2e/a
Other emissions per year per vehicle	D		tCO_2e/a
Total emissions per year per vehicle	E		tCO_2e/a
		Baseline emissions (BE) per annum	tCO_2e
		Baseline emissions cumulative (BE)	tCO_2e

2) **Calculation tables for "Baseline emissions", "Project emission", and "Leakage emissions"** (sheet SI1 | 1 ER): Users can either directly enter figures related to the used parameters or – where needed – calculate them. Please note: the grey cells are filled automatically based on the information provided in the yellow cells. For example, "Baseline emissions cumulative" are filled in automatically once the equation for calculating the baseline emissions per annum is filled.



Zukunft Umwelt Gesellschaft

IKI

S 1 - Mitigation: GHG emissions reduced or carbon stocks enhanced directly or indirectly by IKI project measures.

< SI 1 | 1 ER: Direct mitigation (Emission reductions) > Go to: Basic Data Manual

Does our project need to provide information in this sheet? | Yes: Since the project aims at mitigating GHG directly through financial investments, please fill out this sheet.

Planned target estimate - "Baseline emissions"

Please use the table below to qutantify the baseline emission for the planned target estimate.

Item / Description	Row reference	Calculation / Source	Unit	2021 Year 1	2022 Year 2	2023 Year 3	2024 Year 4	2025 Year 5	2026 Year 6
Urban standard buses (diesel)	A								
Number of buses replaced / in operation (accumulated)	B	Project documents	#	2	5	10	10	10	10
TtW emissions per year per vehicle	C	See 'Parameters and assumptions' section on 'SI1 | Mitigation' sheet.	tCO_2e/a	70	70	70	70	70	70
Other emissions per year per vehicle	D		tCO_2e/a	18	18	18	18	18	18
Total emissions per year per vehicle	E		tCO_2e/a	88	88	88	88	88	88
		Baseline emissions (BE) per annum	tCO_2e	175	438	876	876	876	876
		Baseline emissions cumulative (BE)	tCO_2e	175	613	1.490	2.366	3.243	4.119

3) **Calculation of baseline, project, and leakage emissions** (sheet SI1 | 1 ER)**:** Users need to enter or calculate all project figures or assumption for the "Baseline emissions", "Project emissions", and – if applicable – "Leakage emissions". For each of these three emission categories, there are two sections: i) **Planned target estimate** and ii) **Reporting**. Depending on the status of the project, e.g. the project's planning or implementation phase, the corresponding tables needs to be filled or updated. See Guidelines on Project Planning and Monitoring in the International Climate Initiative for more information and the definition of **Planned target estimate** and **Reporting** figures.

Zukunft Umwelt Gesellschaft

S 1 - Mitigation: GHG emissions reduced or carbon stocks enhanced directly or indirectly by IKI project measures.

< SI 1 | 1 ER: Direct mitigation (Emission reductions) >

Does our project need to provide information in this sheet?	**Yes: Since the project aims at mitigating GHG directly through financial investments, please fill o**

Planned target estimate - "Baseline emissions"

Please use the table below to qutantify the baseline emission for the planned target estimate.

Item / Description	Row reference	Calculation / Source	Unit	2021 Year 1	2022 Year 2	2023 Year 3
Urban standard buses (diesel)	A					
Number of buses replaced / in operation (accumulated)	B	Project documents	#	2	5	10
TtW emissions per year per vehicle	C	See 'Parameters and assumptions' section on 'SI1 | Mitigation' sheet.	tCO_2e/a	70	70	70
Other emissions per year per vehicle	D		tCO_2e/a	18	18	18
Total emissions per year per vehicle	E		tCO_2e/a	88	88	88
		Baseline emissions (BE) per annum	tCO_2e	175	438	876
		Baseline emissions cumulative (BE)	tCO_2e	175	613	1.490

Reporting - "Baseline emissions"

Please use the table below to quantify the baseline emission for the annual reporting estimate.

Item / Description	Row reference	Calculation / Source	Unit	2021 Year 1	2022 Year 2	2023 Year 3
Urban standard buses (diesel)	A					
Number of buses replaced / in operation (accumulated)	B	Project documents	#	2	4	0,00
TtW emissions per year per vehicle	C	See 'Parameters and assumptions' section on 'SI1 | Mitigation' sheet.	tCO_2e/a	70	70	0,00
Other emissions per year per vehicle	D		tCO_2e/a	18	18	0,00
Total emissions per year per vehicle	E		tCO_2e/a	88	88	0,00

4) **Contribution and role of IKI project** (sheet SI1 | 1 ER): If the project receives funding from other donors, the project should estimate the share of reduced emissions that accrue from IKI funds. For instance, if a project reduced 100 tCO_2e using 40% IKI funds and 60% funds from a different donor, it should only report 40 tCO_2e within the indicator. The contribution estimation only applies for direct emission reductions and is not applicable for indirect mitigation.

4. Contribution and role of IKI project

IKI Funding Factor - Adjustments for pro-rata share due to other actors:

If the project receives funds from other donors, funds or climate / biodiversity programmes, the project should estimate the share of reduced emissions that accrue from IKI funds. To illustrate, if a project reduced 100 tonnes of CO_2eq using 40% IKI funds to finance support measures and 60% funds from a different donor, it should only report 40 tonnes of CO_2eq within the indicator.

Does your project use funds from other donors / programmes to finance the mitigation measures that lead to the effects reported here?	No
If yes, what percentage of the mitigation can be attributed to IKI funds? (Will be used for automatic adjustment to pro-rata share of total emission reduction in the overview table above.	%
Please briefly elaborate:	

No additional funds from other sources are being used.

