PROJECTS CERTIFICATION AND REGISTRATION GUIDELINES

Energy Sector
Non-Conventional Renewable Energy sources

BIOCARBON REGISTRY®

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Abbreviations and Acronyms

BM	Building Margin
CPA	Component Project Activity
CDM	Clean Development Mechanism
CM	Combined Margin
CME	Coordinating / Managing Entity
EE	Energy Efficiency
NCRE	Non-Conventional Renewable Energy Sources
GHG	Greenhouse Gases
LNG	Liquid Natural Gas
MW	Megawatt
MWh	Megawatt-hours
LED	Light Emitting Diode
OM	Operation Margin
CAB	Conformity Assessment Body
PCH	Small hydro power plants (Spanish initials "Pequeñas Centrales Hidroeléctricas"
SSC	Small-scale
UNCFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The IPCC Working Group III report, Climate Change 2022[1], states that between 2010 and 2019 the annual average of greenhouse gas emissions reached their highest levels in the human history. During the presentation of the report, the UN Secretary General said: "*It's time to stop burning our planet, and start investing in the abundant renewable energy all around us*". The UN secretary also pointed out that "*To keep the 1.5-degree limit agreed in Paris within reach, we need to cut global emissions by 45% this decade*".

As for the energy sector, according to the IPCC report, 35% of global GHG emissions are due to the energy sector. Consequently, it is clear that the global challenges of climate change must consider a radical change in the way energy is produced and used.

In this sense, the objective of this document is to present the general guidelines for GHG reduction through Non-conventional Renewable Energies sectorial projects (NCRE), that intend to obtain Certification and Registration under the BIOCARBON REGISTRY STANDARD (BCR).

Valid methodologies for these project types are those of the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNCFCCC). They are appropriate to diverse projects types, and they also provide general and specific methodological tools for associated calculations and procedures.

In conclusion, this document constitutes guidelines for selection of appropriate CDM methodology, either for large- or small-scale renewable and energy efficiency projects, and additional requirements under the BCR STANDARD.

2 Version and Term

This document version is 1.1 of July 1, 2022.

The current version should be updated periodically. Users should make sure of using this document's most recent version.

[1] https://www.ipcc.ch/report/ar6/wg3/

3 Scope

This document is limited to GHG projects in the mining-energy sector, related to Non-Conventional Renewable Energy Sources (NCRE).

In the scope of the BCR STANDARD[2] can be certified and registered renewable energy generation projects. This type of GHG project is an alternative to the mining energy sector, which includes the generation of energy with non-conventional sources of renewable energy, particularly those of renewable energies such as solar, wind, biomass, and hydraulic power, defined as well:

Solar energy. Energy obtained from that non-conventional source of renewable energy that consists of electromagnetic radiation from the sun.

Wind energy. Energy obtained from that non-conventional source of renewable energy that consists of the movement of air masses.

Biomass energy. Energy obtained from that unconventional source of renewable energy is based on the spontaneous or induced degradation of any organic matter that has had its immediate origin as a result of a biological process. It also refers to plant photosynthesis products and products from heterotrophic organisms, provided that those products are not in contact with traces of elements that confer some degree of danger on them.

Energy from small hydroelectric developments. Energy obtained from that non-conventional source of renewable energy is based on water bodies on a small-scale. This includes only small hydroelectric plants (PCH), i.e., with an installed capacity between 500 and 20,000 kW, run-of-river operation.

Also included are some methodologies for buildings and lighting, and electrification in rural areas, as long as they involve the use of FNCRE.

Activities from unconventional sources also include geothermal and tidal renewable energy. However, it is not currently within the scope of the BCR STANDARD or this guide. However, BIOCARBON REGISTRY may analyze on a case-by-case basis the potential future projects submitted to the standard for this type of energy, or modify this scope in subsequent versions of the standard and this document.

[2] VOLUNTARY CARBON MARKET STANDARD. BCR STANDARD. From differentiated responsibility to common responsibility. Version 2.0. February 14, 2022. Bogotá, Colombia. 67 p. http://www.biocarbonregistry.com

To sum up, CDM methodologies included in BCR STANDARD are described in Figure 1. This figure describes some of its classifications, to facilitate the selection of an appropriate methodology.

4 Applicability

These guidelines will serve to:

(a) any natural or legal person, public or private that seeks to register its GHG project within BIOCARBON REGISTRY;

(b) any natural or legal person, public or private that seeks to register its GHG project to demonstrate its mitigation results in the context of compliance national climate change targets, established under the CMNUCC, as a result of the implementation of such actions;

(c) GHG project holders;

(d) independent entities that perform validation and verification processes of GHG projects, meaning, Conformity Assessment Bodies (CAB);

(e) the persons in charge of carrying out first party audits;

(f) actors involved in the trading and transaction of GHG emission reductions and removals;

(g) entities involved in climate change information management.

5 Normative references

The following references are indispensable for the implementation of those Guidelines:

(a) BCR Methodological Documents and BIOCARBON REGISTRY Methodological Guides, as applicable to GHG projects;

(b) BCR Validation and Verification Manual[3]. GHG Projects, in the most recent version;

3 BioCarbon Registry. Manual de Validación y Verificación. Available in: https://biocarbonregistry.com/wp-content/uploads/2022/02/BCR_Validation-and-Verification-Manual-v2.0.pdf

(c) General guidance on leakage in biomass project activities[4];

(d) Guidelines for sampling and surveys for CDM project activities and programs of activities[5];

(e) Methodologies and tools approved under Executive Board of the Clean Development Mechanism (CDM, UNCFCCC).

6 Project types and methodologies

Figure 1 describes links between NCRE projects and CDM methodologies under these guidelines. CDM methodologies selection was made following three criteria:

i) CDM classifies it, according to its technology or mitigation action, as renewable energy methodology.

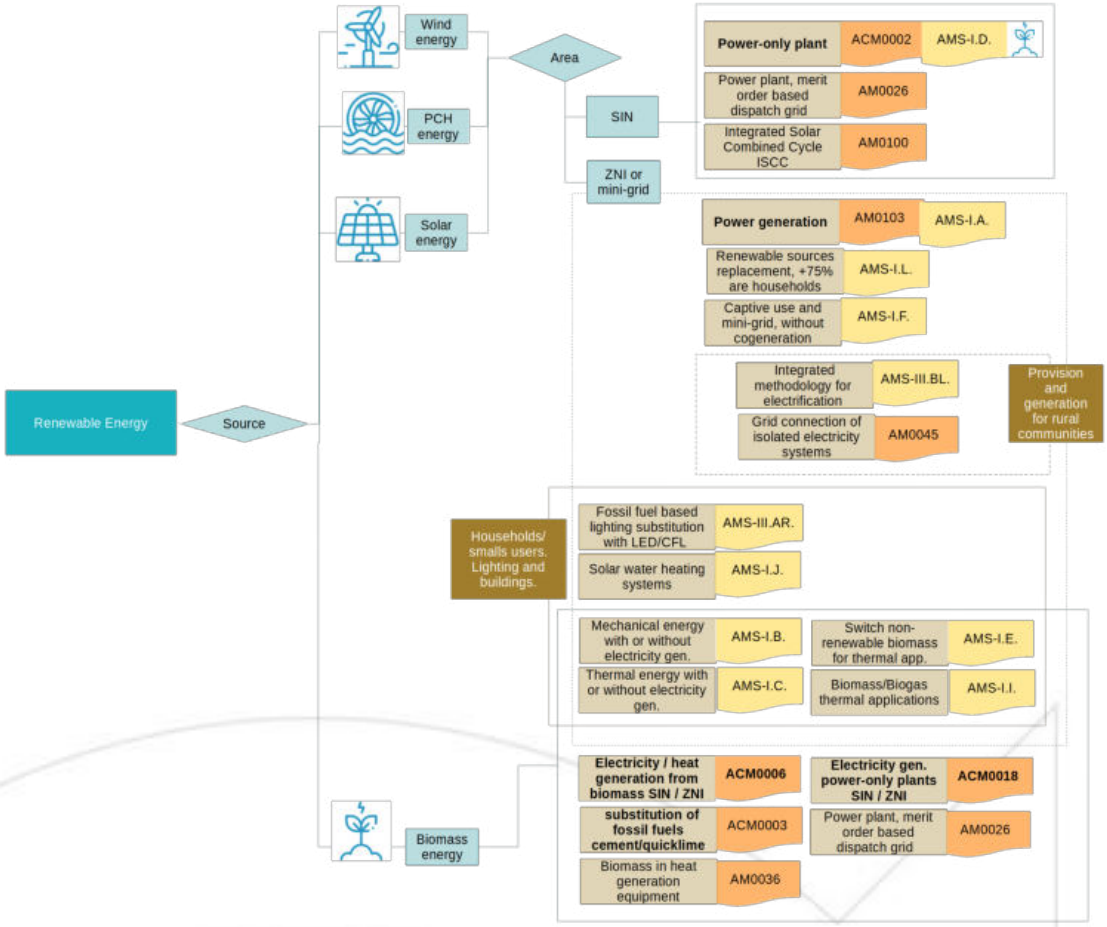
ii) There are at least five (5) active projects in the world. There are no consolidated methodologies that replace it.

iii) Even if it doesn't have enough registered projects, if a methodology is relevant for Latin-American context, these guidelines include it. In example, CDM methodology that refers to solar technologies and rural areas electrification.

[4] CLEAN DEVELOPMENT MECHANISM. General guidance on leakage in biomass project activities [Online]. UNFCCC, 2009. Available on: https://cdm.unfccc.int/methodologies/SSCmethodologies/approved/history/c_leak_biomass/guid_biomass_v03.pdf

[5] CLEAN DEVELOPMENT MECHANISM. Guideline: Sampling and surveys for CDM project activities and programmes of activities—Version 04.0 [Online]. UNFCC, 2015. Available on: https://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid48.pdf

Figure 1. NCRE projects and CDM methodologies links under these guidelines



Source: Based on CDM Booklet[6] classification by GHG mitigation Activity, and sectorial classification given by UNEP DTU[7]

[6] CLEAN DEVELOPMENT MECHANISM. Methodology Booklet [Online]. CDM, 2019. Available on: https://cdm.unfccc.int/methodologies/documentation/meth_booklet . p. 16-17.

