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

Building Sector

Version 1.0 (February 2024)

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

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List of Abbreviations

AC	Air conditioning
AFOLU	Agriculture/Forestry/Other Land Use
AR5	Fifth Assessment Report
BAU	Business-as-Usual
BE	Baseline emissions
CDM	Clean Development Mechanism
CO_2e	Carbon dioxide equivalents
EF	Emission factor
ER	Emission reductions
GEF	Grid emission factor
GHG	Greenhouse gas emissions
GHGP	GHG Protocol
GS	Gold Standard
ICE	Internal combustion engine
IKI	International Climate Initiative
PE	Project emissions
SI 1	Standard Indicator 1
VCS	Verified Carbon Standard

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 **Buildings** presents typical approaches for estimating emission reductions from IKI project activities in the building sector. Through the fictitious project "Energy Efficient Retrofitting of Residential Buildings" the methodological approach is explained in detail and further guidance for IKI implementing organisations is provided. 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 emissions, if applicable),
(4) calculation of emission reductions, illustrated with sample calculations using the IKI Standard Indicator Report (Excel Tool), 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 emission 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. 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

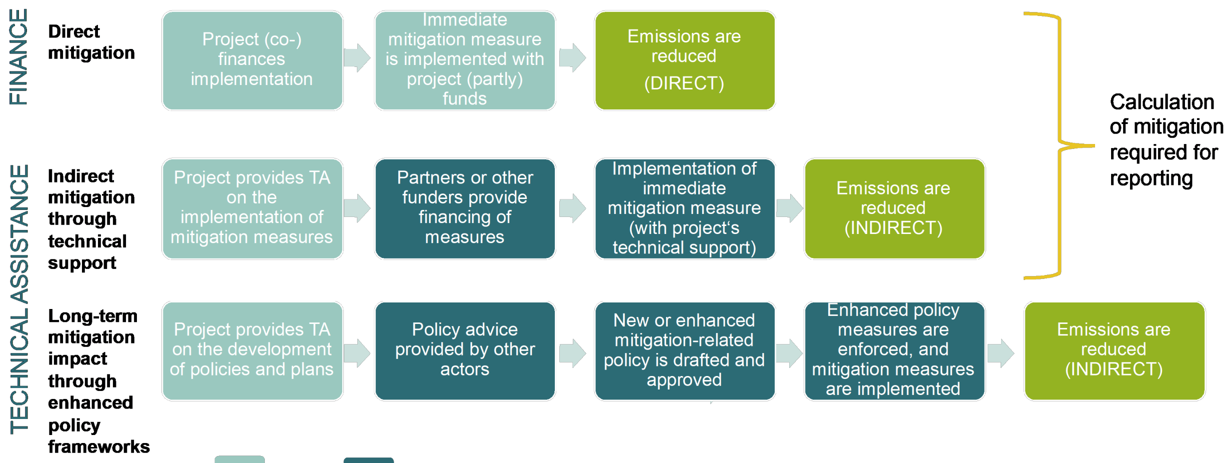
Indirect GHG emission reduction / carbon stock enhancement refers to an amount of CO_2e reduced, avoided, or sequestered with the help of IKI-funded technical assistance or capacity development measures. This includes cases where a physical mitigation measure was financed by an actor other than the IKI (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.

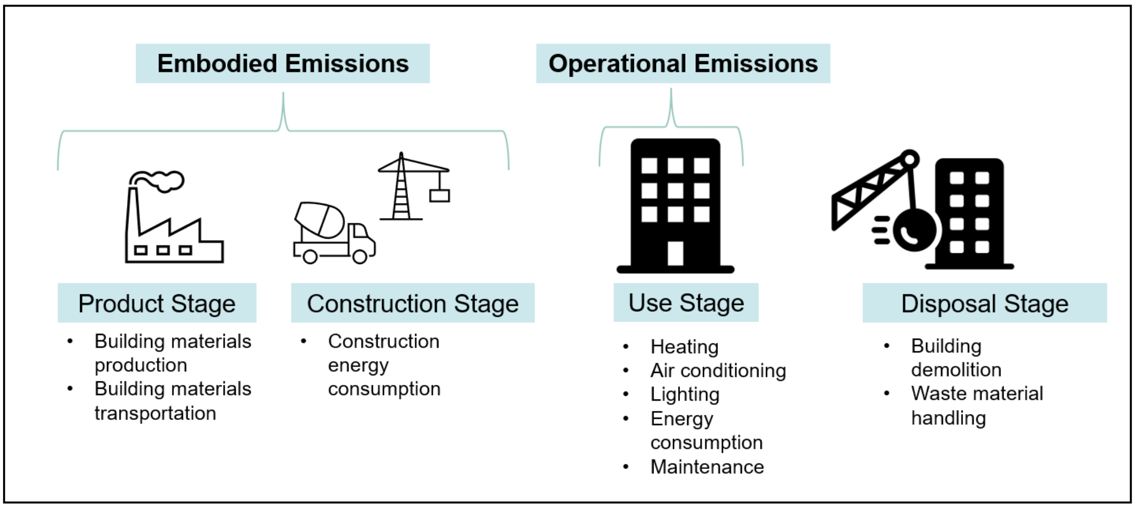
3 Typical emission sources and emission reduction activities in the building sector

