Standard Indicator 1 - Mitigation

Estimating emission reductions from IKI project activites

Online Seminar 3 - Transport

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Virtual, 13.09.2023

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Agenda

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1 Introduction

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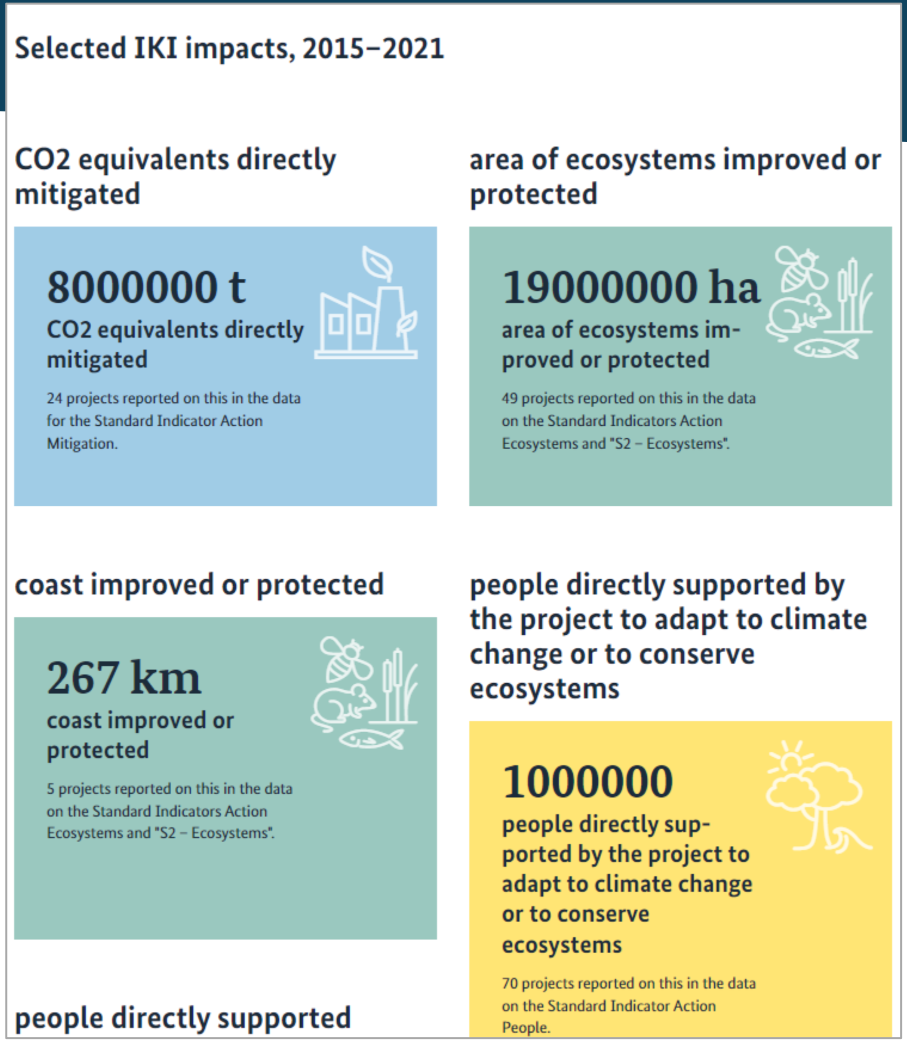
Introduction to the IKI Standard Indicators (SI)

- First introduced in 2015 and revised in 2022
- SI enable the IKI to aggregate headline results across individual projects
- Data is used to communicate IKI‘s achievements to the public, German parliament and other stakeholders and as part of national and international reporting



Source: https://www.international-climate-initiative.com/en/about-iki/impact-and-learning/.

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Overview of IKI Standard Indicators

SET A - Old SI

- Action Mitigation
- Action Ecosystems
- Action People

SET B – SI as of 2022

SI 1 - Mitigation	**GHG emissions reduced or carbon stocks enhanced directly or indirectly by IKI project measures.**
SI 2 - Ecosystems	Area of ecosystems with improved conservation and sustainable use due to IKI project measures.
SI 3 - Adaptation	Number of people directly and indirectly supported by IKI projects to better adapt to climate change.
SI 4 - Capacity People	Number of people directly supported by IKI projects through networking and training to address climate change and/or to conserve biodiversity.
SI 5 – Leveraged Finance	Volume of private and/or public finance leveraged for climate change and biodiversity purposes in EUR.

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Provisions for IKI projects in a nutshell

- Report **on new Standard Indicators (Set B),** if the project has submitted the first interim report in April 2022 or thereafter.
  - Older projects may be required to switch due to large amendment requests or can switch voluntarily
- Report **on all relevant Standard Indicators** (i.e. SI for which the project is producing results)
- Report in line with the respective Indicator Guidance Sheets in the **IKI Project Planning and Monitoring Guidelines**
- Report on new Standard Indicators (SET B) through the **IKI Standard Indicator Report** (Annex 7, Excel Tool)

Key guidance documents (click here)

- IKI Standard Indicator Report (Excel Tool)
- IKI Project Planning and Monitoring Guidelines (incl. Standard Indicator Guidance Sheets)

Please note that slight updates where made to both documents in July 2023 to improve clarity and useability.