7 UNEP DTU PARTNERSHIP CENTRE ON ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT. CDM projects by type [Online]. Denmark: UNEP DTU, 2020. Available on: https://www.cdmpipeline.org/cdm-projects-type.htm

7 Definitions

Next definitions sources are CDM standards and methodologies [8, 9, 10, 11, 12, 13], ISO14067-2[14] and ISO5001[15].

Backup generator

A generator that is used in the event of an emergency, such as power supply outage due to either main generator failure or grid failure or tripping of generator units, to meet the electricity demand of the equipment at power plants/units' site during emergency (ACM0002).

Baseline scenario

The scenario that reasonably represents the anthropogenic emissions by sources of GHGs that would occur in the absence of the Project activities (CDM Glossary).

Biomass

Non-fossilized and biodegradable organic material originating from plants, animals, and micro-organisms including biomass residue, non-fossilized and biodegradable organic fractions of industrial and municipal wastes, and gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material (CDM Glossary).

Capacity addition

Investment to increase the installed power generation capacity of existing power plants through the installation of new power plants/units besides or additional to the existing

[8] CLEAN DEVELOPMENT MECHANISM. Glossary -- version 10.0. [Online]. 2019. Available on: https

[9] CLEAN DEVELOPMENT MECHANISM. AMS-I.D.: Grid connected renewable electricity generation—Version 18.0. [Online]. 2014. Available on: https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK, p. 5.

[10] CLEAN DEVELOPMENT MECHANISM. ACM0002: Grid-connected electricity generation from renewable sources—Version 20.0. [Online]. 2019. Available on: https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

[11] CLEAN DEVELOPMENT MECHANISM. AM0103: Renewable energy power generation in isolated grids—Version 4.0. [Online]. 2019. Available on: https://cdm.unfccc.int/methodologies/DB/AZCWWMVZUR0O3J548RVSXPR97GS5GC

[12] CLEAN DEVELOPMENT MECHANISM. ACM0006: Electricity and heat generation from biomass—Version 14.0. [Online]. 2014. Available on: https://cdm.unfccc.int/methodologies/DB/QFLMQ6JJHL625H0XR2N6WUSE6BEA7E

[13] CLEAN DEVELOPMENT MECHANISM. ACM0012: Waste energy recovery—Version 6.0. [Online]. 2015. Available on: https://cdm.unfccc.int/methodologies/DB/FXBXLVGFF4DLI5WC1PKFW7KBRW62QB

[14] ISO. ISO 14067:2018, GHG. Carbon footprint of products. Requirements and guidelines for its calculation 2018.

[15] ISO. ISO5001:2011, Energy systems management. Requirements with guidelines for its use. 2011.

power plants/units. The existing power plants/units in the case of capacity addition continue to operate after the implementation of the project activity (AMS-I.D.).

Dedicated plantations (for biomass production)

Plantations that are newly established as part of the project activity to supply cultivated biomass to the project plant. (ACM0006).

Existent reservoir

A reservoir that has been in operation for at least three years before the implementation of the project activity. (ACM0002).

Greenfield power plant

A new renewable energy power plant that is constructed and operated at a site where no renewable energy power plant was operated prior to the implementation of the project activity. (ACM0002).

Heat

Useful thermal energy that is generated in a heat generator (e.g., a boiler, a cogeneration plant, thermal solar panels, etc.) and transferred to a heat carrier (e.g., hot liquids, hot gases, steam, etc.) for utilization in thermal applications and processes, including power generation. This definition does not include waste heat, i.e., heat that is transferred to the environment without utilization, for example, heat in flue gas, heat transfer to cooling towers, or any other heat losses (ACM0006).

Heat generator

A facility that generates heat by combustion of fuels. This includes, for example, a boiler that supplies steam or hot water, a heater that supplies hot oil or thermal fluid, or a furnace that supplies hot gas or combustion gases. When several heat generators are included in one project activity, each heat generator is referred to as "unit" (ACM0006).

Heat-to-power ratio

The quantity of process heat recovered from a heat engine per unit of electricity generated in the same heat engine, measured in the same energy units. For example, a heat engine producing 1 MWh el of electricity and 2 MWh of process heat has a heat-to-power ratio of 2. (ACM0006).

Installed power generation capacity (installed capacity, nameplate capacity)

Capacity, expressed in Watts or one of its multiples, for which the power unit has been designed to operate at nominal conditions (AM0103). When addressing electric energy, power generation capacity refers to the rated capacity of the alternator (generator)[16]. This amount may be greater than the energy delivered to the grid or users.

Isolated grid

An electrical grid supplying electricity to household users, and if applicable, industries and commercial areas, that is not connected to any other electrical grid. (ACM0103).

Monitoring

Continuous or periodic assessment of GHG emissions or removals and other GHG related data (ISO14067:2018).

Net quantity of electricity generation

The electricity generated by a power plant unit after exclusion of parasitic and auxiliary loads, i.e., the electricity consumed by the auxiliary equipment of the power plant unit (e.g., pumps, fans, flue gas treatment, control equipment etc.) and equipment related to fuel handling and preparation (ACM0006).

Organization

Person or group of people that have functions with responsibilities, authorities and relationships to achieve their objectives. (ISO14067:2018).

Power plant/unit

Facility that generates electric power or heat from heat conversion, or mechanical energy. Heat is produced by a heat generator, and electric energy by an electric generator coupled to a heat engine. A plant/unit includes all the necessary equipment to produce energy, like heat generator, heat engines, electricity generators, gears, speed reductors,

[16] Generator capacity in MW, is equal to rated capacity of the alternator, as specified by the manufacturer. From: CLEAN DEVELOPMENT MECHANISM. Clarification on the 15 MW eligibility limit for small-scale renewable energy projects [Online]. Available on: https://cdm.unfccc.int/filestorage/A/M/_/AM_CLAR_7ME1VFDU0A1RKC8M3XUJGE07FBIWYT/Response%20WG%20provided%20at%20SSC%20WG%2022.pdf?t=QXd8cWZiemowfDAYQ9sCxY87_ODu1lmM3Q-Z p. 2. Revision to the approved consolidated baseline methodology ACM0002 [Online]. CDM: 2005. Available on: https://cdm.unfccc.int/EB/Meetings/023/eb23_repan9.pdf. p. 5

instrumentation and control, cooling, pumps, fans, and systems for preparing, storing and transporting fuels (ACM0002).

Power-and-heat plant

Power-and-heat plants encompass two broad categories of power plants: cogeneration plants and plants in which heat and power are produced at the same installation although not in cogeneration mode. (ACM0006).

Power-only plant

Plant where all heat engines of the power plant produce only power and do not cogenerate heat, and thermal energy produced in the equipment of the power plant is only used in heat engines and not for other processes (ACM0006).

Power unit

A facility that generates electric power. Several power units at one site comprise one power plant, whereas a power unit is characterized by the fact that it can operate independently from other power units at the same site. Where several identical power units (i.e., with the same capacity, age, and efficiency) are installed at one site, they may be considered as one single power unit (ACM0002).

Process heat

The useful heat that is not used for electric power generation. It could include the heat used for mechanical power generation. (ACM0006).

Recipient facility

The facility that receives useful energy generated using waste energy under the project activity from the waste energy generation facility. It may be the same as the waste energy generation facility. (ACM0012).

Rehabilitation (or refurbishment)

It is an investment to restore the existing power plants/units that were severely damaged or destroyed due to foundation failure, excessive seepage, earthquake, liquefaction, or flood. The primary objective of rehabilitation or refurbishment is to restore the performance of the facilities. Rehabilitation may also lead to an increase in efficiency, performance, or power generation capacity of the power plants/units with/without adding new power plants/units. (ACM0002).

Renewable energy sources

These include: hydropower plants (either with a run-of-river reservoir or an accumulation reservoir), wind power plants, geothermal power plants, solar power plants, wave power plants, or tidal power plans (AM0103). Biomass plants are renewable energy sourced only if their biomass is renewable or a waste.

Replacement

Investment in a new power plant or unit that replaces one or several existing unit(s). The new power plant or unit has the same or a higher power generation capacity than the plant or unit that was replaced. The new power plant(s) or unit(s) may be either installed at the same location as the existing power plant(s) or unit(s) or (partially) at a different location. (ACM0002).

Reservoir

water body created in valleys to store water generally made by the construction of a dam. (ACM0002).

Retrofit

It is an investment to repair or modify existing operating power plants/units, with the purpose to increase the efficiency, performance, or power generation capacity of the plants/units, without adding new power plants/units. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures. (ACM0002).

Waste energy

The energy contained in a residual stream from industrial processes in the form of heat, chemical energy or pressure, for which it can be demonstrated that it would have been wasted in the absence of the project activity. (ACM0012).

8 Applicability

The Project owner shall assess and document the characteristics of its project and establish whether it meets the applicability conditions described in the "applicability" section of the selected CDM methodology.

These program and guidelines scope includes projects associated with NCRE. Therefore, it includes some additional conditions of applicability besides those within the methodologies referenced in Figure 1.

This scope's conditions are as follows:

1. Only pico-central, mini-power, and small hydroelectric plants (PCH), i.e., with less than 20,000 kW installed capacity. Also, the operation shall be run-of-the-river, either on not connected and interconnected areas. Besides, if the PCH diverts the river flow, it shall guarantee a permanent environmental flow on the natural riverbed. Finally, PCHs with reservoirs or dams are not included.

2. Geothermal and tidal energy sources are not included.

3. Only projects with renewable energies associated activities, or that, as a result of the project activities, replace fossil fuels by NCRE.

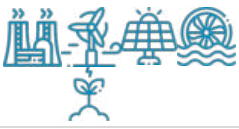
If the CDM methodology applicability allows it, the GHG emissions reduction from the project activities related to NCRE can be combined with those from fuel switch, abatement of methane, and energy efficiency activities.