Buildings are responsible for 39% of global energy related carbon emissions: 28% from operational emissions, i.e. from energy needed to heat, cool and power them, and the remaining 11% from embodied emissions which include all the emissions created during the building materials' production and the construction stage.[3] In 2022, direct CO_2 emissions from buildings decreased to 3 gigatonnes (Gt) while indirect CO_2 emissions (from production of electricity and heat used in buildings) increased to 6.8 Gt. Another 2.5 Gt were associated with buildings construction.[4]

CO_2 emissions in a building's life cycle

Embodied emissions are emitted in the production of a building. Operational emissions are released from its ongoing operation.

Figure 2: Embodied and operational emissions



Source: Own illustration

Projects in the building sector primarily focus on reducing operational emissions by electrifying buildings and by the installation of renewable energy sources. Additionally, projects in the buildings sector encompass the selection of low-carbon and recycled building materials to reduce embodied emissions. These activities can involve both public and private / commercial sectors.[5]

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[3] World Green Building Council et al. (2019): Bringing Embodied Carbon Upfront. Retrieved from here.

[4] IEA (2022): Tracking Buildings. Retrieved from here.

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

Mitigation actions in the building sector differentiate between operational and embodied emissions:

Reducing operational emissions

- Energy efficiency upgrades (implement better insulation, high-efficiency HVAC systems LED lighting, etc.)
- Building electrification (replace any equipment – usually heating – in a facility that uses natural gas with equipment that only uses electricity, like heat pumps)
- Renewable energy sources (install on-site renewable energy sources)
- Energy management systems (implement smart building automation systems for control of energy use)
- Occupant engagement (educate building occupants about energy conservation practices and encourage them to reduce energy consumption)

Reducing embodied emissions

- Material selection (choose low-carbon or carbon-neutral building materials such as recycled steel, reclaimed wood, and sustainable concrete alternatives)
- Local sourcing (select materials that are locally sourced to reduce transportation-related emissions)
- Innovative construction methods (e.g., modular construction, where building components are prefabricated off-site and then assembled on-site thus reducing construction waste and transportation-related emissions)
- Building information modelling (BIM enables virtual simulations to optimize construction processes)
- Circular economy (embrace circular economy principles by reusing and recycling materials from existing buildings)

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.[6]

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

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), or Verified Carbon Standard (VCS).

[6] 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: Sources for identifying applicable methodological approaches for the building 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 etc.
    - consult existing methodologies: CDM, VCS etc., e.g. in the CDM Methodology Booklet
- consult and use simplified tools for the estimation, if existing. For example:
    - CDM Tool 31: Determination of standardized baselines for energy efficiency measures in residential, commercial, and institutional buildings
    - UNFCCC Compendium on greenhouse gas baselines and monitoring
    - Embodied Carbon in Construction Calculator (EC3) - Carbon Leadership Forum
    - Instruments for your CO2 accounting | DGNB
    - Risk Assessment Tool I CRREM Project
    - IFC EDGE App I EDGE Buildings
- 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

For building projects on energy efficiency measures small-scale CDM methodologies provide a good orientation on the calculation approaches for a majority of projects. For a complete list of CDM methodologies, please consult CDM: Approved SSC methodologies (unfccc.int).

