Standard Indicator 1 - Mitigation

Estimating emission reductions from IKI project activites

Online Seminar 1 - Energy (Energy supply incl. renewable energies)

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Virtual, 27.07.2023

Agenda

1	Introduction
2	Common understanding of direct and indirect mitigation
3	Typical emission sources for emission reduction activities / measures in the energy sector (incl. applicable methodologies)
4	Typical baseline and project scenario (incl. leakage)
5	Calculation of emission reductions (incl. example)
6	Relevant default values and reference source
7	Conclusion

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1 Introduction

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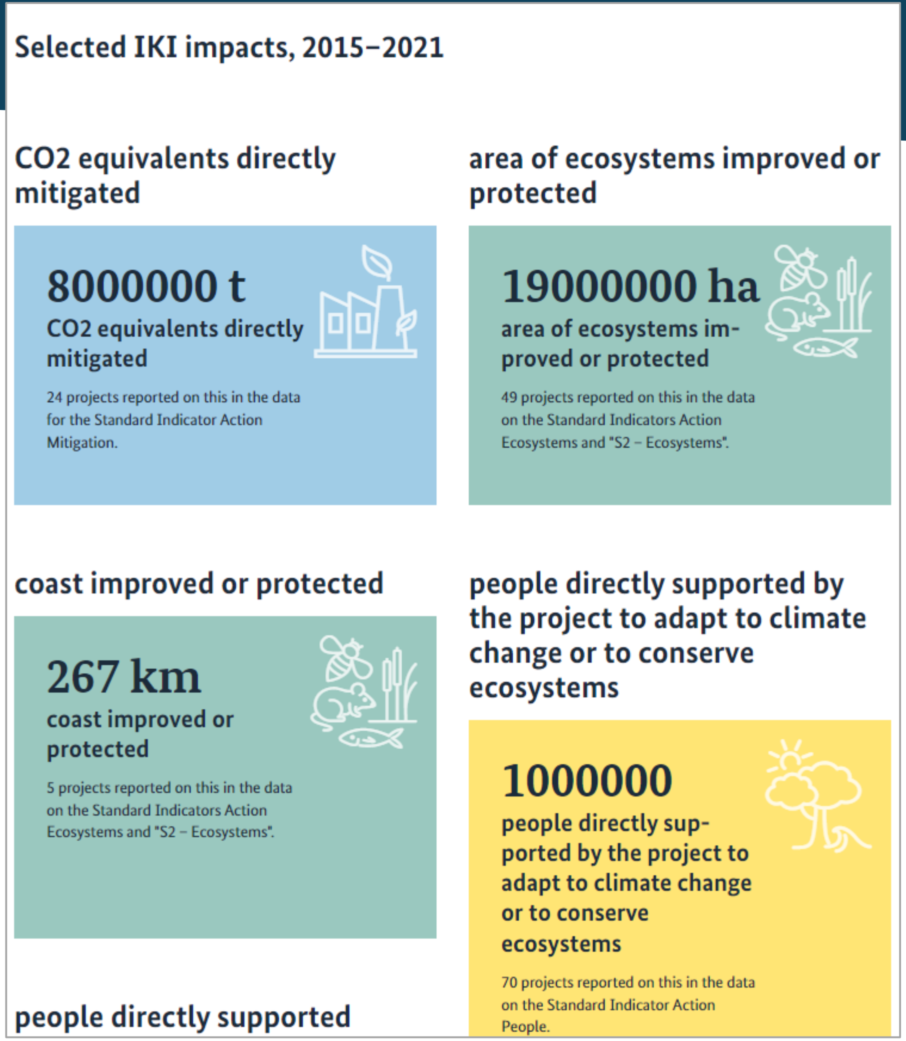
Introduction to the IKI Standard Indicators (SI)

- 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.