CDM methodologies can be combined when they are applied to the same project. These guidelines' scope does not allow the combination among methodologies that are not included in Figure 1. BIOCARBON REGISTRY may evaluate on a case-by-case basis if the program can allow combination with excluded methodologies, or it may modify applicability conditions in future versions of these guidelines and other associated guides.

9 GHG emissions sources

Table 1 shows the main GHG emissions included in NCRE projects' applicable methodologies, both for the baseline and the implemented project. The project participants shall evaluate the selected CDM methodology and its section 5.1 "Project boundary" to obtain a detailed list of GHG emissions and sources included or excluded from the project scope.

Table 1. GHG emissions sources included or excluded from the project boundary

Baseline	Project activities	GHG emissions sources activities		Gas
			Electricity and heat generation	CO_2

Baseline	Project activities	GHG emissions sources activities	Gas
		Uncontrolled burning or decay of surplus biomass residues	CO_2 CH_4
		Emission from residual gas release or burning	CO_2 CH_4
		On-site or Off-site transportation of biomass	CO_2
		Combustion of biomass for energy and heat (they must be included in project activities if emission from uncontrolled burning or decay of biomass residues in the baseline scenario are included)	CH_4
		Wastewater from the treatment of biomass	CH_4
		Cultivation of land to produce biomass feedstock	CO_2 CH_4 N_2O

Conventions			
	Fossil fuel energy		Hydroelectric energy
	Wind energy		Biomass energy
	Solar energy		

Source: Adapted from CDM methodologies related to NCRE.

10 Identification of the baseline scenario and additionality

The baseline scenario identification and additionality demonstration shall apply what is described in the section "Identification of baseline scenario", of CDM methodology selected for the project activities.

In consequence, the Project proponent shall select CDM tools as follows:

Tool 02 should be used for selecting baseline scenario and demonstrate additionality in a large-scale project if (i) it has a generation capacity of more than 15 MW and it does not

have associated energy efficiency activities or they are not greater than 60 GWh per year; (ii) GHG emissions reductions are between 20 and 60 $ktCO_{2eq}$ per year.

Tool 21[17] should be used to demonstrate additionality in a small-scale project if (i) It has a generation capacity between 5 and 15 MW and it does not have associated energy efficiency activities, or if it has them, they sum between 20 and 60 GWh per year, or (ii) GHG emissions reductions are between 20 and 60 $ktCO_{2eq}$ per year.

Tool 19[18] should be used to demonstrate additionality in a micro/small-scale project if (i) it has a generation capacity of up to 5 MW and uses renewable energy as its main technology. Also, it does not have associated energy efficiency activities, or if it has them, they sum up 20 GWh per year; (ii) it reduces GHG emissions in less than 20 $ktCO_{2eq}$ per year.

Tool 01[19] is an additional CDM's reference that may be used to demonstrate and establish additionality.

These tools are summarized in appendix B.0.

Some technologies confer automatic additionality. To confirm whether this case applies, these guidelines recommend using CDM's tool 32 in its last version.[20] Appendix B.e includes a summary of this tool, up to date as for these guidelines' version date.

11 CDM Methodologies

Appendix A presents Figure 1's methodologies summaries as presented in CDM booklet[21] to facilitate appropriate selection of methodology for NCRE project. These include:

(a) Which are the typical project types under that methodology,

(b) Type of GHG mitigation action,

(c) Important conditions under which the methodology is applicable,

17 CLEAN DEVELOPMENT MECHANISM. TOOL 21: Demonstration of additionality of small-scale project activities. [Online]. 2015. Available on: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v1.pdf/history_view, p. 4.

18 CLEAN DEVELOPMENT MECHANISM. TOOL 19: Demonstrating additionality of microscale project activities. [Online]. 2017. Available on: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v9.pdf, p. 3.

19 CLEAN DEVELOPMENT MECHANISM. Tool 01: Tool for the demonstration and assessment of additionality [Online]. UNFCC, 2012. Available on:https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

20 CLEAN DEVELOPMENT MECHANISM. T 32: List of positive technologies. UNFCC, 2019. Available on:https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-32-v2.0.pdf

21 CLEAN DEVELOPMENT MECHANISM. Methodology Booklet. Óp. Cit. p. 57-269

(d) Important parameters at validation and, if applicable, what parameters shall be part of the monitoring plan and shall be monitored during verification processes,

(e) Description and diagram of both the baseline scenario and the project scenario.

Moreover, each summary table presents a section of "Applicability conditions under BCR Standard", if applicable. These conditions are the same stablished in these guidelines' chapter **¡Error! No se encuentra el origen de la referencia.**. Once the project proponents select an appropriate CDM methodology, they shall evaluate its last version. In it, they will find detailed information, including calculations and estimations procedures, default values, information sources, data quality requirements. Regarding the monitoring plan, they can also find general CDM methodologies' guidelines,[22] which describe calibration requirements, sampling a surveys procedure[23], that are summarized in appendix B.f.

[22] CDM. Guidelines [Online]. Available on: https://cdm.unfccc.int/Reference/Guidclarif/index.html
[23] CLEAN DEVELOPMENT MECHANISM. Guideline: Sampling and surveys for CDM project activities and programmes of activities—Version 04.0 [Online]. Available in https://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid48.pdf

Appendices

A. CDM methodologies related with Non-conventional Renewable Energy Sources NCRE summaries

This section presents a summary of CDM methodologies, as presented by the UNCFCCC Booklet.[24]

ACM0002. Grid-connected electricity generation from renewable sources

Retrofit, rehabilitation (or refurbishment), replacement or capacity addition of an existing power plant or construction and operation of a new power plant/unit that uses renewable energy sources and supplies electricity to the grid.

Type of GHG emissions mitigation action

- Renewable energy.

Displacement of electricity that would be provided to the grid by more-GHG-intensive means.

Important conditions under which the methodology is applicable

1. The project power plant is using one of the following sources: hydro, wind, geothermal, solar, wave or tidal power. Biomass-fired power plants are not applicable;
2. In the case of capacity additions, retrofits, rehabilitation or replacements, the existing power plant started commercial operation prior to the start of a minimum historical reference period of five years, and no capacity expansion or retrofit, rehabilitation or replacement of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project;
3. In case of hydro power:
    i) The project has to be implemented in an existing reservoir, with no change in the volume of reservoir;
    ii) The project has to be implemented in an existing reservoir, where the volume of reservoir is increased and the power density is greater than 4 W/m2;
    iii) The project results in new reservoirs and the power density are greater than 4 W/m2; or
    iv) The project activity is an integrated hydro power project involving multiple reservoirs;
4. The following technologies are deemed automatically additional if their penetration rate of the technology is below 2 per cent of the total installed grid connected power generation capacity in the host country or the total installed capacity of the technology in the host country is less than or equal to 50 MW:
    i) Solar photovoltaic technologies;
    ii) Solar thermal electricity generation including concentrating Solar Power (CSP);
    iii) Off-shore wind technologies;

[24] CLEAN DEVELOPMENT MECHANISM. Methodology Booklet. Óp. Cit. p. 57-269

iv) Marine wave technologies;
v) Marine tidal technologies;
vi) Ocean thermal technology

Applicability conditions BCR

1. Only pico-central, mini-power, and small hydroelectric plants (PCH), i. e., with less than 20,000 kW installed capacity. Also, the operation shall be run-of-the-river, either on not connected and interconnected areas. Besides, if the PCH diverts the river flow, it shall guarantee a permanent environmental flow on the natural riverbed. Finally, PCH with reservoirs or dams are not included.
2. Geothermal and tidal energy sources are not included.
3. Technologies that confer automatic additionality are: thermal solar electricity generation, and thermal solar technologies (installed capacity is less than 2%)

Important parameters

At validation

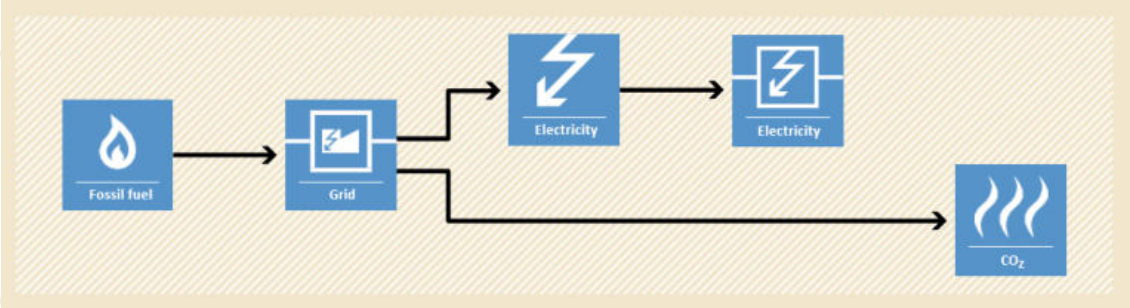
- Grid emission factor (can also be monitored ex post).

Monitored

(i) Electricity provided by the grid to the project
(ii) If applies: methane emissions of the project

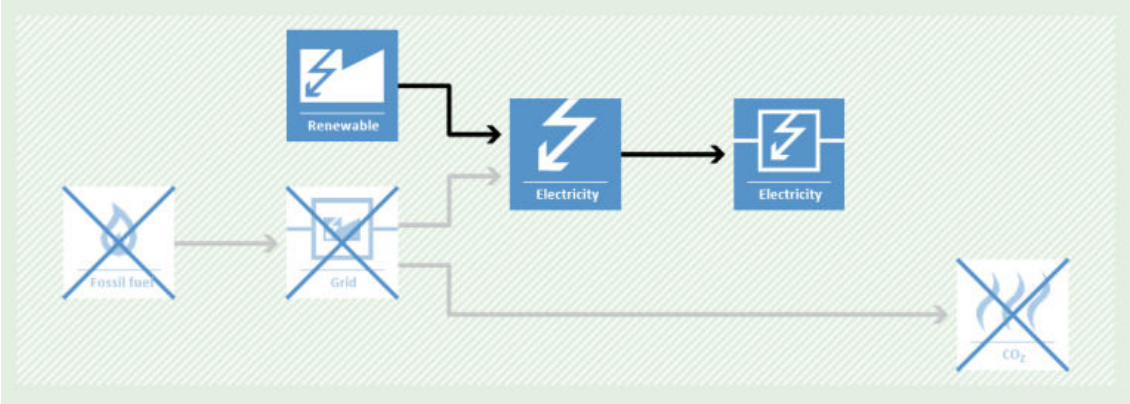
Baseline scenario

Electricity provided to the grid by more-GHG-intensive means.