Table 1: Recommendations for appropriate CDM methodologies

Methodology / Tool	Description	Project activity example
AMS-II.E.: Energy efficiency and fuel switching measures for buildings	Installation of, or replacement or retrofit of, existing equipment with energy efficiency (e.g. efficient appliances, better insulation) and optional fuel switching (e.g. switch from oil to gas) measures in residential, commercial or institutional buildings	Project finances implementation of electric heating systems.
AMS-II.Q.: Energy efficiency and/or energy supply projects in commercial buildings	This methodology is applicable to on-site building energy supply and whole building energy efficiency projects whose associated emission reductions can be determined with a whole building computerized simulation tool.	Project finances on-site installation of solar project at commercial building site.

Methodology / Tool	Description	Project activity example
AMS-II.R.: Energy efficiency space heating measures for residential buildings	Energy efficiency and fuel switching measures implemented within residential buildings to improve the space heating.	Project finances improved building insulation of a multi-family residence.
AMS-III.AE.: Energy efficiency and renewable energy measures in new residential buildings	This category comprises activities that lead to reduced consumption of electricity in new, grid connected residential buildings (single or multiple-family residences) through the use of one or more of the following measures: efficient building design practices, efficiency technologies, and renewable energy technologies.	Project finances a solar photovoltaic system in a new, grid-connected residential building.

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. Generally, the baseline approach, as defined in the applied methodology (refer to section 3), should be adhered to, considering the following guidance. 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[7]:

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

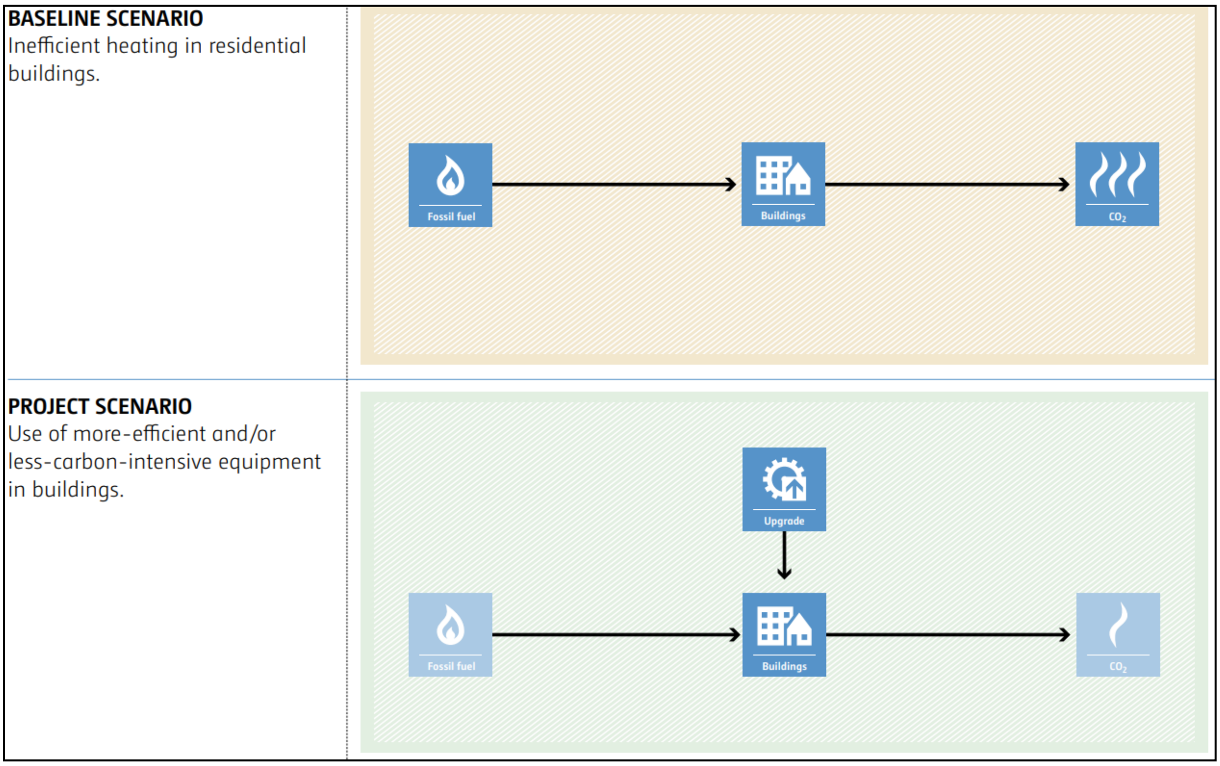
1. **Business-as-Usual (BAU):** This refers to the continuation of existing activities, technologies, or practices that offer the same type, quality, and quantity of product or service as the project. BAU results in emissions based on current or historical data, as applicable.
2. **Benchmark Approach:** 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, for energy efficiency projects, the benchmark approach could involve introducing technologies or equipment with higher energy efficiency than existing market solutions. 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 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 internal combustion engine (ICE) mini-buses) are more economically appealing and 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 thus the baseline emissions (BE) 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 finances the energy efficient retrofitting of a building, the baseline scenario is given by the energy consumption of the building before the retrofitting measures are implemented.