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2 Common understanding of direct and indirect mitigation

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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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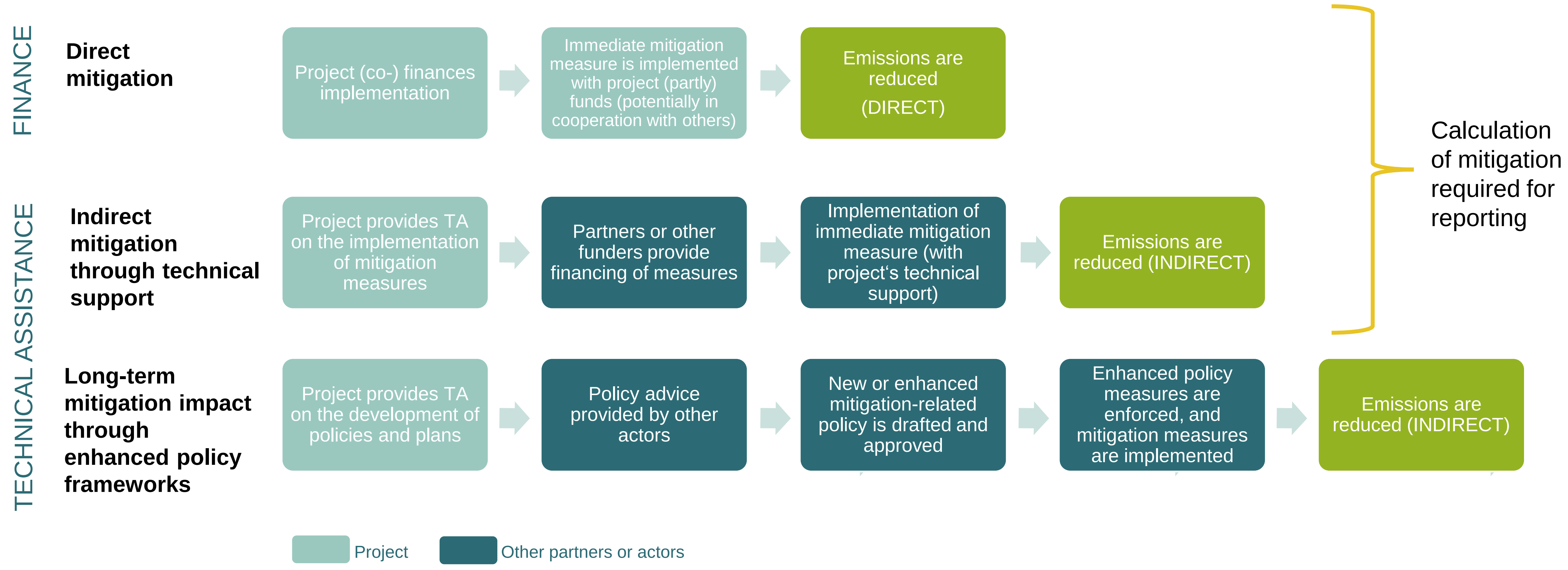
Different pathways and causal chains of IKI projects

Direct financing, technical support and enhanced policy framework



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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