Project scenario

Displacement of electricity provided to the grid by more- GHG-intensive means by installation of a new renewable power plant or the retrofit, replacement or capacity addition of an existing renewable power plant.



ACM0003. Partial substitution of fossil fuels in cement or quicklime manufacture

Typical project(s)

Partial replacement of fossil fuels in an existing clinker or quicklime production facility by less-carbon-intensive fossil fuel or alternative fuel (e.g., wastes or biomass residues).

Type of GHG emissions mitigation action

• Fuel switch;

• Renewable energy. Reduction of GHG emissions by switching from carbon-intensive fuel to less-carbon intensive or alternative fuel; GHG emission avoidance by preventing disposal or uncontrolled burning of biomass residues.

Important conditions under which the methodology is applicable

• No alternative fuels have been used in the project facility during the last three years prior to the start of the project;

• The biomass to be combusted should not have been processed chemically;
• For biomass from dedicated plantations, specific conditions apply

Applicability conditions BCR

1. Only projects with renewable energies associated activities, or that, as a result of the project activities, replace fossil fuels by NCRE.

Important parameters

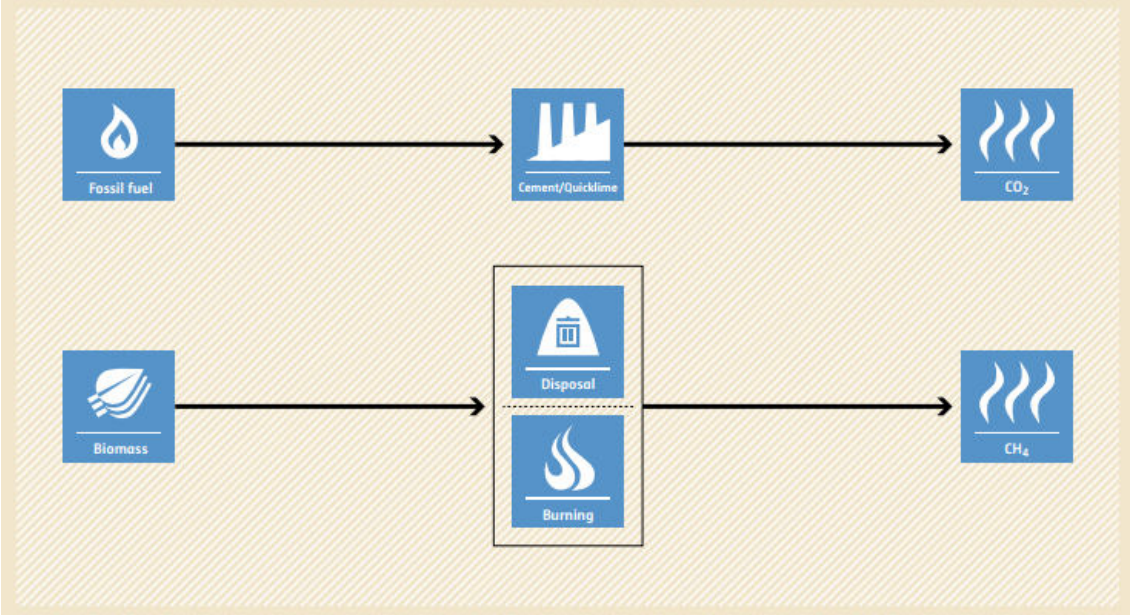
Monitored

• Quantity and net calorific value of alternative fuel and/or less-carbon-intensive fossil fuel used in the project plant;

• Quantity of clinker or quicklime produced.

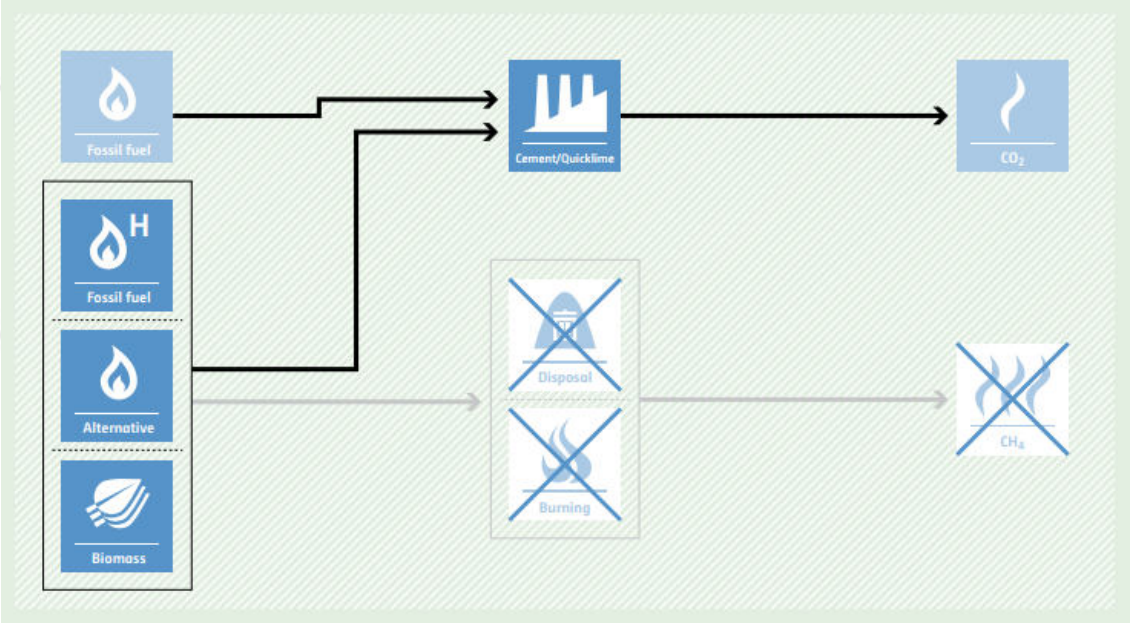
Baseline scenario

Clinker or quicklime is produced using more-carbon-intensive fuel and/or decay or uncontrolled burning of biomass leads to CH_4 emissions.



Project scenario

Clinker or quicklime is produced using less-carbon-intensive fuel and/or alternative fuel and/or biomass is combusted.



ACM0006. Consolidated methodology for electricity and heat generation from biomass

Typical project(s)

Generation of power and heat in thermal power plants, including cogeneration plants using biomass. Typical activities are new plant, capacity expansion, energy efficiency improvements or fuel switch projects.

Type of GHG emissions mitigation action

• Renewable energy;

• Energy efficiency;

• Fuel switch;

• GHG emission avoidance.

Displacement of more-GHG-intensive electricity generation in grid or heat and electricity generation on-site. Avoidance of methane emissions from anaerobic decay of biomass residues.

Important conditions under which the methodology is applicable

• Only power and heat or cogeneration plants are applicable;

• Only biomass residues, biogas and biomass from dedicated plantations are eligible;

• Fossil fuels may be co-fired in the project plant. The amount of fossil fuels co-fired shall not exceed 80% of the total fuel fired on an energy basis;

• Planted biomass is eligible if specific conditions elaborated in "Project and leakage emissions from biomass" are met.

Important parameters

At validation

1. Grid emission factor (can also be monitored ex post).

Monitored

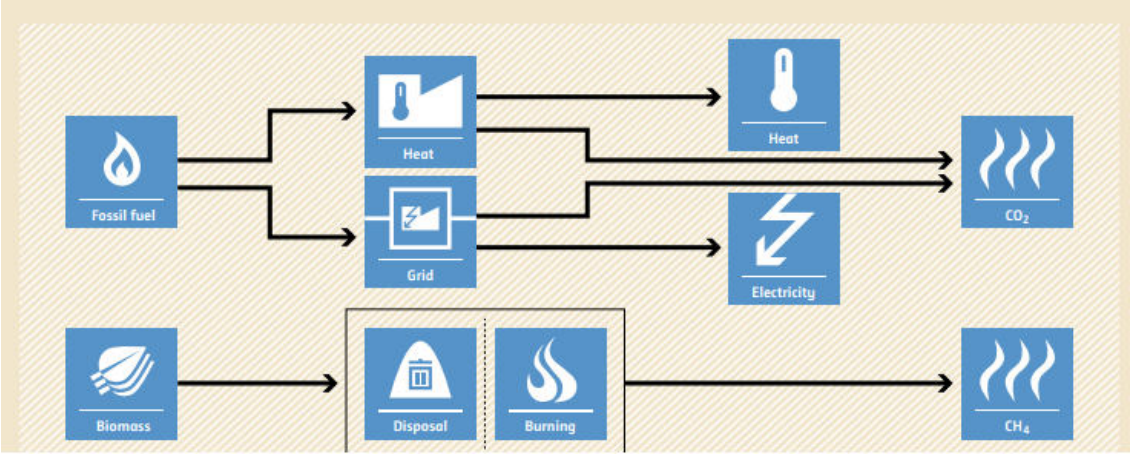
• Quantity and moisture content of the biomass used in the project activity;

• Electricity and heat generated in the project activity;

• Electricity and, if applicable, fossil fuel consumption of the project activity.