2 Common understanding of direct and indirect mitigation

IKI differentiates between direct and indirect GHG mitigation

Estimating mitigation required for reporting of direct financed and technical support leading to immediate mitigation

Direct GHG emission reduction / carbon stock enhancement (in tCO_2e)	reduced or avoided immediately through mitigation measures (partly) ***financed by the IKI project or measures***	Estimating mitigation required for reporting
Indirect GHG emission reduction / carbon stock enhancement (in tCO_2e)	reduced or avoided by means of ***IKI-funded technical support*** for mitigation measures financed by a party other than the IKI, but the IKI plays a critical role in providing essential technical implementation support	
Long-term mitigation impact through enhanced policy frameworks	potential future / long-term emission reductions through ***enhanced policy frameworks***	Reference to existing target only

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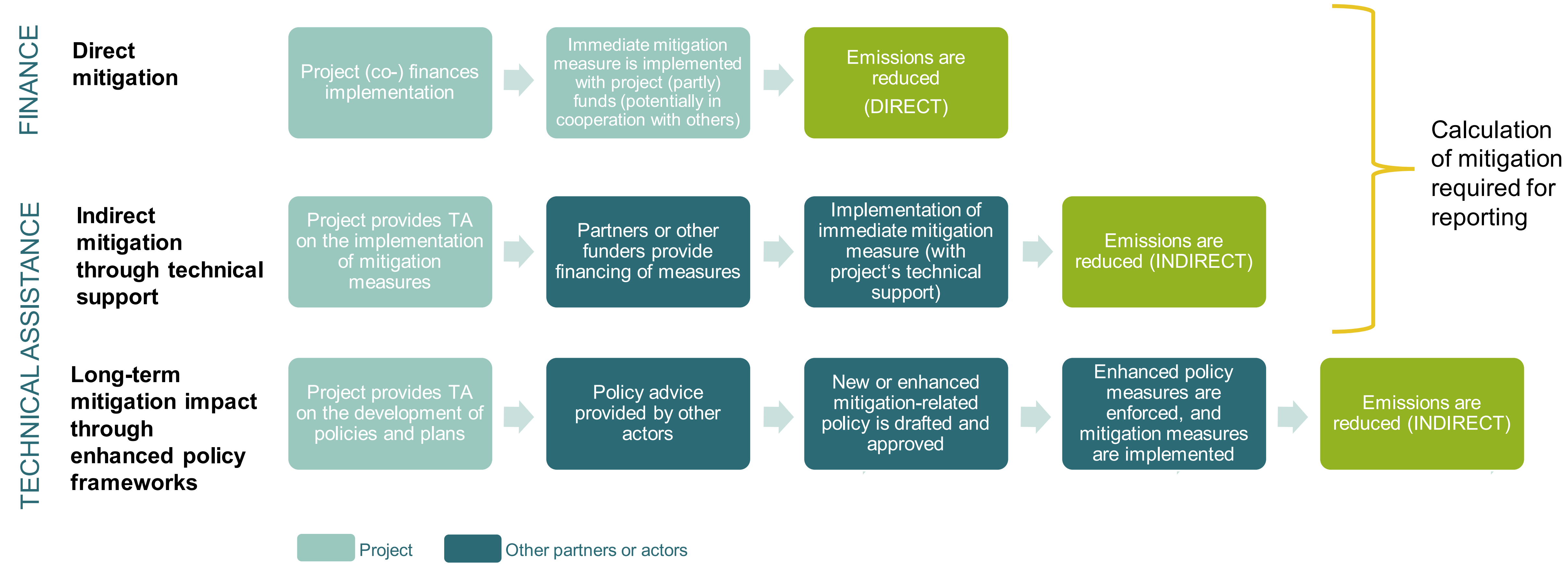
Different pathways and causal chains of IKI projects

Direct financing, technical support and enhanced policy framework



Project activities lead to different impact and potential mitigation

Examples for the three categories of impact

Direct mitigation

- On-the-ground piloting or demonstration components of IKI projects
- Use of financial mechanisms
- Development and financing of an app
- Project activities resulting in lower-carbon intensity of services or products

Immediate GHG emission reductions

Indirect mitigation through technical support

- Technical capacity development for the scaling of pilots
- Implementation of community forest management plans that translate into protected forest areas
- Improved land or marine management status
- Short-term removal of regulatory barriers

Short-term / upscale GHG emission reductions

Enhanced policy frameworks

- Technical support on the development/ revision of NDCs or LT-LEDS
- Development of sectoral policies / strategies
- Development of subnational net-zero emissions action plans
- Roadmaps for policies