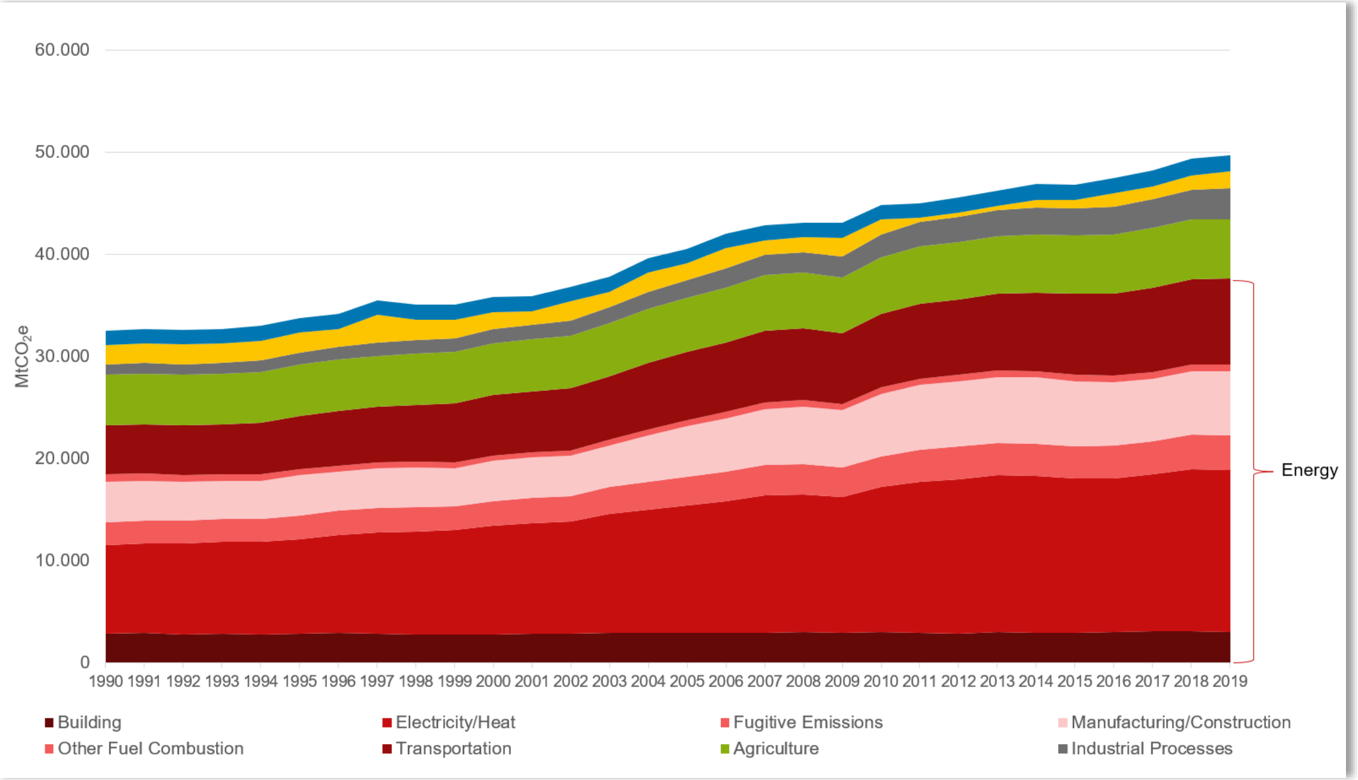
3 Typical emission sources and emission reduction activities

Global energy-related CO_2 emissions reached a new high in 2022

Key messages from the IEA 2022 report „CO_2 Emissions in 2022“

- Global energy-related CO_2 emissions grew by 0.9% or 321 Mt in 2022, reaching a new high of **36.8 $GtCO_2e$**
- The ***biggest sectoral increase*** in emissions in 2022 came from ***electricity and heat generation***
- ***Electricity and heat generation*** account for over ***40% of global CO_2 emissions from fuel combustion***

Historical Development of GHG emissions since 1990



approx. 75% total GHG emissions

Source: Own illustration based on data from ClimateWatch, 2023

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Options to avoid and reduce GHG emissions from energy-consuming activities

Energy generation

- Use of **renewable energies for power generation**
  - Solar energy for centralised grids
  - Solar energy for isolated grids and autonomous systems
  - Wind energy
  - Ocean energy
  - Geothermal energy
  - Biofuel fired power plants
  - Hydroelectric power plants
- Use of **renewable energies for heating and cooling**
  - Solar energy - thermal applications
  - Biomass
  - Biogas
  - Heat pumps
  - Geothermal energy

Energy efficiency

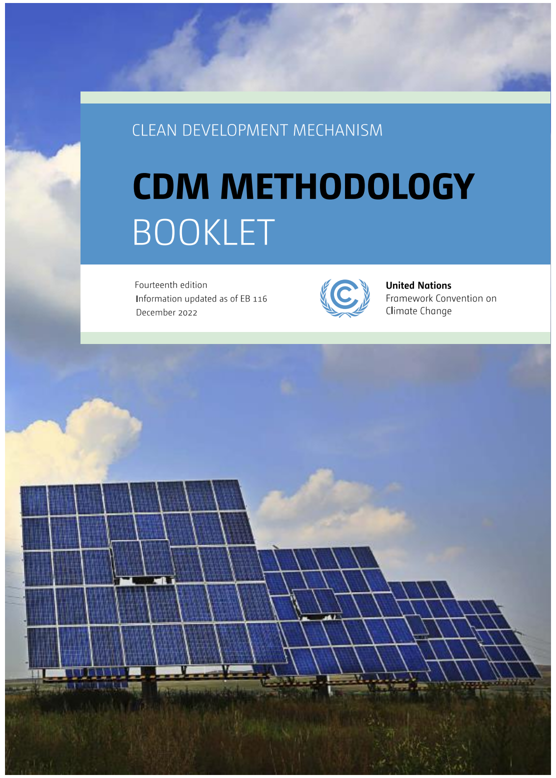
- Increasing **energy efficiency in electricity generation,** such as
  - Combined heat and power plants
  - District heating and cooling systems
- Improving **energy distribution**, e.g., through the use of
  - Modern electricity transmission and distribution (centralised grids)
  - Modern electricity transmission and distribution (isolated mini-grids)
  - Modern urban infrastructure for the supply of natural gas and the production, distribution and refilling of LPG cylinders
  - Infrastructures for electric mobility
- **Energy efficiency measures** to reduce the consumption of consumed electricity and energy
  - Use of energy-efficient equipment
  - Energy efficiency in the manufacturing / industry sector