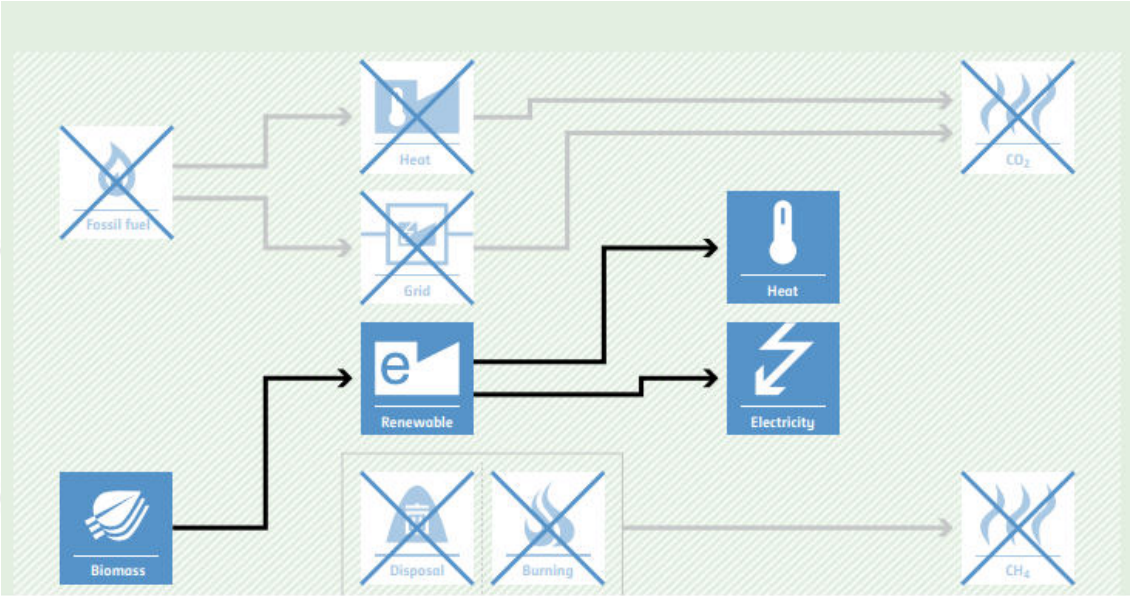
Baseline scenario

Electricity and heat would be produced by more-carbon intensive technologies based on fossil fuel or less-efficient biomass power and heat plants. Biomass could partly decay under anaerobic conditions, bringing about methane emissions.



Project scenario

Use of biomass for power and heat generation instead of fossil fuel or increase of the efficiency of biomass-fuelled power and heat plants. Biomass is used as fuel and decay of biomass is avoided.



ACM0018. Electricity generation from biomass residues in power-only plants

Typical project(s)

Generation of power using biomass as fuel, in new biomass-based power plants at sites where currently no power generation occurs (Greenfield), replacement or installation of operation units next to existing power plants (capacity expansion projects), energy efficiency improvement projects or replacement of fossil fuel by biomass in existing power plants (fuel switch projects). The biomass-based power generation may be combined with solar thermal power generation.

Type of GHG emissions mitigation action

• Renewable energy;

• Energy efficiency;

• Fuel switch.

• Displacement of more GHG-intensive electricity generation in the grid or on-site. Avoidance of methane emissions from anaerobic decay of biomass residues.

• Displacement of more-GHG-intensive fossil fuel for combustion in stationary installations.

Important conditions under which the methodology is applicable

• If biomass from a production process is used, the implementation of the project shall not result in an increase of the processing capacity of raw input;

• The methodology is applicable to power-only plants;

• Planted biomass is eligible if specific conditions elaborated in "Project and leakage emissions from biomass" are met;

• Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired shall not exceed 80% of the total fuel fired on an energy basis;

• In case of existing facilities, three years of historical data is required for the calculation of emissions reductions;

• Projects that chemically process the biomass prior to combustion (e.g., by means of esterification of waste oils, fermentation and gasification, etc.) are not eligible under this methodology. The biomass can however be processed physically such as by means of drying, pelletization, shredding and briquetting.

Important parameters

At validation

If applicable: grid emission factor (can also be monitored ex post)

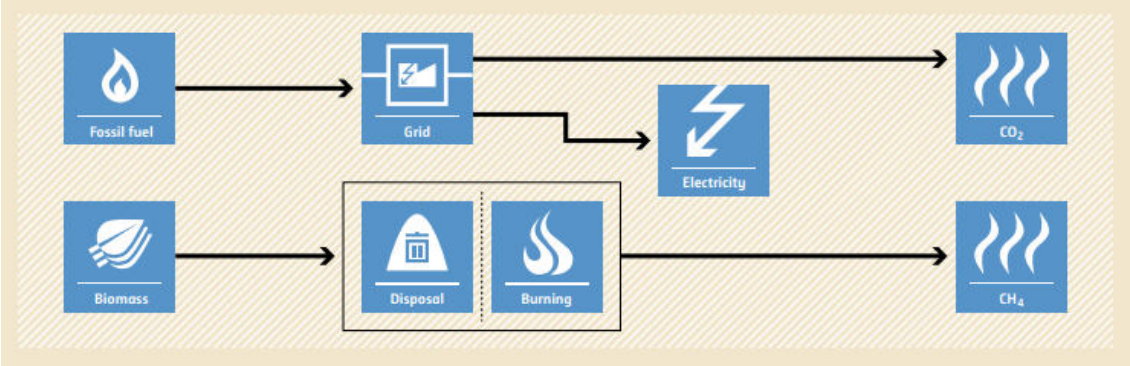
Monitored

• Electricity generated in the project;
• Quantity and moisture content of the biomass used in the project and electricity and fossil fuel consumption of the project.

Baseline scenario

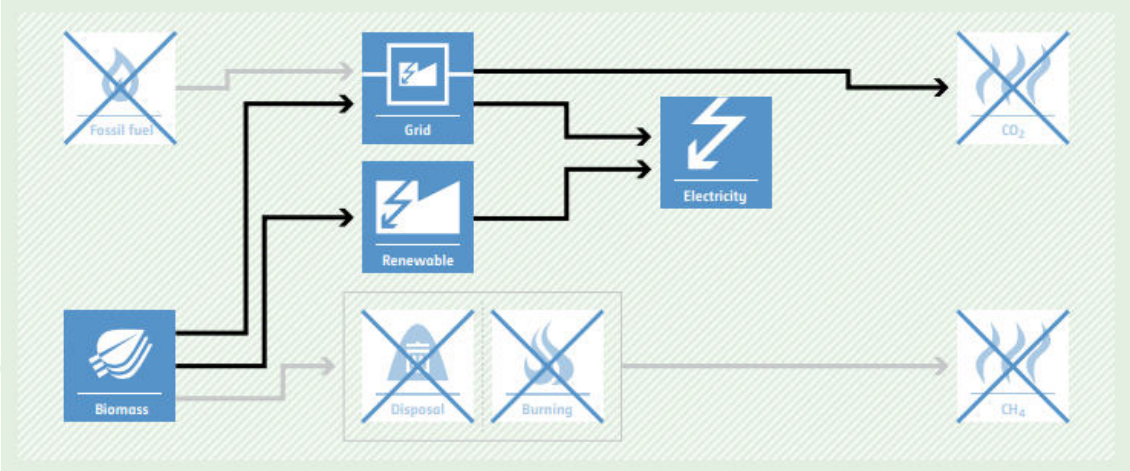
Electricity would be produced by more-carbon-intensive technologies based on fossil fuel or less efficient power plants.

Biomass could partially decay under anaerobic conditions, resulting in methane emissions.



Project scenario

Use of biomass residues replaces fossil fuel use. Decay of biomass residues used as fuel is avoided.



AM0026. Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order-based dispatch grid

Typical project(s)

Electricity capacity additions (either through the installation of new, or the modification of existing, power plants) that supply electricity to the grid and use renewable energy sources such as hydro, wind, solar, geothermal, wave or tidal power. The capacity additions have to be connected to the Chilean interconnected grid or others countries' grids providing a similar merit order-based framework.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of electricity that would be provided to the grid by more-GHG-intensive means.

Important conditions under which the methodology is applicable

• The project power plant must either be connected to the grid of Chile and fulfil the legal obligations under the Chilean Electricity Regulation, or be implemented in other countries if the

country has a regulatory framework for electricity generation and dispatch that meets the conditions described in the methodology;
• New hydroelectric power projects with reservoirs require power densities greater than 4 W/m2.

Applicability conditions BCR

1. Only pico-central, mini-power, and small hydroelectric plants (PCH), i. e., with less than 20,000 kW installed capacity. Also, the operation shall be run-of-the-river, either on not connected and interconnected areas. Besides, if the PCH diverts the river course, it is not applicable.
2. Geothermal and tidal energy sources are not included.

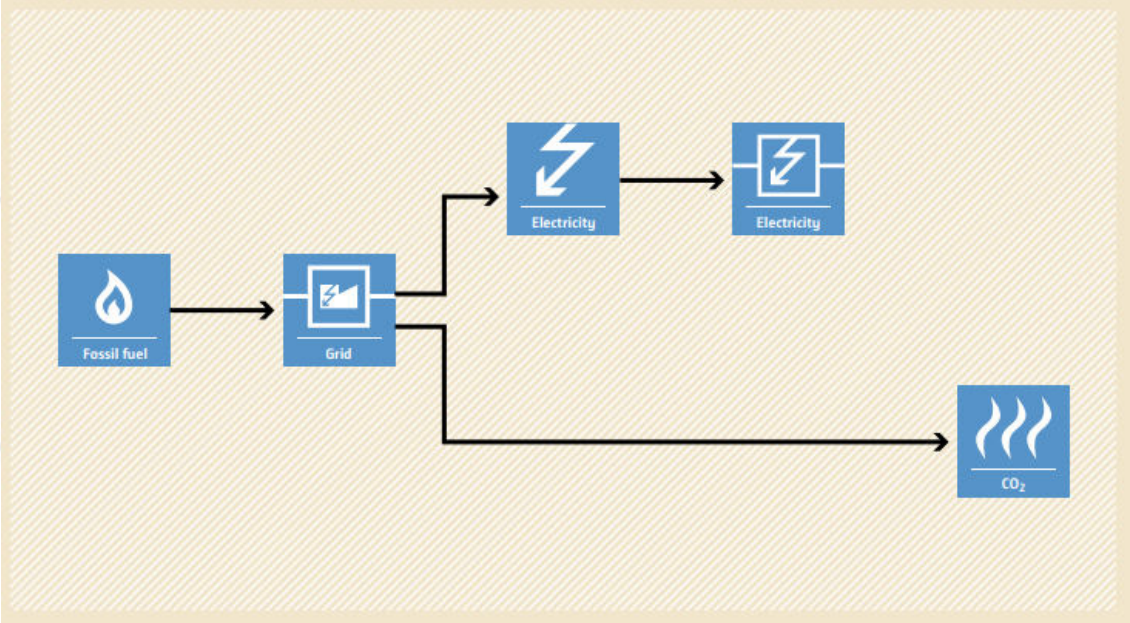
Important parameters

Monitored

• Electricity supplied to the grid by the project;
• Hourly data for merit order based on marginal costs;
• Operational data of the power plants connected to the same grid as the project.