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. Depending on the specific mitigation activities, project emissions for renewable energy power generation activities can be zero. 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., MAF 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. 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 energy sector include diesel gen-set, inefficient air conditioners or electric appliances that are replaced 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 3: Typical baseline and project scenario for energy efficiency technologies



Source: UNFCCC (2022): CDM Methodology Booklet, p. 189.

5 Sample calculation of emission reductions

5.1 Energy efficient retrofitting of buildings

This chapter illustrates the calculation of emission reductions for a typical building project. To estimate the mitigation potential of the retrofitting of residential buildings, the general approach of the CDM methodology AMS-II.R.: Energy efficiency space heating measures for residential buildings[8] can be used. An introduction to the example case can be found in the following box. The detailed calculations can be found in IKI SI1_Buildings Example on the IKI Website.

Example: Energy Efficient Retrofitting of Residential Buildings

The project's objective is to retrofit existing residential buildings. The project finances a unique set of cost-effective refurbishments and retrofit measures for 10 buildings (4 storey multi-family buildings) with a total floor area of about 17,000 m². Since the project finances refurbishments which will lead to reduced CO_2 emissions of the selected buildings, it directly mitigates GHG emissions. The measures include external wall insulation, rooftop and basement insulation, door replacement, replacement of single/double-glaze windows with triple-glaze windows, refurbishment of heater / radiator incl. meter and efficient lighting. In addition, the carbon intensity of the current heat supply, which is mainly based on coal, will be lowered through the use of renewable energy sources (biomass, solar thermal, ground and air source heat pumps) added to the energy systems for each building or group of buildings (district energy systems). As a result, through the deployment of renewable energies in the energy mix, the emission factors of the heat supply for the buildings will be reduced.

In the **baseline scenario**[9]**,** due to financial barriers, the inefficient heating situations in residential buildings prevail to exist. This means that the energy efficiency measures would not be implemented at the residential buildings and the energy consumption of the selected households would thus continue to be high. Moreover, the heat supply would continue to be based on coal. However, improvement of both the grid emission factor and heating emission factor is assumed (dynamic baseline improvement) as a result of increased renewable energy sources in the country's energy mix. The baseline emissions are calculated based on historical figures on the specific energy demand for reference buildings (sourced from an energy efficiency study).

Under the **project scenario,** energy efficiency and renewable energy measures (switch from coal to renewable energy sources and onsite renewable electricity generation) will be implemented within 10 residential buildings. The project duration is from January 2021 until December 2025. It is estimated that energy savings will continue up to 20 years, depending on the measures' lifetime.

Leakage emissions do not apply for the project activities. The project will undertake required actions to avoid leakage, e.g. by scrapping replaced equipment such as light bulbs to avoid the establishment of a secondary market.

[8] UNFCCC (2022): Small-Scale CDM Methodology "Energy efficiency space heating measures for residential buildings" (AMS-II.R.). Retrieved from here.