Right choice of an applicable methodological approach and use of default and reference values

How to estimate the mitigation impact from energy project activities and measures

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.,
  - SEforAll Minigrid Emission Tool
  - IGES CDM Emission Reductions Calculation Sheet Series for typical project types (waste energy recovery, treatment of wastewater, electrification of rural communities using RE, efficient lightning, composting, landfill, manure management)
- 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



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4 Typical baseline and project scenario (incl. leakage)

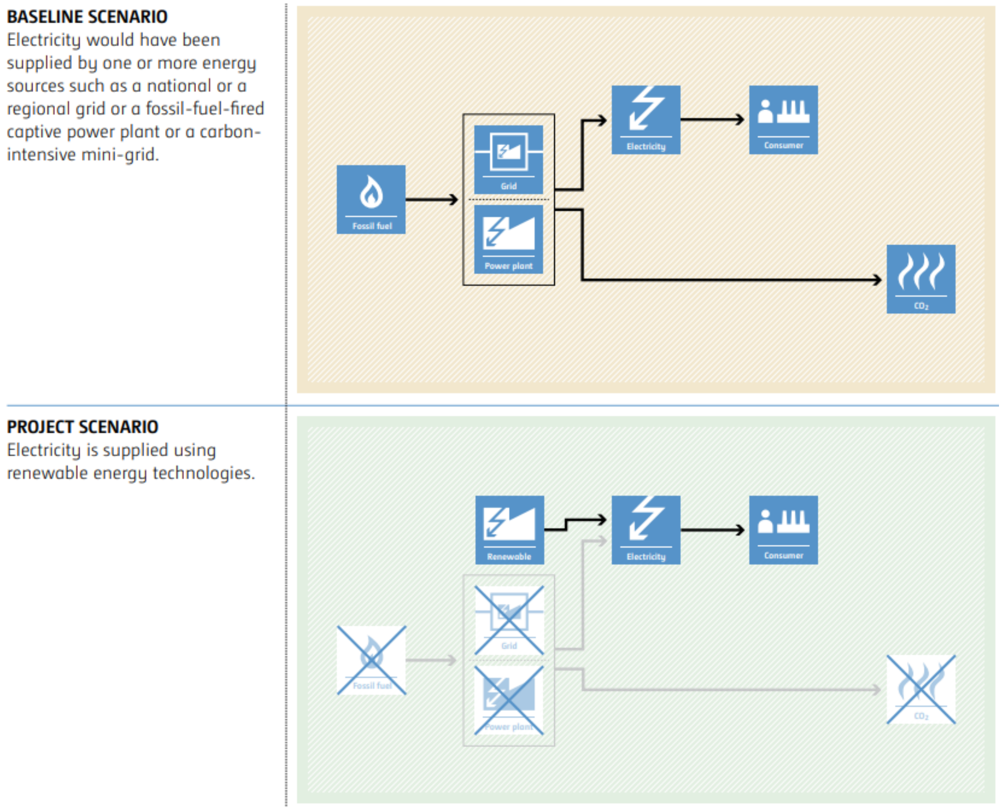
Typical baseline and project scenario

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. 176.