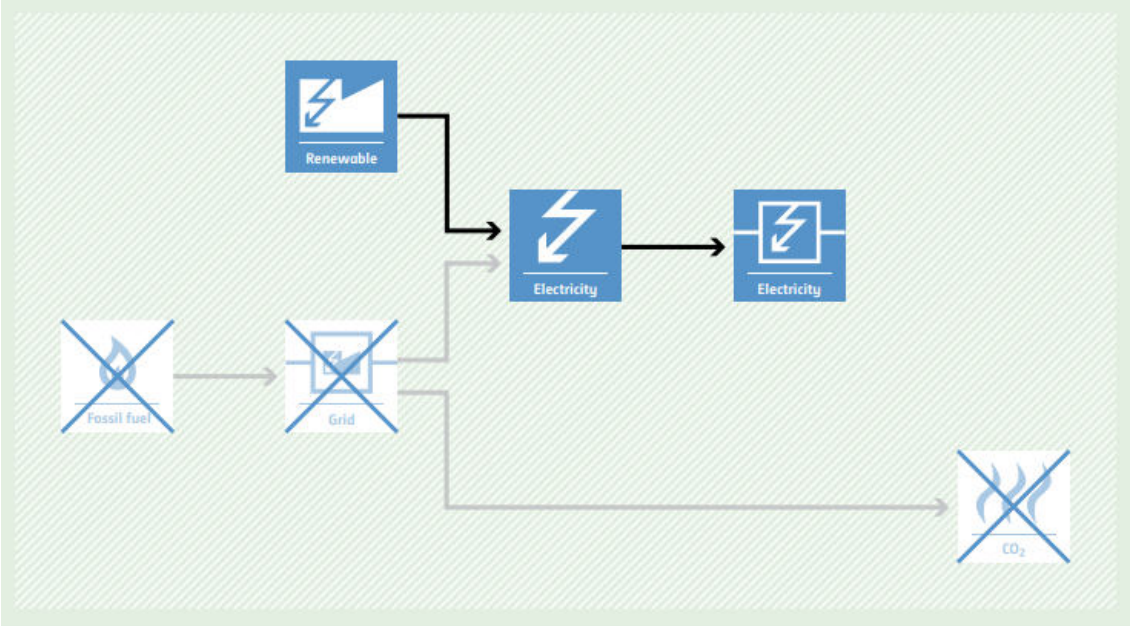
Baseline scenario

Power is provided to the grid using more-GHG-intensive power sources.



Project scenario

Installation of a new, or modification of an existing, renewable power plant that results in an increase of renewable power and displacement of electricity that would be provided to the grid by more-GHG intensive means.



AM0036. Fuel switch from fossil fuels to biomass residues in heat generation equipment

Typical project(s)

Fuel switch from fossil fuels to biomass in the generation of heat. Applicable activities are retrofit or replacement of existing heat generation equipment and installation of new heat generation equipment.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of more-GHG-intensive heat generation using fossil fuel and avoidance of CH_4 emissions from anaerobic decay of biomass residues.

Important conditions under which the methodology is applicable

• Heat generated in the project can only be used for power generation if power generation equipment was previously installed and is maintained throughout the crediting period;
• Biomass types used by the project activity are limited to biomass residues, biogas, Refuse Derived Fuel (RDF) and/or biomass from dedicated plantations;
• In case of existing facilities, three years of historical data is required for the calculation of emissions reductions.

Important parameters

At validation

• Historical annual heat generation and biomass consumption at the project site.

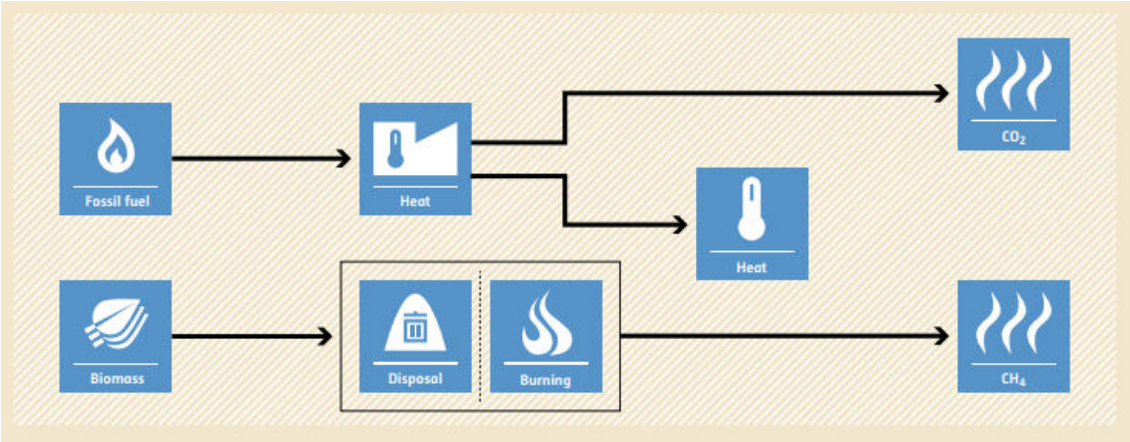
Monitored

• Heat generated by the project activity;
• Quantities of biomass used in the project plant;

• Electricity and fossil fuel consumption by the project activity;
• Parameters related to project and leakage emissions from biomass.

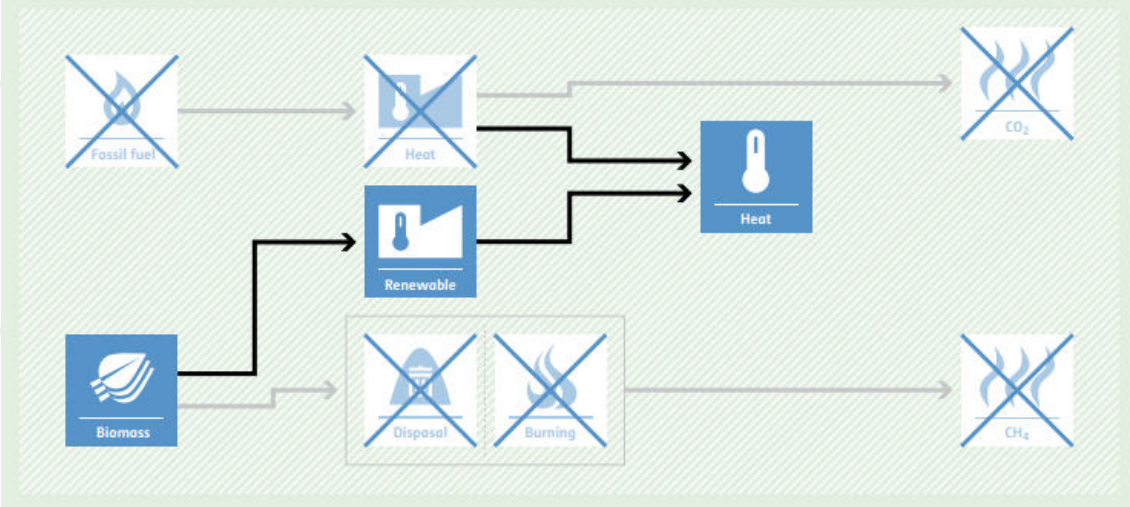
Baseline scenario

Heat would be produced by the use of fossil fuels. Biomass residues could partially decay under anaerobic conditions, generating CH_4 emissions.



Project scenario

Use of biomass for heat generation avoids fossil fuel use and its associated GHG emissions.



AM0045. Grid connection of isolated electricity systems

Typical project(s)

Expansion of an interconnected grid to supply electricity generated by more-efficient, less-carbon-intensive means to an isolated electric power system.

Type of GHG emissions mitigation action

• Displacement of a more-GHG-intensive output.
Displacement of electricity that would be provided by more-GHG-intensive means.

Important conditions under which the methodology is applicable

• Renewable energy-based electricity generation in the isolated systems is not displaced and its operation is not significantly affected;
• All fossil-fuel-fired power plants in the isolated system are 100% displaced.

Important parameters

At validation

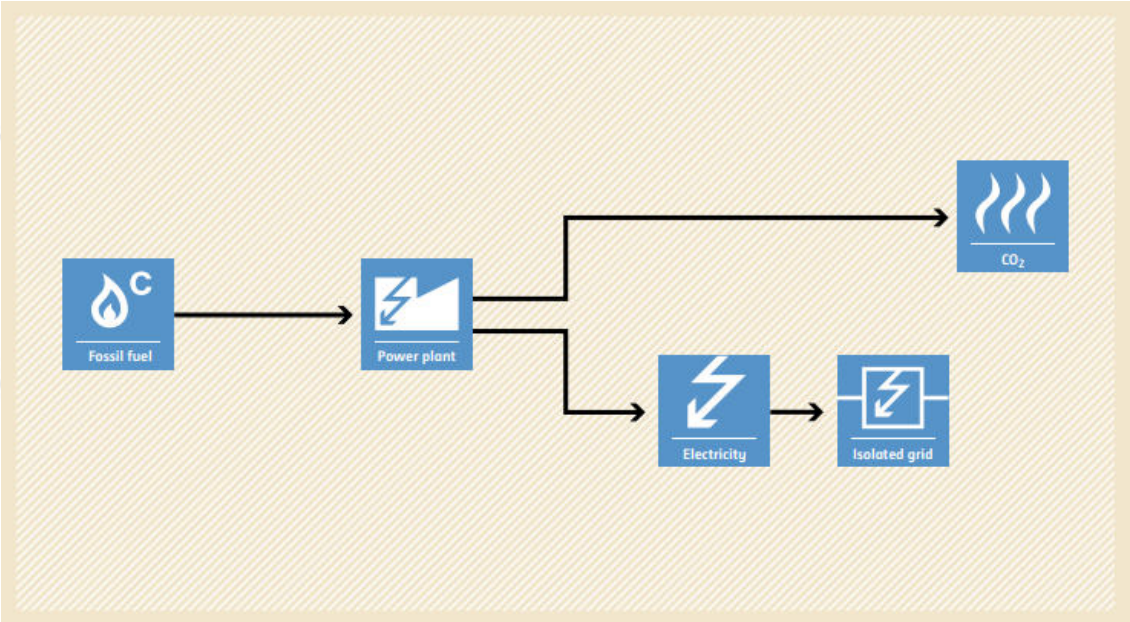
• Grid emission factor of isolated system before start of the project;
• Electricity supplied to isolated system before start of the project (three years of historic data required).