Long-term mitigation impact / potential for future GHG emission reductions

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3 Typical emission sources and emission reduction activities

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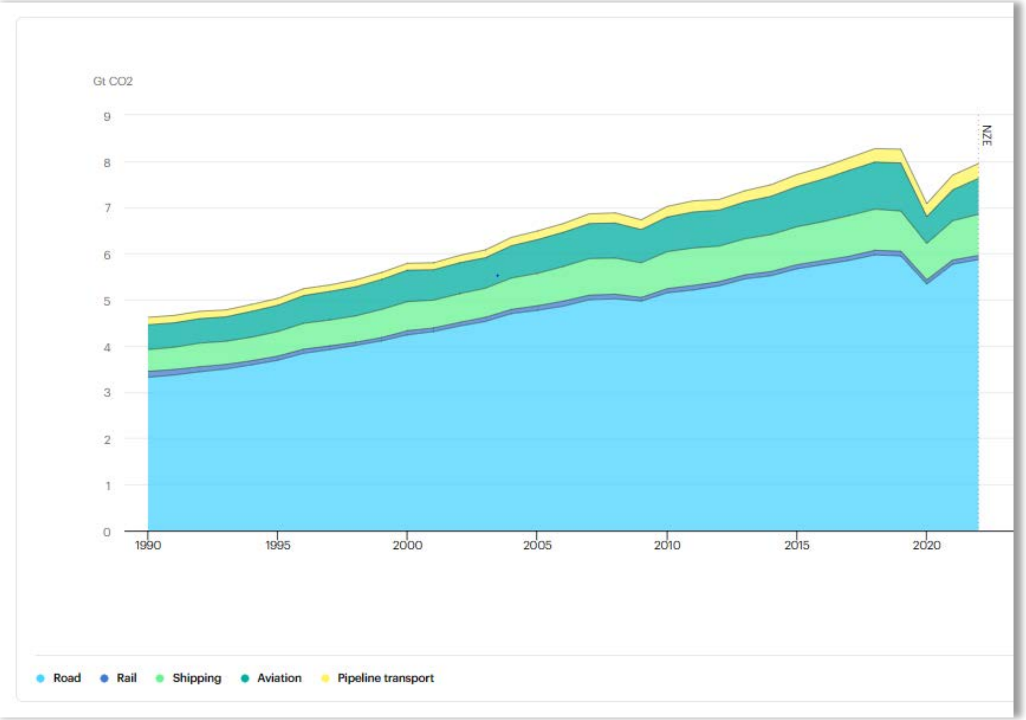
Transport accounts for more than a third of CO_2 emissions from end-use sectors

International Energy Agency's transport emission figures (see https://www.iea.org/energy-system/transport)

- 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)
- Most transportation-related emissions come from **road vehicles**
- Although they represent fewer than 8% of vehicles (excluding two- and three-wheelers), **trucks and buses are responsible for more than 35% of direct CO_2 emissions from road transport**

CO_2 emissions from transport since 1990



Source: https://www.iea.org/energy-system/transport#tracking

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Measures to reduce GHG emissions in the transport sector

Aim of the Avoid, Shift, and Improve (ASI) approach is to develop sustainable transport systems

AVOID

Avoid and reduce the need for motorised travel via

- a transport-oriented compact development of cities

SHIFT

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

- Promotion of the use of intermodal transport systems, such as using a combination of road, rail and water

IMPROVE

Adoption of cleaner and more efficient vehicle technologies

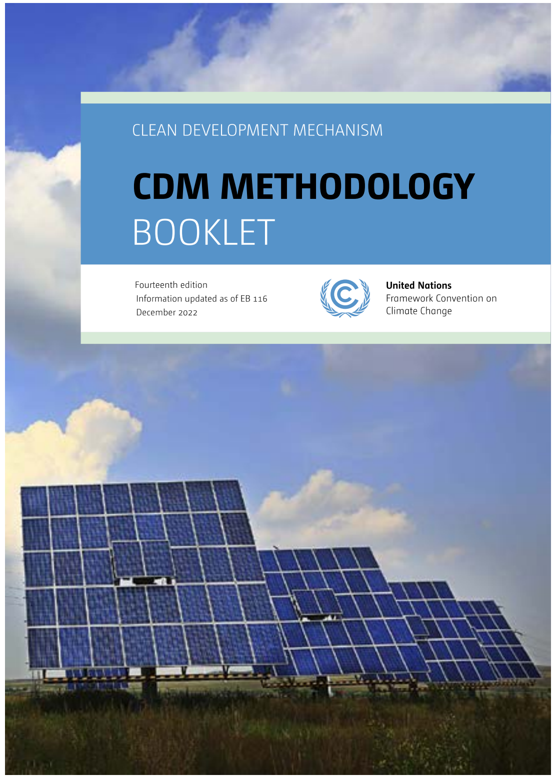
- Electric and hybrid vehicles
- Vehicles powered by alternative fuels like hydrogen
- Extension of renewable energy charging infrastructure
- Improvements in engine efficiency
- Energy efficient technologies in aviation and maritime sectors such as electric ground support equipment