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

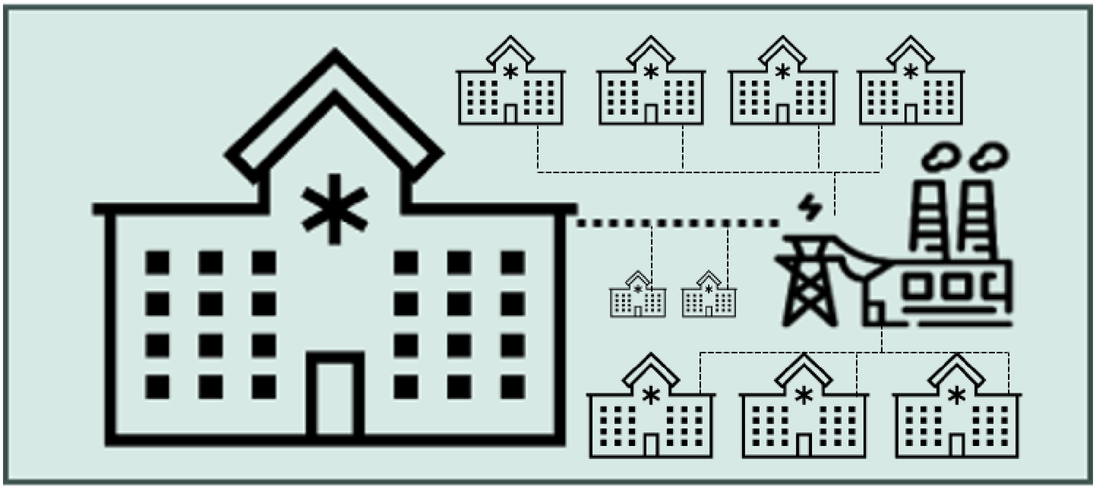
5.1.1 Project boundary

Typically for building projects, the project boundary includes the physical, geographical site of the building(s) in which the installation of new equipment or products or the modifications of existing equipment or products are implemented. Moreover, energy supply facilities might be included within the project boundary when they provide energy to the buildings under consideration.

Example: Energy Efficient Retrofitting of Residential Buildings

In the project example, the spatial extent of the project boundary comprises all 10 buildings where retrofitting measures will be implemented. Since the buildings obtain electricity from the grid, the project boundary extends to the power plant(s) providing electricity to the grid.[10]

Figure 4: Project boundary of the example case



Source: Own illustration

5.1.2 Baseline, project, and leakage emissions

Most of the climate funds and facilities are focused on emission reduction achieved through measures in Scope 1 and 2[11] (i.e. in the building's use phase) as per common methodologies and do not require the calculation of embodied emissions[12]. For an estimation of the embodied energy and carbon, data on building material used in the local context are needed.

[10] UNFCCC (2022): Small-scale Methodology - Renewable electricity generation for captive use and mini-grid (Clean Development Mechanism, AMS-I.F.), Version 5.0 (p. 6.) Retrieved from here.

[11] Scope 1 emissions are direct GHG emissions from sources that are within the company or building's control (e.g., on-site fuel combustion or refrigerant leakage). Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity and other energy sources (e.g. steam).

[12] Embodied carbon is the amount of carbon emitted during the construction of a building. Embodied carbon emissions can, e.g., be produced during the extraction of raw materials, the manufacturing and refinement of materials, transportation, installation, and the disposal of old supplies.

Environmental Product Declaration (EPD) databases, for example, provide specific information regarding the properties of certified products. It is recommended to use available tools such as the EDGE App and underlying data bases to assess embodied emissions.

For calculating the **baseline emissions** during the use stage, the energy use and/ or fuel consumption in the buildings before the project implementation is determined.

$$BE_y = BE_{EC,y} + BE_{FC,y} + BE_{WC,y} \quad \text{Equation (2)}$$

Where

BE_y	=	Baseline emissions in year y (tCO_2e).
$BE_{EC,y}$	=	Baseline emissions from electricity consumption of baseline building in year *y* (tCO_2)
$BE_{FC,y}$	=	Baseline emissions from fossil fuel consumption of baseline building in year *y* (tCO_2)
$BE_{WC,y}$	=	Baseline emissions from chilled/ hot water consumption of baseline building in year *y* (tCO_2)

There are three options to determine building(s) baseline emissions:

1. Based on **ex-post monitoring of** fuel and electricity **consumed** (see example calculation)
2. Based on a **standardised tCO_2 emission factor per m^2**
3. Based on a **standardised value of tCO_2 emissions per occupant** of building

For more information on Options 2 and 3 see CDM AMS-II.E.: Energy efficiency and fuel switching measures for buildings and CDM Methodological Tool 31.

For calculating the **project emissions** (PE) during the use stage, the energy use and/ or fuel consumption in the buildings after the project implementation is determined.