Monitored

• Quantity of electricity supplied to the previously isolated system by the interconnected grid;
• Grid emission factor of the interconnected grid.

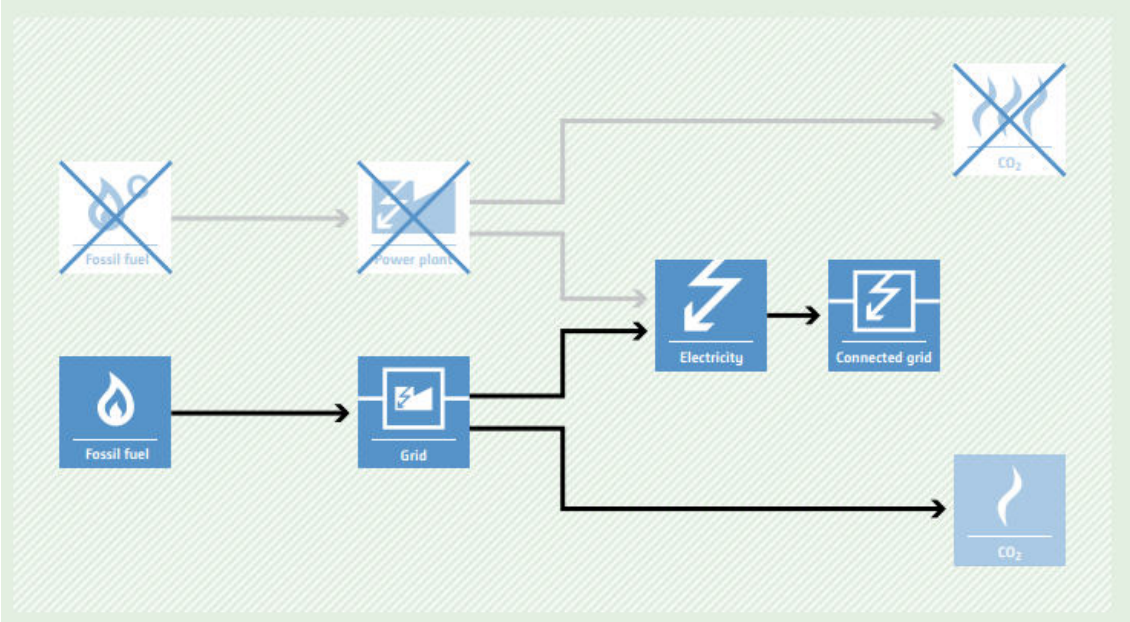
Baseline scenario

Power generation based on fossil fuel applying less-efficient technologies in isolated electricity systems.



Project scenario

Displacement of fossil-fuel fired power plants in the isolated grid by expansion of an interconnected grid to the isolated electricity system.



AM0100. Integrated Solar Combined Cycle (ISCC) projects

Typical project(s)

Implementation of Integrated Solar Combined Cycle (ISCC) projects.

Type of GHG emissions mitigation action

• Renewable Energy.
Displacement of electricity that would be provided to the grid by more-GHG-intensive means.

Important conditions under which the methodology is applicable

• Applicable to:
– Conversion of an existing Combined Cycle Power Plant into an ISCC; or
– Conversion of an existing single cycle gas turbine power plant into an ISCC, where the project activity comprises exclusively the Solar Field and Supplementary Firing; or
– Construction of a new ISCC, where the project activity comprises exclusively the Solar Field and Supplementary Firing;
• Electric Solar Capacity does not account for more than 15% of the Electric Steam Turbine Capacity of the ISCC.

Important parameters

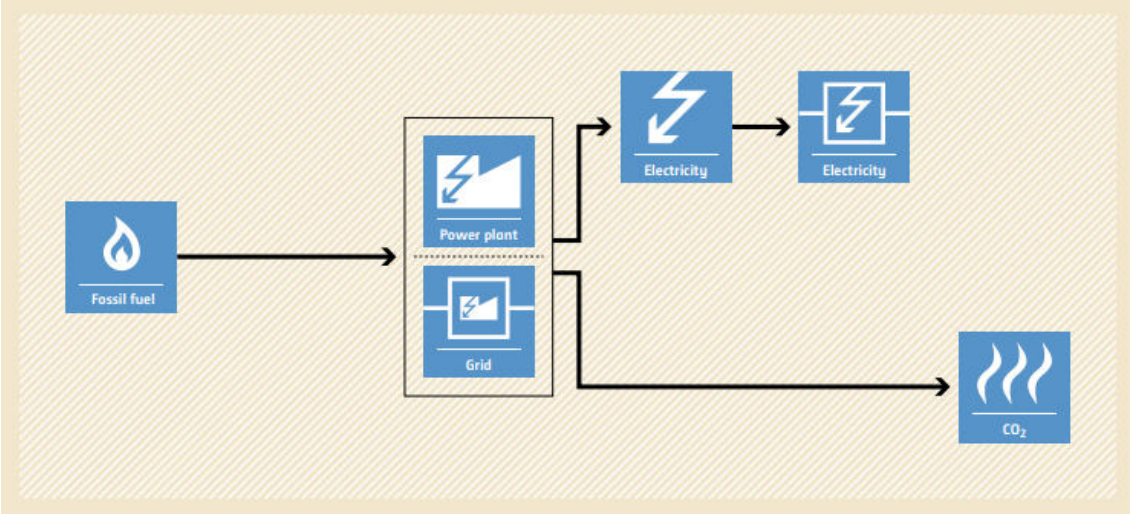
Monitored

• Average temperature, pressure and mass flow of steam leaving the solar steam generator;
• Average temperature, pressure and mass flow of high pressure and low-pressure steam entering the steam turbine and at the condenser outlet;
• Gross electricity generation from gas turbine;
• Net electricity generation from the ISCC;

• Mass or volume, net calorific value (NCV), and emission factor of supplementary fuel;
• Grid emission factor and/or emission factor of supplementary firing.

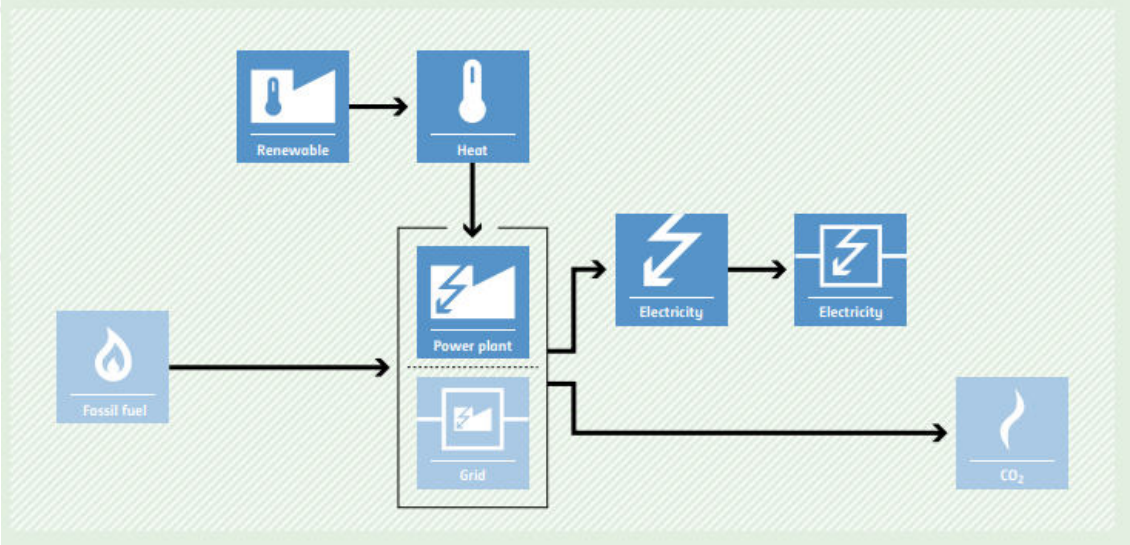
Baseline scenario

Electricity is generated in the grid using more-carbon-intensive fuel.



Project scenario

Electricity is generated using steam generated from solar collectors and reducing the use of fossil fuel.



AM0103. Renewable energy power generation in isolated grids

Typical project(s)

Power generation using renewable energy sources connected to a new or an existing isolated grid.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of electricity that would be provided to the isolated grid by more-GHG-intensive means.

Important conditions under which the methodology is applicable

• The project power plant is using one of the following sources: hydro, wind, geothermal, solar, wave or tidal power. Biomass-fired power plants are not applicable;
• In case of hydro power:
– The project shall be implemented in an existing reservoir, with no change in the volume of reservoir;
– The project shall be implemented in an existing reservoir, where the volume of reservoir is increased and the power density is greater than 4 W/m2;
– The project results in new reservoirs and the power density is greater than 4 W/m2; or
– The project activity is an integrated hydro power project involving multiple reservoirs;
• The following technologies are deemed automatically additional if their penetration rate of the specific technology is below 2 per cent of the total installed isolated grid connected power generation capacity in the host country or the total installed isolated grid power generation capacity of the specific technology in the host country is less than or equal to 50 MW:
– Solar photovoltaic technologies;
– Solar thermal electricity generation including concentrating Solar Power (CSP);
– Off-shore wind technologies;
– Marine wave technologies;
– Marine tidal technologies;
– Ocean thermal technology.