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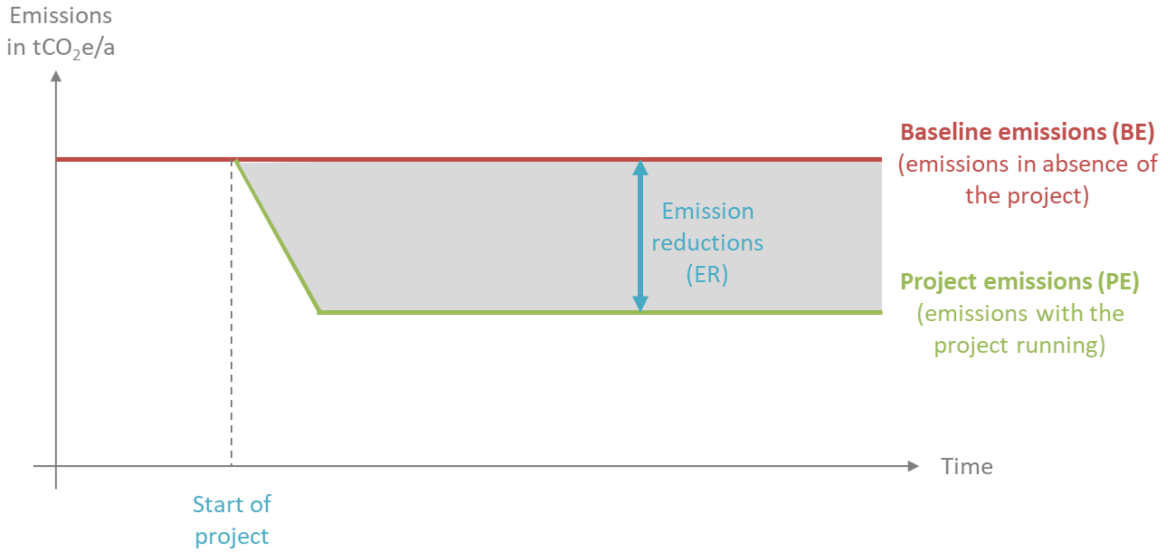
Calculation of emission reductions

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

- Transfer and continued use of baseline equipment outside of the project boundary (e.g., old internal combustion engine vehicles)
- Biomass projects
  - Shift of pre-project activities (e.g., deforestation outside the land area where the biomass is grown)
  - Emissions from biomass generation / cultivation and transportation (outside project boundary)
  - Competing uses for the biomass

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5 Calculation of emission reductions (incl. example)

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Solar energy-based water treatment for hospitals

Introduction to an example case for illustrating the approach and calculation

Case study

Project: Solar energy-based water treatment for hospitals

- Target group: ***Water treatment systems in hospitals*** in rural areas and urban areas
- More sustainable energy supply: Implementation of ***solar-powered*** water treatment plants to ***displace fossil fuel-based electricity***
- Project intervention:
  - Technical support
  - Financial support for installing new solar energy-based water treatment system (direct mitigation through pilots)

Source: Applied Membranes

Solar power replaces fossil fuel-based electricity

Baseline and project scenario for water treatment

Case study

Baseline scenario

- Use of ***fossil fuel powered water treatment*** continues to prevail
- The operators of water treatment systems are very likely to go for ***diesel generation or use an existing grid connection*** since the upfront investment costs are lower compared to those of solar PV

Source: Energy News Network

Project scenario

- Construction of ***25 solar energy-based water treatment systems***
- The solar energy-based water treatment systems will ***replace conventional systems run by diesel generators (in rural areas)*** or with ***electricity from fossil-fuel based power grid (in urban areas)***
- 20% of the diesel generators used in the baseline scenario will continue to be used outside the project boundary thus causing ***leakage emissions***

Source: Solar Powered Water Purification – GSEL

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Project boundary includes the hospitals and the power generation facilities

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

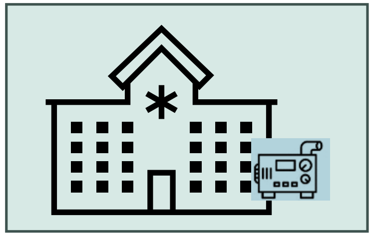
For typical energy projects

- The project boundary includes the ***physical site of the renewable electricity generating unit(s) and the equipment that uses the electricity produced***
- For grid connected renewable electricity projects, the project boundary includes the ***power plant(s) connected physically to the electricity system*** to which the project power plant is connected to

Case study:

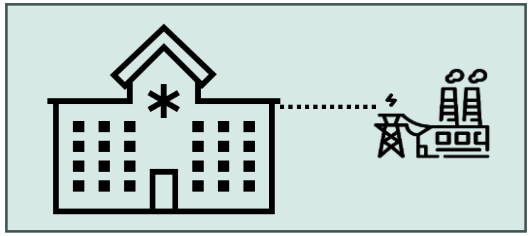
Case 1) On-site electricity generation by diesel gen-sets

The spatial extent of the project boundary includes only the hospital facilities.