5) **Overall accuracy and rebound effects** (sheet SI1 | 1 ER): Lastly, users should describe any uncertainties regarding estimations and assumptions. Moreover, users should describe any rebound effects expected through the project and, if possible, provide an estimate of their scale.

6 Relevant default values and reference sources

The following table provides an overview of typical and useful default values for estimating the baseline and project emissions from e-mobility, modal shift and other transport projects (e.g. water and rail projects).

Table 5: Default values and references for mitigation estimation

Parameter	Value and Unit	Source
E-mobility projects		
ICEVs		
ICEV WtW emission factor	various, gCO_2/km	In decreasing order of preference: 1. Local measured data 2. National or international data from studies; 3. IPCC default values 4. Design data for relevant vehicle categories; 5. Globally applicable default values. OR calculate based on the parameters below.
Specific fuel consumption of baseline vehicle	various, l/km	Manufacturer's specification
Road transport emission factor	Gas/ diesel oil: 74,100 $kgCO_2/TJ$ Gasoline: 69,300 $kgCO_2/TJ$	IPCC 2006 Mobile Combustion and EEA GHG emission intensity of fuels and biofuels for road transport in Europe
Upstream emission factor	Diesel oil: 16.7 tCO_2e/TJ Gasoline: 13.5 tCO_2e/TJ	CDM Tool 15 Upstream leakage emissions associated with fossil fuel use
Fuel density	Gas/ Diesel oil: 0.84 kg/l Gasoline: 0.71 to 0.77 kg/l	CDP-Conversion-of-fuel-data-to-MWh.pdf or WorldAtlas.com
Fuel net calorific value	Gas/ Diesel oil: 43 MJ/kg Gasoline: 44.3 MJ/kg	IPCC 2006 Table 2

<table>
<tr><th>Parameter</th><th>Value and Unit</th><th>Source</th></tr>
<tr><td colspan="3">EVs</td></tr>
<tr><td>EV energy consumption</td><td>kWh/km</td><td>Energy consumption of full electric vehicles - EV Database (ev-database.org)</td></tr>
<tr><td>Emission factor electricity grid for the specific country</td><td>various, tCO_2/MWh</td><td>Harmonized IFI Default Grid Factors 2021 v3.2, combined margin for energy consumption</td></tr>
<tr><td colspan="3">Modal shift to public transport projects</td></tr>
<tr><td>Baseline distance and transport mode</td><td>km per vehicle category i</td><td>Municipal transit authorities or specific studies
Survey involving the users of the project transport system</td></tr>
<tr><td>Occupancy rates of different transport modes</td><td><table>
<tr><td colspan="4">Average occupancy</td></tr>
<tr><td></td><td>World</td><td>e.g. South Asia</td><td>Unit</td></tr>
<tr><td>Car</td><td colspan="2">2</td><td>Person incl. driver</td></tr>
<tr><td>Taxi</td><td colspan="2">1.1</td><td>Person excl. driver</td></tr>
<tr><td>Motor-cycle</td><td colspan="2">1.5</td><td>Person incl. driver</td></tr>
<tr><td>Bus</td><td>40%</td><td>80%</td><td>Total capacity</td></tr>
</table></td><td>Municipal transit authorities or specific studies
Default values (source: CDM Tool 18)
Survey</td></tr>
<tr><td>Share of passengers out of total number of passengers using the project system who have shifted from road-based vehicle categories to the urban public system</td><td>%</td><td>Survey involving the users of the project transport system</td></tr>
<tr><td>Specific fuel consumption</td><td>l/km</td><td>In decreasing order of preference:
Local measurements
National defaults
International defaults (IPCC)
Design data for relevant vehicle categories</td></tr>
<tr><td>Fuel emission factor</td><td>g CO_2/MJ</td><td>National defaults
International defaults (IPCC)</td></tr>
<tr><td>Emission factors</td><td>g CO_2/km</td><td>Calculation based on information above
Value provided by manufacturer</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Value and Unit</th><th>Source</th></tr>
<tr><td colspan="3">Modal shift of cargo projects</td></tr>
<tr><td>Emission factors for road transportation depending on the type of cargo transported</td><td>g CO_2/tonne-km

• Default emission factors for road transportation (AM0090)

<table>
<tr><th>Type of cargo transported</th><th>Emission factor (gCO_2/tonne .km)</th></tr>
<tr><td>Agricultural products and live animals</td><td>83</td></tr>
<tr><td>Beverage</td><td>61</td></tr>
<tr><td>Groceries</td><td>76</td></tr>
<tr><td>Perishable and semi-perishable foodstuff and canned food</td><td>94</td></tr>
<tr><td>Fertilizers</td><td>76</td></tr>
<tr><td>Chemicals</td><td>70</td></tr>
<tr><td>Transport equipment</td><td>100</td></tr>
<tr><td>Machinery and metal products</td><td>119</td></tr>
<tr><td>Glass and ceramic and porcelain products</td><td>84</td></tr>
<tr><td>Grouped goods</td><td>94</td></tr>
<tr><td>Other manufactured articles</td><td>113</td></tr>
</table>
</td><td>• Data bases or manufacturer information
• Default emission factors for road transportation in existing methodologies, e.g. see for instant, Table 2 in CDM methodology AM0090.</td></tr>
</table>

Finally, as indicated in Box 2 above, other projects that estimated emission reductions from similar activities potentially provide good references and entry points for the estimation of emission reduction. Projects can, inter alia, consult the CDM Project Search, VERRA / VCS Project Registry, or the Gold Standard Project Registry for reference sources.

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