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{WC,y} \quad \text{Equation (3)}$$

There are different ways to assess ex-ante the percentage or amount of energy savings caused by the implementation of energy efficiency measures, including:

1. Commissioning of an **energy service expert** who can evaluate the potential energy savings of planned measures.
2. Some **government agencies offer guidance** and support for emissions reductions in buildings; they may have experts who can assist or provide resources.
3. **Digital modelling tools** can be used to assess retrofit interventions (e.g. the IFC EDGE App I EDGE Buildings or CARE Tool to estimate the carbon benefits of reusing and upgrading existing buildings).

Leakage emissions may result from replaced equipment through a mitigation action project that is continued to be used outside of the project boundary leading to increased emissions.

Typical examples at buildings are replaced inefficient ACs, inefficient electric appliances or cook-stoves that are then used elsewhere. If leakage is a relevant and significant emissions source, corresponding emissions should be addressed in the same level of detail as project emissions.

Example: Energy Efficient Retrofitting of Residential Buildings

The **baseline emissions** of a building are calculated by adding the product of the electricity consumed (in MWh/a) and the grid emission factor (tCO_2/MWh) as well as the product of the thermal energy consumed (MWh/a) and the central heating coal-based emission factor (tCO_2/MWh). The derived value is multiplied with the number of buildings which undergo retrofitting measures under the project.

The **project emissions** are calculated using the same formula as for the baseline emissions using updated consumption values and emission factors. The electricity consumption needs to be updated because of i) a 20% saving potential through the energy efficiency measures which have been implemented and ii), an increase in electricity demand due to the introduction of heat pumps which run on electricity. The electricity emission factor decreases by 50% since renewable energy generation covers 50% of the buildings' electricity demand in the project scenario. The thermal energy consumption is also decreased in the project scenario due to implemented efficiency measures. The central heating emission factor decreases to 0 tCO_2/MWh since the heat mix in the project scenario consists exclusively of renewable energies.

Leakage emissions do not apply for the project activities. The project will undertake required actions to avoid leakage, e.g. by scrapping replaced equipment such as light bulbs to avoid the establishment of a secondary market.

Key parameters required for the calculation

For calculating the emission reduction from retrofitting measures such as the sample case the following parameters are required. Potential default values are listed in Table 3 (see also Section 6 below).

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

Parameter	Unit	Value / source
Number of buildings which undergo retrofitting measures	No.	Project documentation
Heated floor area per building unit	m^2	Project documentation (building plan, statistics or onsite measurement)
Electricity consumption per building unit	MWh/a	Utility billing records / invoices
Grid EF	tCO_2/MWh	Harmonized IFI Default Grid Factors 2022 | UNFCCC
Central heating EF (coal-based)	tCO_2/MWh	National/ local default values or Emissions Factors 2022 I IEA

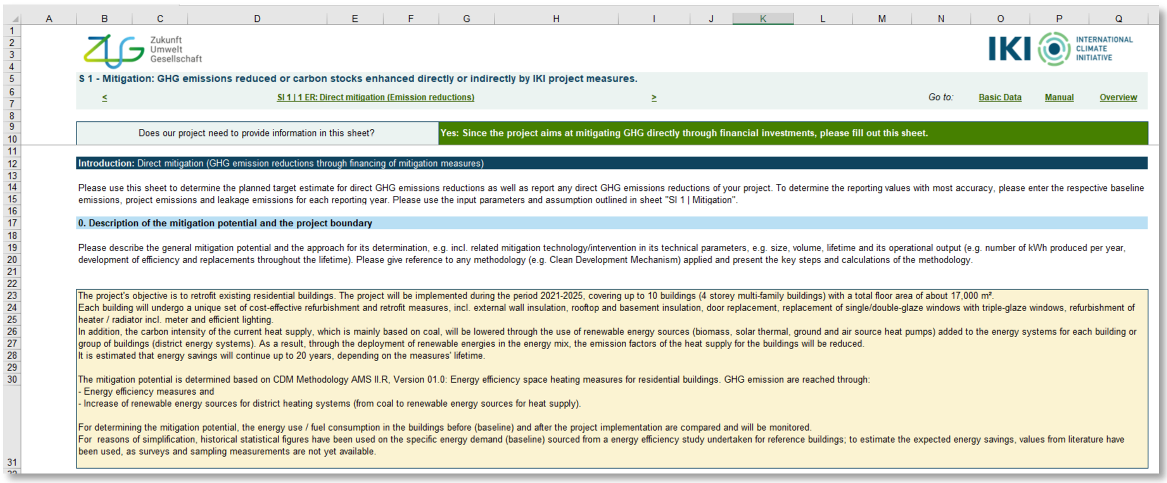
5.2 Mitigation estimation using the IKI Standard Indicator Report (Excel Tool)