Case 2) Electricity is obtained from the national grid

Project boundary includes the hospital facilities as well as power plant(s) providing electricity to the national grid.



Source: Own illustration

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Calculation of baseline emissions based on fuel consumption or equivilant energy generation

Baseline emissions are calculated based on the ***fuel consumption of the technology in use*** or that would have been used ***to generate the equivalent quantity of energy*** under the baseline scenario.

$$ER_y = BE_y - PE_y - LE_y$$

$$BE_y = E_{BL,y} * EF_{CO2,y}$$

Where:

BE_y = Baseline emissions in year y (tCO_2)

$E_{BL,y}$ = Energy baseline in year y (kWh), i.e., Quantity of net electricity / energy displaced (or reduced) as a result of the implementation of the project

$EF_{CO2,y}$ = Emission factor of the displaced fuel (tCO_2 /kWh)

Project emissions of renewable energy projects are typical zero

In case of renewable energy, including solar, wind etc. but except hydropower and geothermal energy, project emissions are deemed zero, i.e., $PE_y = 0$.

$$ER_y = BE_y - PE_y - LE_y$$

$$PE_y = 0$$

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)

Leakage emissions of renewable energy projects

While renewable energy projects often assume leakage to be zero (except for biomass projects), leakage emissions in the example may be caused by the continued use of diesel generators outside the project boundary.

$$ER_y = BE_y - PE_y - LE_y$$

LE_y = CO_2 caused by, e.g., continued use of baseline equipment outside the project boundary

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)

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Key parameters required to estimate emission reductions

Parameter	Unit	Value/source
Number of renewable energy facilities installed	No.	Project data
Average and total installed capacity of renewable energy facilities	kWp	Project data
$E_{BL,y}$ = Energy baseline per project facility (generation or consumption)	kWh	Measured or historical figures (for ex-ante estimation default capacity factors can be used for estimating the energy generation)
$EF_{CO2,y}$ = Emission factor of baseline energy source	tCO_2e/kWh	**Grid-connected**: Harmonized IFI Default Grid Factors 2021 v3.2, provides default grid emissions factors. **Off-grid**: If no project-specific data is available, a default value as per Table 1 of CDM TOOL33 Methodological tool: Default values for common parameters Version 02.0 should be considered.

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Example: Calculation of baseline emissions

Case study

The baseline emissions are the annual electricity generated by the renewable energy units * an emission factor.

$$BE_y = E_{BL,y} * EF_{CO2,y}$$

Further information:

- ***40%*** of the hospitals participating in the pilot project are ***in rural communities***
  - they use ***diesel-based generators*** to power their water treatment systems
  - the size of typically replaced diesel gensets is assumed to be >15 kW with a load factor of about 50%
- ***60%*** of the participating hospitals are ***in urban areas***
  - they use electricity from the grid to power their water treatment systems
  - the ***grid emission factor (GEF)*** is applied as emission factor

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Example: Calculation of baseline emissions

Case study

Commonly used emission factors are provided, for example, by *CDM Small-scale Methodology* and *IFI Harmonized Default Grid Factors*.

$$BE_y = 0.4 * E_{BL,y} * 0.9\ tCO_2/MWh + 0.6 * E_{BL,y} * 0.46\ tCO_2/MWh$$

Share of hospitals using diesel in baseline scenario

Emission factor for diesel generator systems (<15 kW)
Source: CDM Small-scale Methodology

Share of hospitals connected to grid in baseline scenario

Grid emission factor (GEF) for project country
Source: Harmonized Default Grid Factors

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Example: Calculation of baseline emissions

Estimation of energy baseline – using the energy generation by the PV systems

Case study

To assess the annual electricity generated by the renewable energy units, the respective capacity factor (in this case, for PV) needs to be used.