Choosing an applicable methodological approach and default values

Numerous methodologies and tools exist to assess emissions associated with transport project activities

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

- check other projects that estimated emission reductions from same / similar activities, e.g.,
  - CDM Project Search, VERRA / VCS Project Registry, NAMA Support Projects etc.
  - consult existing methodologies: CDM Meths, VCS, GS etc., e.g., in the CDM Methbook
- consult and use simplified tools for the estimation, if existing, e.g.,
  - COPERT is the EU standard vehicle emissions calculator (vehicle population, mileage, speed and other data; emissions and energy consumption)
  - Vehicle Energy Consumption calculation TOol - VECTO
  - GHG Protocol GHG Emissions from Transport or Mobile Sources
  - GEF_Transport Emissions Evaluation Models for Projects (TEEMP)
- make use of default values and reasonable assumption source from references, e.g.,
  - CDM TOOL33 Methodological tool: Default values for common parameters
  - Harmonized IFI Default Grid Factors 2021 v3.2



4 Typical baseline and project scenario (incl. leakage)

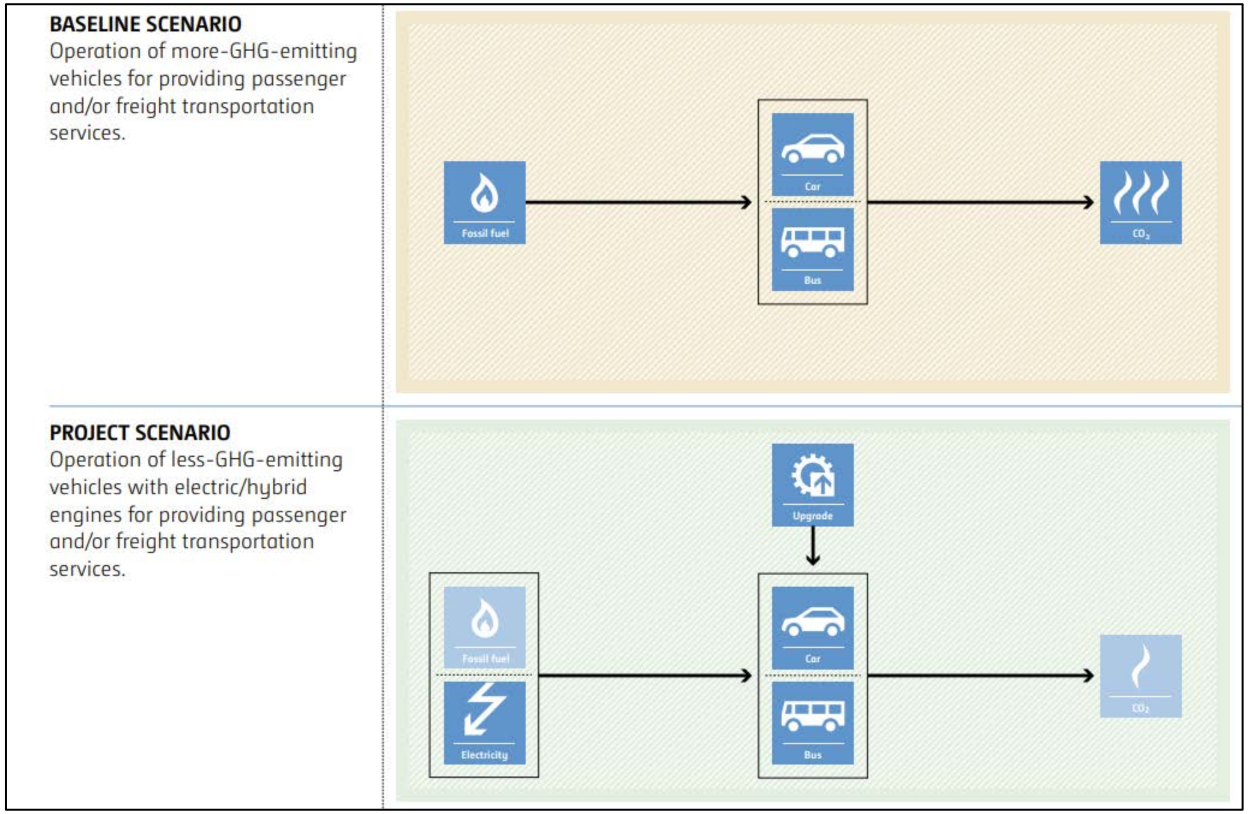
Typical baseline and project scenario

Baseline scenario

- reflects the emissions that would occur without the project
- represents the reference situation, e.g.
  - *the continuation of current activities (e.g. Business-as-Usual)*
  - *emissions from a technology that represents an economically attractive course of action*
  - *a benchmark approach (considering emissions from similar project activities undertaken in the previous five years in similar circumstances)*