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 Standard Indicator 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 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 sources and units of the respective parameters should be mentioned, making use of and direct referencing to the table for *Parameters and assumptions applied* in sheet SI1 | Mitigation. When filling all calculation tables, users should reference the parameter sheet 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 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 thro

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
4 storey multi-family buildings	A		
Accumulated number of buildings (4 storeys) to be retrofitted	B	Project Implementation Plan	No.
Heated floor area per building	C	Energy Efficiency Study, 2020, See Appendix 2, p. 3	m^2
Specific thermal energy demand (baseline)	D	Energy Efficiency Study, 2020, See Appendix 2, p. 4	kWh$_t$/m^{2}a
Specific electric energy demand (baseline)	E	Energy Efficiency Study, 2020, See Appendix 2, p. 4	kWh$_{el}$/a
Thermal energy consumption before EE measures per building	F	Calculated based on data from Energy Efficiency Study,	MWh$_t$/a
Electricity consumption before EE measures per building	G	Calculated based on data from Energy Efficiency Study,	MWh$_{el}$/a
	H		
Grid emission factor (GEF) and central heating emission factors	I		
Central heating emission factor (coal based)	K	Calculated based on public utility data, Annual Energy Statistic Report for Project Country, p. 64, see sheet "Auxiliary calculation"	tCO_2/MWh$_t$
GEF$_{grid}$	J	The latest version of the Harmonized IFI Default Grid Factors 2021 (v3.2, April 2022, "Combined Margin Grid Emission Factor, gCO2/kWh"", Energy Efficiency)	tCO_2/MWh$_{el}$
Dynamic baseline improvement	L	Energy Plan Project Country, 2021	%
	M		
	*insert more r		
	Z		
		Baseline emissions (BE) per annum	tCO_2e
		Baseline emissions cumulative (BE)	tCO_2e

2) **Calculation tables for "Baseline emissions", “Project emission” and “Leakages 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.

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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

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
4 storey multi-family buildings	A							
Accumulated number of buildings (4 storeys) to be retrofitted	B	Project Implementation Plan	No.	2	5	8	10	10
Heated floor area per building	C	Energy Efficiency Study, 2020, See Appendix 2, p. 3	m^2	1,680	1,680	1,680	1,680	1,680
Specific thermal energy demand (baseline)	D	Energy Efficiency Study, 2020, See Appendix 2, p. 4	kWh$_t$/m^{2}a	280	280	280	280	280
Specific electric energy demand (baseline)	E	Energy Efficiency Study, 2020, See Appendix 2, p. 4	kWh$_{el}$/a	1,500	1,500	1,500	1,500	1,500
Thermal energy consumption before EE measures per building	F	Calculated based on data from Energy Efficiency Study,	MWh$_t$/a	470	470	470	470	470
Electricity consumption before EE measures per building	G	Calculated based on data from Energy Efficiency Study,	MWh$_{el}$/a	36	36	36	36	36
	H			0	0	0	0	0
Grid emission factor (GEF) and central heating emission factors	I			0	0	0	0	0
Central heating emission factor (coal based)	K	Calculated based on public utility data, Annual Energy Statistic Report for Project Country, p. 64, see sheet "Auxiliary calculation"	tCO_2/MWh$_t$	0.40	0.40	0.40	0.39	0.39
GEF$_{grid}$	J	The latest version of the Harmonized IFI Default Grid Factors 2021 (v3.2, April 2022, "Combined Margin Grid Emission Factor, gCO2/kWh"", Energy Efficiency)	tCO_2/MWh$_{el}$	0.65	0.65	0.64	0.64	0.64
Dynamic baseline improvement	L	Energy Plan Project Country, 2021	%	0.5	0.5	0.5	0.5	0.5
	M			0	0	0	0	0
	*insert more r			0	0	0	0	0
	Z			0	0	0	0	0
		Baseline emissions (BE) per annum	tCO_2e	424	1,054	1,678	2,087	2,077
		Baseline emissions cumulative (BE)	tCO_2e	424	1,478	3,156	5,243	7,320

3) **Calculation of baseline, project, and leakage emissions:** 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.