$$BE_y = 0.4 * E_{BL,y} * 0.9\ tCO2/MWh + 0.6 * E_{BL,y} * 0.46\ tCO2/MWh$$

$$E_{BL,y} = 25 * 14\ kWp * 16\% * 8{,}760h = 490{,}560\ kWh$$

- No. of PV water treatment systems
- Average solar system size
- Capacity factor solar PV
  Source: Global Solar Atlas
- No. of hours per year

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Example: Calculation of leakage emissions

Conservative considerstion of leakage

Case study

Given the assumption that ***20% of the diesel generators*** which are used for the water treatment systems in the baseline scenario will still be ***used after the project implementation outside the project boundary***, leakage emissions must be calculated.

$$ER_y = BE_y - PE_y - LE_y$$

$$LE_y = 0.2 * 0.4 * E_{BL,y} * 0.9\ tCO2/MWh$$

Share of diesel generators which is continued to be used

Emissions caused by diesel generators in baseline scenario

Example: Solar energy-based water treatment for hospitals

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.**

Please use the table below for the estimation as follows:

- The cells in the section **"Planned target estimate"** can be used in the beginning of your project to quantify your baseline scenario.
- The cells in the section **"Reporting"** can be used for annual reporting purposes. To this end, please annually update the baseline scenario, if needed. If no changes are necessary, you can simply enter the values from your planned target estimate for each year.

ⓘ Practical tips:
- Please link values of inputs parameters used in the table to sheet "SI 1 - Mitigation" (section "Parameters and assumptions applied in the estimations") as applicable using cell references.
- It is important to identify in each row of the calculation table the description of what is calculated in the row, the calculation approach or source used and the unit of the values presented.
- With the row reference, users can refer to other rows while explaining the calculation (e.g., Row A x B). When describing your calculations / sources, please make sure that the formulas used are transparent. Use cell references to input parameters when needed.
- You can add more rows through inserting additional ones above the Row Reference Z.

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	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)
Number of solar energy-based water treatment systems	A	Email correspondence with project team	Number	2	5	10	15	20	25
Average solar system size	B	Project documents	kWp	14	14	14	14	14	14
Total installed capacity - solar PV systems	C	Calculated	kWp	28	70	140	210	280	350
Capacity factor - solar PV	D	CDM-SSC WG Thirty-third meeting Report Ar	%	16	16	16	16	16	16
Total annual electricity generation from solar PV	E	Calculated	kWh/year	39.245	98.112	196.224	294.336	392.448	490.560
Share of water treatment systems connected to the electricity grid (import)	F	Assumed, based on expert judgement	%	60	60	60	60	60	60
Combined Margin Grid emission factor (GEF), intermittent energy generation	G	Harmonized IFI Default Grid Factors 2021 v3.:	tCO2e/MWh	0,46	0,46	0,46	0,46	0,46	0,46
Baseline emissions - electricity consumption from national power grids	H	Calculated	tCO_2e/year	11	27	54	82	109	136
Share of water treatment systems powered by diesel generators (captive generation)	I	Assumed, based on expert judgement	%	40	40	40	40	40	40
Emission factors for diesel generator systems (<15 kW) - productive applications/ water pumps	J	CDM TOOL33 Methodological tool: Default va	kgCO2e/kWh	0,90	0,90	0,90	0,90	0,90	0,90
Baseline emissions - diesel gensets	K	Calculated	tCO_2e/year	14	35	71	106	141	177
		Baseline emissions (BE) per annum	tCO_2e	25	63	125	188	250	313
		Baseline emissions cumulative (BE)	tCO_2e	25	88	213	400	651	963

Row reference	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Values until** 2030	2040	2050
A	25	25	25	25	25	25	25	25	0,00
B	14	14	14	14	14	14	14	14	0,00
C	350	350	350	350	350	350	350	350	0,00
D	16	16	16	16	16	16	16	16	0,00
E	490.560	490.560	490.560	490.560	490.560	490.560	490.560	490.560	0,00
F	60	60	60	60	60	60	60	60	0,00
G	0,46	0,46	0,46	0,46	0,46	0,46	0,46	0,46	0,00
H	136	136	136	136	136	136	136	136	0,00
I	40	40	40	40	40	40	40	40	0,00
J	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,00
K	177	177	177	177	177	177	177	177	0,00
Baseline emissions (BE) per annum	313	313	313	313	313	313			
Baseline emissions cumulative (BE)	1.276	1.589	1.902	2.215	2.528	2.840	2.528	5.656	0