Project scenario

- represents the emissions associated with the (proposed) project's implementation
- reflects the expected outcomes of the project



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

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Calculation of emission reductions

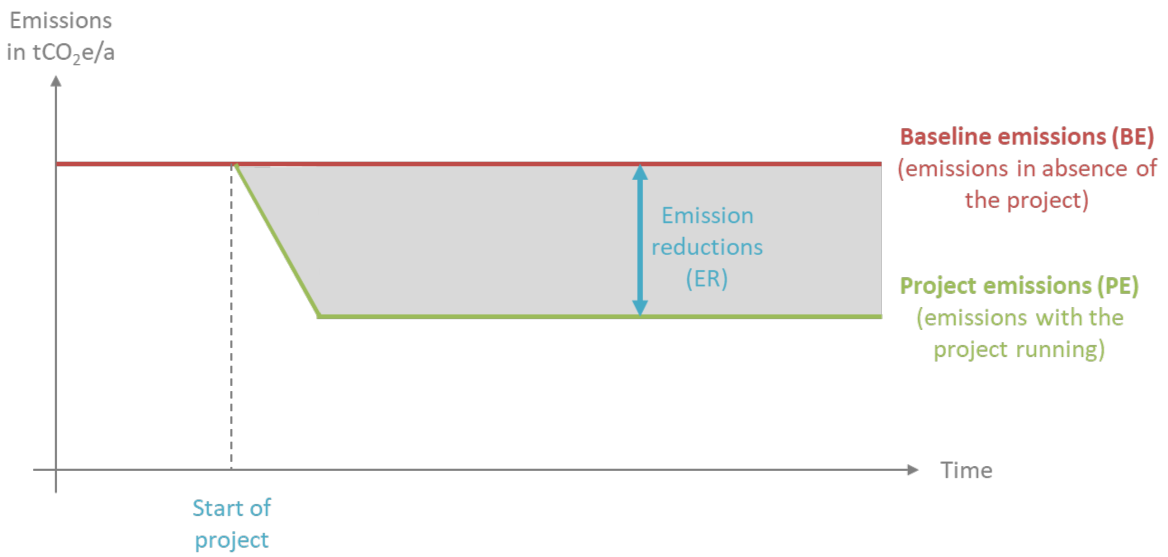
General approach for mitigation activites considering baseline and project emissions

The achieved emissions reductions are typically calculated as the difference between baseline emissions and emissions after project implementation, considering any potential leakage.

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emissions 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)



Source: Mitigation Action Facility (2023): [Mitigation Action Facility – Mitigation Guideline for the Project Concept Phase](), p. 10

Consideration of leakage emissions

GHG emissions which occurs outside the project boundary attributable to the project activity

Carbon leakage

- The increase of **GHG emissions which occurs outside the project boundary** which is attributable to the project activity (cf. Glossary: CDM terms)
  - Under GHG Protocol, leakage emissions are also referred to as “secondary effects”
  - Attention: leakage is used in different meanings: e.g., “physical leakage” from bio-digester (i.e., a project emission source)

Examples of carbon leakage in transport projects

- Transfer and continued use of baseline equipment outside of the project boundary (e.g., old internal combustion engine vehicles)

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5 Calculation of emission reductions (incl. example)

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Case study: Public bus fleet electrification

Introduction to an example case for illustrating the approach and calculation

Case study

Project: Public bus fleet electrification

- Target group: **Public transport operators** in the project city
- Electrification of bus fleet: **Replacement of standard Diesel EURO IV buses with battery electric buses** (BEBs)
- Project intervention:
  - Technical support
  - **Financial support for purchase of BEBs**

Source: Sustainable bus

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Baseline and project scenario

Case study

Baseline scenario

- Use of **Diesel EURO IV buses** continues to prevail
- For new buses, public transport operators are very likely to go for **standard urban Diesel buses** due to existing barriers, such as high up-front cost (compared to BEBs), missing infrastructure, and lack of confidence in the technology

Source: Saporedicina.com

Project scenario

- Support the purchase of **10 BEBs incl. relevant infrastructure**
  - The BEBs will be **purchased instead of new** Diesel EURO IV buses (no leakage)
  - BEB can carry same number of passengers as Diesel EURO IV bus

Source: Sustainable bus

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Project boundary

Case study

The project boundary

- Refers to the defined **scope or geographical area** within which emissions and emission reductions are accounted for
- Sets the limits for **what emissions** are included in the assessment

For e-mobility transport projects project boundary includes the

- The vehicles of the project;
- The geographic boundaries where the project activity vehicles are operated;
- 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.