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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) ≥

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

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
4 storey multi-family buildings	A				
Accumulated number of buildings (4 storeys) to be retrofitted	B	Project Implementation Plan	No.	2	5
Heated floor area per building	C	Energy Efficiency Study, 2020, See Appendix 2, p. 3	m^2	1,680	1,680

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
4 storey multi-family buildings	A				
Accumulated number of buildings (4 storeys) to be retrofitted	B	Project Implementation Plan	No.	1	5
Heated floor area per building	C	Energy Efficiency Study, 2020, See Appendix 2, p. 3	m^2	1,680	1,680
Specific thermal energy demand (baseline)	D	Energy Efficiency Study, 2020, See Appendix 2, p. 4	kWh_t/m^2a	280	280
Specific electric energy demand (baseline)	E	Energy Efficiency Study, 2020, See Appendix 2, p. 4	kWh_e/a	1,500	1,500
Thermal energy consumption before EE measures	F	Calculated based on data from Energy Efficiency Study,	MWh_t/a	470	470
Electricity consumption before EE measures	G	Calculated based on data from Energy Efficiency Study,	MWh_e/a	36	36

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 building sector projects.

Table 3: Default values and references for mitigation estimation

<table>
<tr><th>Parameter</th><th>Value and Unit</th><th>Source</th></tr>
<tr><td>Emission factor electricity grid for the specific country (for energy efficiency / electricity consumption / renewable electricity)</td><td>various, tCO_2/MWh</td><td>Harmonized IFI Default Grid Factors 2021 v3.2, combined margin for energy consumption or fore renewable electricity</td></tr>
<tr><td>Grid transmission and distribution losses[13]
(for conservativeness distinguished between project and baseline energy consumption)</td><td>• 20% for project (or leakage) electricity consumption sources
• 3% for baseline electricity consumption sources</td><td>CDM TOOL05 Methodological tool Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation Version 03.0</td></tr>
<tr><td>Emission factors of typical fossil fuel types for heating</td><td>IPCC default CO_2 Emission Factors for combustion</td><td>2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chpt. 1, Page I.23</td></tr>
<tr><td>Global-warming potential of refrigerants, if applicable, e.g. for exchange of air conditioning or chillers</td><td>Selected default values:<table><tr><td>HFC-23</td><td>12,400</td></tr><tr><td>HFC-32</td><td>677</td></tr><tr><td>HFC-41</td><td>116</td></tr><tr><td>HFC-125</td><td>3,170</td></tr><tr><td>HFC-134</td><td>1,120</td></tr><tr><td>HFC-134a</td><td>1,300</td></tr></table></td><td>GHG Protocol Global Warming Potential Values based on IPCC values, IPCC Fifth Assessment Report, 2014 (AR5)</td></tr>
</table>

For energy-related projects, the CDM Tool 33 offers additional default values applicable for different project contexts. The tool currently provides default values for, among other, the following parameters:

[13] As of CDM Tool 05: In the generic approach, project, baseline and/or leakage emissions from consumption of electricity from the grid are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses. Transmissions and distribution losses occur during the transmission of electricity from the powerplant to the end consumer.

- CO_2 emission factor for diesel generating system used for off-grid power generation purposes;
- CO_2 emission factor for kerosene used for lighting applications;
- Wood-to-charcoal conversion factor;
- Efficiency of pre-project cooking device.

Please check the most recent version available for the corresponding values.

Finally, as indicated in Box 2 above, other projects that have estimated emission reductions from similar activities and potentially published Excel calculation sheets, 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 Gold Standard Project Registry for reference sources.

References

IEA - International Energy Agency (2022): Tracking Buildings, accessed 6 February 2024. Retrieved from here.

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UNFCCC (2022): CDM Methodologies Booklet, accessed 6 February 2024. Retrieved from here.

UNFCCC (2022): Small-Scale CDM Methodology "Energy efficiency space heating measures for residential buildings" (AMS-II.R.), accessed 6 February 2024. Retrieved from here

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