** until the end of the respectives year

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6 Relevant default values and reference sources

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Default values for mitigation estimation of energy projects

Parameter	Value and Unit	Source
Emission factors and energy efficiency		
Emission factor for diesel generators	0.8 tCO_2/MWh (>15 kW and at least 50% load factor)	CDM TOOL33 Methodological tool: Default values for common parameters Version 02.0
Emission factor electricity grid for the specific country (for energy efficiency / electricity consumption)	tCO_2/MWh	Harmonized IFI Default Grid Factors 2021 v3.2, combined margin for energy consumption
Transmission and distribution losses (for conservativeness distinguished between project and baseline energy consumption)	• 20% for project (or leakage) electricity consumption sources • 3% for baseline electricity consumption sources	CDM TOOL05 Methodological tool Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0

Default values for mitigation estimation of energy projects

Parameter	Value and Unit	Source
Renewable energy electricity generation, e.g., solar, wind, geothermal		
Emission factor for renewable electricity	tCO_2/MWh	Harmonized IFI Default Grid Factors 2021 v3.2, combined margin for intermittent energy generation
Capacity factors for estimating the energy yield, i.e., energy generation	Default values • Wind: 0.29 • PV: 0.16 • Hydro: 0.45 • Biomass: 0.68 • Ocean, Wave/ Tidal: 0.25 • Geothermal: 0.75	CDM-SSC WG Thirty-third meeting Report Annex 6 "Information Note on Guidelines for the demonstration of additionality of microscale project activities" Databases for energy yields: Global Solar Atlas Global Wind Atlas
Global Warming Potential (GWP)		
GWP of refrigerants, if applicable, e.g., for exchange of ACs or chillers	Selected default values • HFC-23: 12,400 • HFC-32: 677 • HFC-41: 116 • HFC-125: 3,170 • HFC-134: 1,120 • HFC134a: 1,300	GHG Protocol Global Warming Potential Values based on IPCC values, IPCC Fifth Assessment Report, 2014 (AR5)

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7 Conclusion

Wrap-up

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

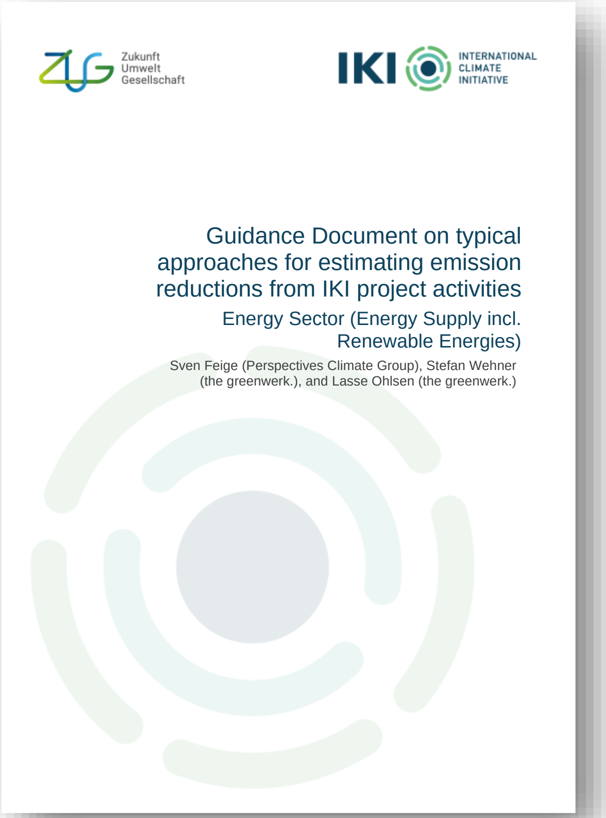
- Identify the ***key characteristics of the projects and the underlying technologies***
- Conduct an ***impact assessment***, e.g., using a causal chain analysis to identify the envisaged effects and possible co-benefits

Identification and quantification of 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


Zukunft Umwelt Gesellschaft

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

Energy Sector (Energy Supply incl. Renewable Energies)

Sven Feige (Perspectives Climate Group), Stefan Wehner (the greenwerk.), and Lasse Ohlsen (the greenwerk.)

Related Guidance Document will be published shortly

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THANK YOU FOR YOUR ATTENTION

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

27.07.2023

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