Life-cycle GHG emission sources of a vehicle

Case study

Vehicle (and battery) production

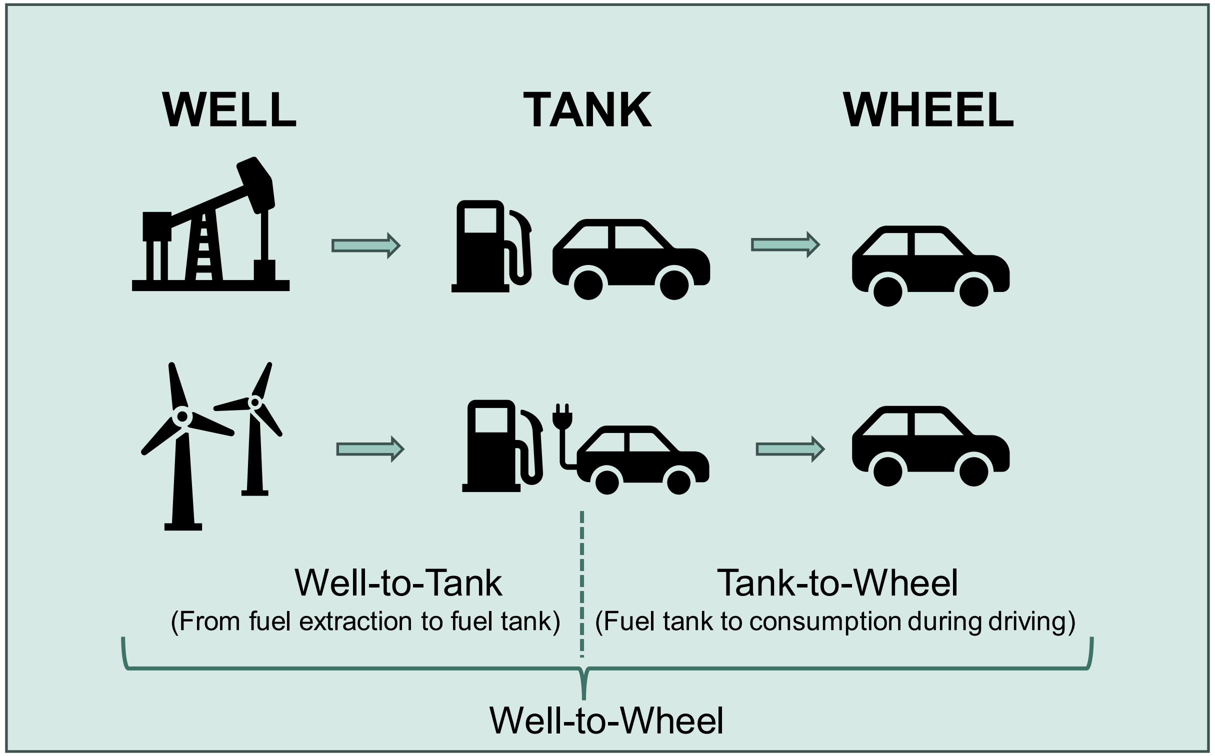
- Emissions associated with production of the vehicle (incl., if applicable, the battery)

Vehicle usage phase

- Tank-to-Wheel (TtW) = Fuel tank to consumption during driving
- Well-to-Tank (WtT) = From fuel extraction to fuel tank

End of life phase

- Relatively low compared to usage phase and not considered in the case study



Source: Own illustration

Life-cycle GHG emission sources of a vehicle

Case study

Depending on data availability, the following sources should be included in the calculation

Priority	Emission Source
1	Tank-to-Wheel = Fuel tank to consumption during driving
2	Well-to-Tank = From fuel extraction to fuel tank
3	Vehicle and battery production
4	End-of-life phase

Priorities 1–2: WtW emissions

Priorities 3–4: Nice to have (best practice)

Calculation of baseline emissions

Case study

Baseline emissions are calculated based on the **unit of service provided by the project vehicles** (travelled distance in km) **times the emission factor for the baseline vehicle** to provide the same unit of service .

$$ER_y = BE_y - PE_y - LE_y$$

$$BE_y = EF_{BL,km,y} * DD_y * N_y * 10^{-6}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2)

$EF_{BL,km,y}$ = ICEV WtW emission factor per kilometre in year *y* (g CO_2/km)

DD_y = Annual average distance travelled by project EV in year *y* (km)

N_y = Number of operational project EVs in year *y*

Calculation of project emissions

Case study

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

$$ER_y = BE_y - PE_y - LE_y$$

$$PE_y = EF_{PJ,km,y} * DD_y * N_y * 10^{-6}$$

Where:

PE_y = Total project emissions in year *y* (tCO_2)

$EF_{PJ,km,y}$ = EV WtW emission factor per kilometre in year *y* (g CO_2/km)

DD_y = Annual average distance travelled by project EV in year *y* (km)

N_y = Number of operational EVs in year *y*

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Calculation of leakage emissions

Case study

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.

$$ER_y = BE_y - PE_y - LE_y$$

$$LE_y = EF_{BL,km,y} * DD_y * N_y * 10^{-6}$$

Where:

LE_y = Leakage emissions in year *y* (tCO_2)

$EF_{BL,km,y}$ = ICEV WtW emission factor per kilometre in year *y* (g CO_2/km)

DD_y = Annual average distance travelled by project EV in year *y* (km)

N_y = Number of replaced ICEVs which continue to be used outside project boundary in year *y*

Key parameters required to estimate emission reductions

Case study

Parameter	Unit	Value/source
Number of EVs operated under the project	No.	Project data
Annual average distance driven by project vehicles	km	Project data
$EF_{BL,km}$ = ICEV WtW emission factor per kilometre	g CO_2e/km	Calculation (*see following slides*)
$EF_{PJ,km}$ = EV WtW emission factor per kilometre	g CO_2e/km	Calculation (*see following slides*)

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Example: Calculation of baseline emissions

Case study

Well-to-Wheel emission factor per kilometer

$$BE_y = EF_{BL,km,y} * DD_y * N_y * 10^{-6}$$

DD_y: Annual average distance travelled by project EV in year *y*

N_y: Number of operational project EVs in year y

Information required to calculate WtW $EF_{BL,km,y}$:

Parameter	Value for Diesel EURO IV	Unit
Direct emissions energy: Tank-to-Wheel EF	1,020	gCO_2e/km
Indirect emissions energy: Well-to-Tank EF	230	gCO_2e/km
Well-to-Wheel EF	**1,250**	**gCO_2e/km**

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Example: Calculation of baseline emissions

Case study

Information required to calculate TtW and WtT EFs of the baseline vehicle:

Parameter	Required parameters (unit)
Tank-to-Wheel EF (gCO_2e/km)	• Specific fuel consumption (l/100 km) • Diesel CO_2 emission factor (kgCO_2e/l)
Well-to-Tank EF (gCO_2e/km)	• TtW EF (gCO_2e/km) • Diesel upstream CO_2 emission factor (gCO_2e/MJ) } WtT mark-up factor (%) • Diesel CO_2 emission factor (gCO_2e/MJ) }

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Example: Calculation of baseline emission factor

Case study

$$TtW_{BL} = \frac{40l}{100km} * (2.55\frac{kgCO2e}{l}) * 1{,}000 = 1{,}020\frac{gCO2e}{km}$$

Specific fuel consumption Diesel CO_2 emission factor

$$Diesel\ CO2\ EF = 0.8\frac{\mathrm{kg}}{\mathrm{l}} * 43\frac{\mathrm{MJ}}{\mathrm{kg}} * 74\frac{\mathrm{gCO2e}}{\mathrm{MJ}} * \frac{1}{1000} = 2.55\frac{\mathrm{kgCO2e}}{\mathrm{l}}$$

Diesel density Diesel NCV Diesel CO_2 EF

$$WtT_{BL} = 1{,}020\frac{gCO2e}{km} * 0.225 = 230\frac{gCO2e}{km}$$

Mark-up factor $= \frac{Upstream\ Diesel\ EF}{Diesel\ CO2\ EF} = \frac{16.7}{74}\frac{gCO2e}{MJ}$

$$WtW_{BL} = TtW_{BL} + WtT_{BL} = 1{,}250\frac{gCO2e}{km}$$

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Example: Calculation of project emissions

Case study

Well-to-Wheel emission factor per kilometer

$$PE_y = EF_{PJ,km,y} * DD_y * N_y * 10^{-6}$$

Annual average distance travelled by project EV in year *y*

Number of operational project EVs in year y

Information required to calculate WtW $EF_{PJ,km,y}$:

Parameter	Value for BEB	Unit
Direct emissions energy: Tank-to-Wheel EF	0	gCO_2e/km
Indirect emissions energy: Well-to-Tank EF	84	gCO_2e/km
Well-to-Wheel EF	**84**	**gCO_2e/km**

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Example: Calculation of project emission factor

Case study

$$TtW_{PJ} = 0$$

$$WtT_{PJ} = 1.296\frac{kWh}{km} * 0.065\frac{tCO2}{MWh} * 1{,}000 = 84\frac{gCO2e}{km}$$

↓ Specific energy consumption project vehicle

↓ Grid emission factor in project country

$$WtW_{PJ} = TtW_{PJ} + WtT_{PJ} = 84\frac{gCO2e}{km}$$

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Example: Public bus fleet electrification

View into the IKI Standard Indicator Report (Excel tool)

Case study

Zukunft Umwelt Gesellschaft

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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 Overview

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	2027 Year 7	2028 Year 8	2029 Year 9	2030 Year 10	2031 Year 11	2032 Year 12
Urban standard buses (diesel)	A														
Number of buses replaced / in operation	B	Project documents	#	2	5	10	10	10	10	10	10	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	70	70	70	70	70	70
Other emissions per year per vehicle	D		tCO_2e/a	18	18	18	18	18	18	18	18	18	18	18	18
Total emissions per year per vehicle	E		tCO_2e/a	88	88	88	88	88	88	88	88	88	88	88	88
		Baseline emissions (BE) per annum	tCO_2e	175	438	876	876	876	876	876	876	876	876	876	876
		Baseline emissions cumulative (BE)	tCO_2e	175	613	1.490	2.366	3.243	4.119	4.995	5.872	6.748	7.625	8.501	9.377

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	2024 Year 4	2025 Year 5	2026 Year 6	2027 Year 7	2028 Year 8	2029 Year 9	2030 Year 10	2031 Year 11	2032 Year 12
Urban standard buses (diesel)	A														
Number of buses replaced / in operation	B	Project documents	#	2	4	0	0	0	0	0	0	0	0	0	0
TtW emissions per year per vehicle	C	See 'Parameters and assumptions' section on 'SI1 | Mitigation' sheet.	tCO_2e/a	70	70	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Other emissions per year per vehicle	D		tCO_2e/a	18	18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total emissions per year per vehicle	E		tCO_2e/a	88	88	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
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	Z			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
		Baseline emissions (BE) per annum	tCO_2e	175	351	0	0	0	0	0	0	0	0	0	0
		Baseline emissions cumulative (BEc)	tCO_2e	175	526	526	526	526	526	526	526	526	526	526	526

6 Relevant default values and reference sources

Default values for mitigation estimation of e-mobility projects

Parameter	Value and Unit	Source
ICEVs		
ICEV TtW or WtW emission factor	various, gCO_2/km	In decreasing order of preference: 1.Local measured data (e.g. from studies) 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/100km	Manufacturer's specifications
Road transport emission factor	Gas/ Diesel oil: 74,100 $kgCO_2$/TJ Gasoline: 69,300 $kgCO_2$/TJ	IPCC 2006 Mobile Combustion
Upstream emission factor	Diesel oil: 16.7 tCO2e/TJ Gasoline: 13.5 tCO2e/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 1.2

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Default values for mitigation estimation of e-mobility projects

Parameter	Value and Unit	Source
EVs		
EV energy consumption	kWh/km	Energy consumption of full electric vehicles - EV Database (ev-database.org)
Emission factor electricity grid for the specific country	various, tCO_2/MWh	Harmonized IFI Default Grid Factors 2021 v3.2, combined margin for electricity consumption

7 Conclusion

Wrap-up

Identify relevant project/ activity types and develop a clear understanding of the project type and mitigation action covered

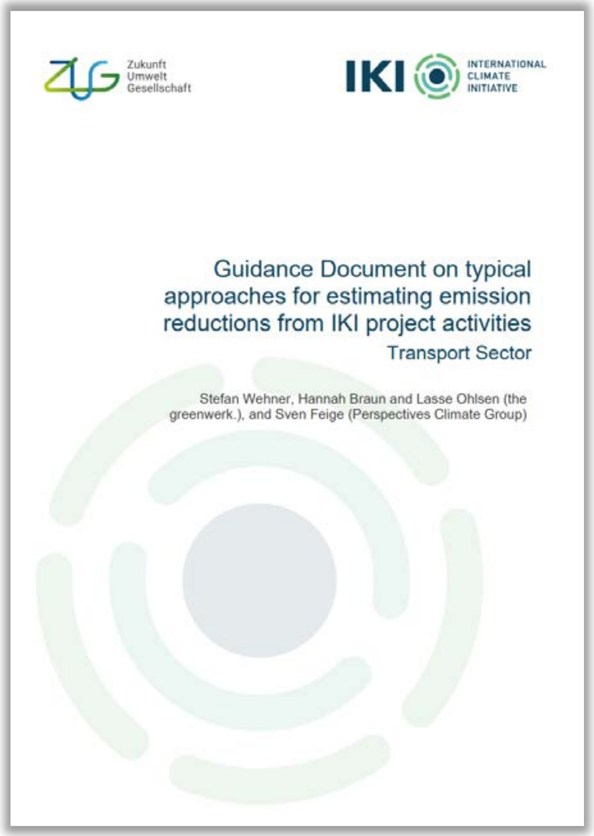
- Identify the **project's key characteristics and the underlying technologies**
- Conduct an **impact assessment**, e.g., using a causal chain analysis to identify the envisaged effects and possible co-benefits

Identify and quantify emission reductions

- Identify the **emission sources** for emission reduction activities
- Select a **suitable methodology** or define an **applicable estimation approach**
- Define **clear baseline and project scenario**

Prepare a **monitoring plan** incl. monitoring and reporting processes

? Contact IKI Standard Indicator Helpdesk for questions: iki-si-helpdesk@z-u-g.org



Related Guidance Document will be published shortly

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THANK YOU FOR YOUR ATTENTION

Stefan Wehner and Hannah Braun (the greenwerk.) & the IKI Standard Indicator Helpdesk

13.09.2023

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