Applicability conditions BCR

1. Only picocentral, mini-power and small hydroelectric plants (PCH), i. e., with less than 20,000 kW installed capacity. Also, the operation shall be run-of-the-river, either on not connected and interconnected areas. Besides, if the PCH diverts the river flow, it shall guarantee a permanent environmental flow on the natural riverbed. Finally, PCH with reservoirs or dams are not included.
2. Geothermal and tidal energy sources are not included.

Important parameters

At validation

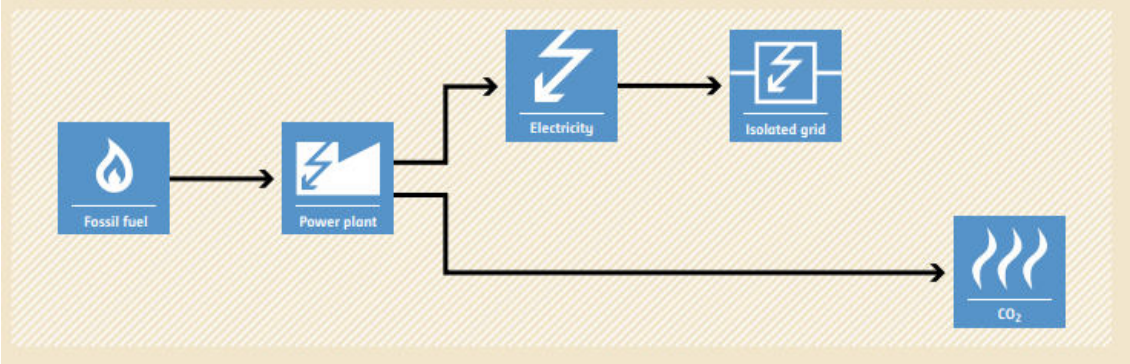
Emission factor of the isolated grid.

Monitored

Electricity supplied to the isolated grid by the project.

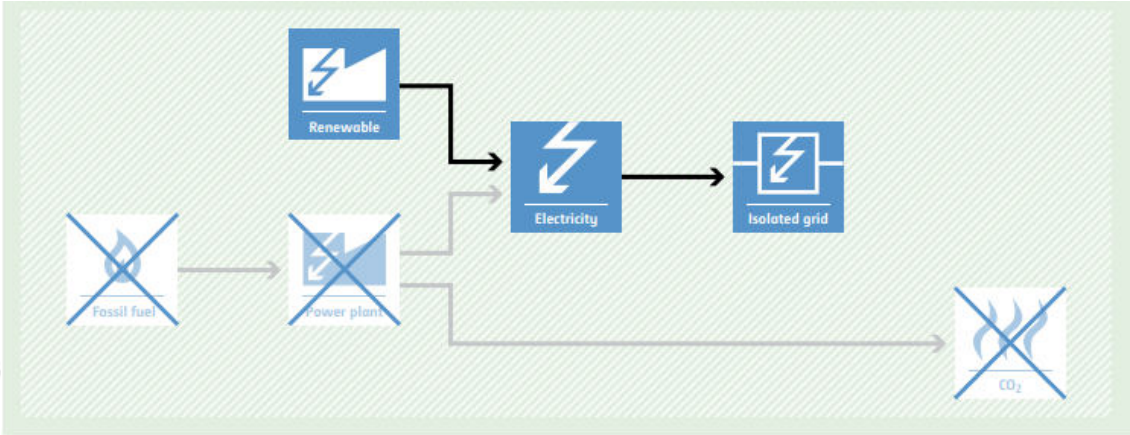
Baseline scenario

Generation of electricity with fossil-fuel-fired generators (e.g., diesel generators).



Project scenario

A renewable energy power plant displaces the energy that was generated by fossil fuel sources.



AMS-I.A. Electricity generation by the user

Typical project(s)

Renewable electricity generation such as solar, hydro, wind or biomass gasification are implemented by the users as new installations (Greenfield) or replacement of existing onsite fossil-fuel-fired generation.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of more-GHG-intensive service (e.g., refrigeration or lighting).

Important conditions under which the methodology is applicable

• Users are in off-grid locations, i.e., they do not have connection to a national/regional grid, unless exceptional situations, e.g., weak grids;
• Users are included in the project boundary;
• Conditions apply for reservoir-based hydro plants.

Applicability conditions BCR

1. Only picocentral, mini-power and small hydroelectric plants (PCH), i. e., with less than 20,000 kW installed capacity. Also, the operation shall be run-of-the-river, either on not connected and interconnected areas. Besides, if the PCH diverts the river flow, it shall guarantee a permanent environmental flow on the natural riverbed. Finally, PCH with reservoirs or dams are not included.

Important parameters

At validation

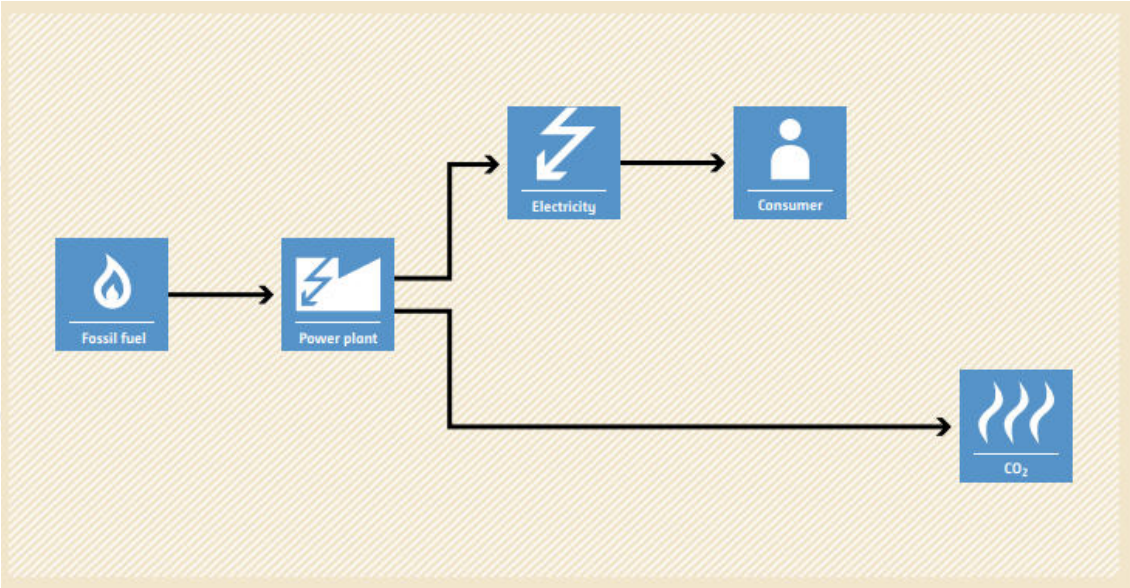
Trend-adjusted projection of historical fuel consumption if an existing technology is replaced (for lighting, daily use duration can be applied).

Monitored

• An annual check of all systems or a sample thereof to ensure that they are still operating, or metering of generated electricity;
• If applicable, consumption of energy sources (e.g., biomass, fossil fuel);
• If applicable, availability of connected grid.

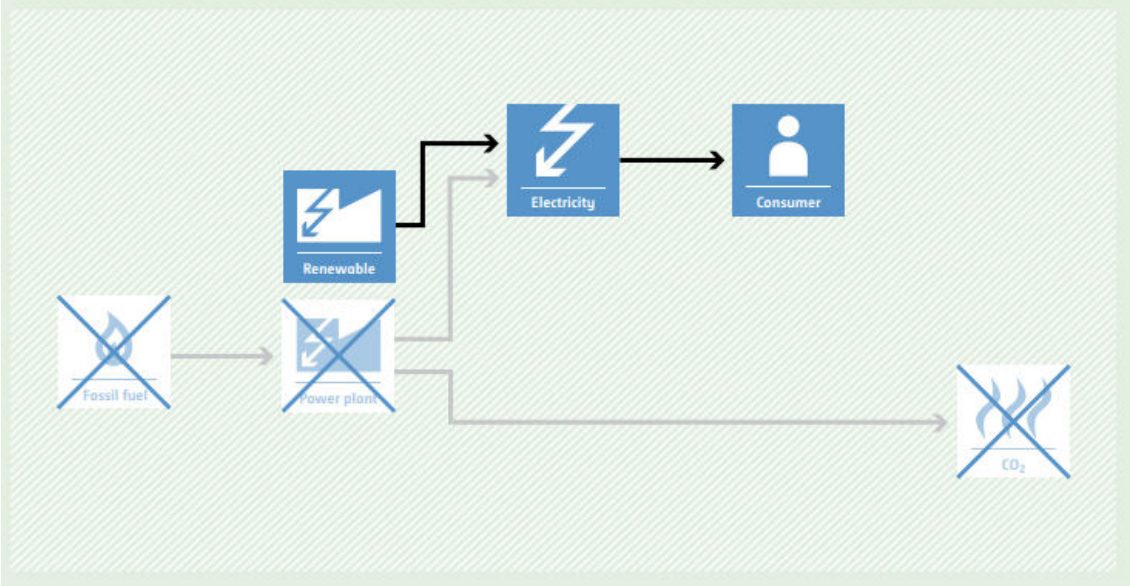
Baseline scenario

Services (e.g., lighting and refrigeration) are provided using fossil-fuel-based technologies (e.g., kerosene lamps and diesel generators).



Project scenario

Electricity is produced by users using renewable energy technologies (e.g., solar home systems for lighting, wind battery chargers for powering domestic appliances).



AMS-I.B. Mechanical energy for the user with or without electrical energy

Typical project(s)

Installation of renewable energy technologies such as hydropower, wind power and other technologies that provide mechanical energy that otherwise would have been supplied with fossil-fuel-based energy. Mechanical energy is used on-site by individual household(s) or user(s). Typical applications are wind-powered pumps, water mills and wind mills. The project may also produce electricity in addition to mechanical energy.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of more-GHG-intensive fossil-fuel-based generation of mechanical power.

Important conditions under which the methodology is applicable

• Operating characteristics of the project system (e.g., head vs. discharge and efficiency of irrigation pump) should be similar to or better than the system being replaced or that would have been replaced.

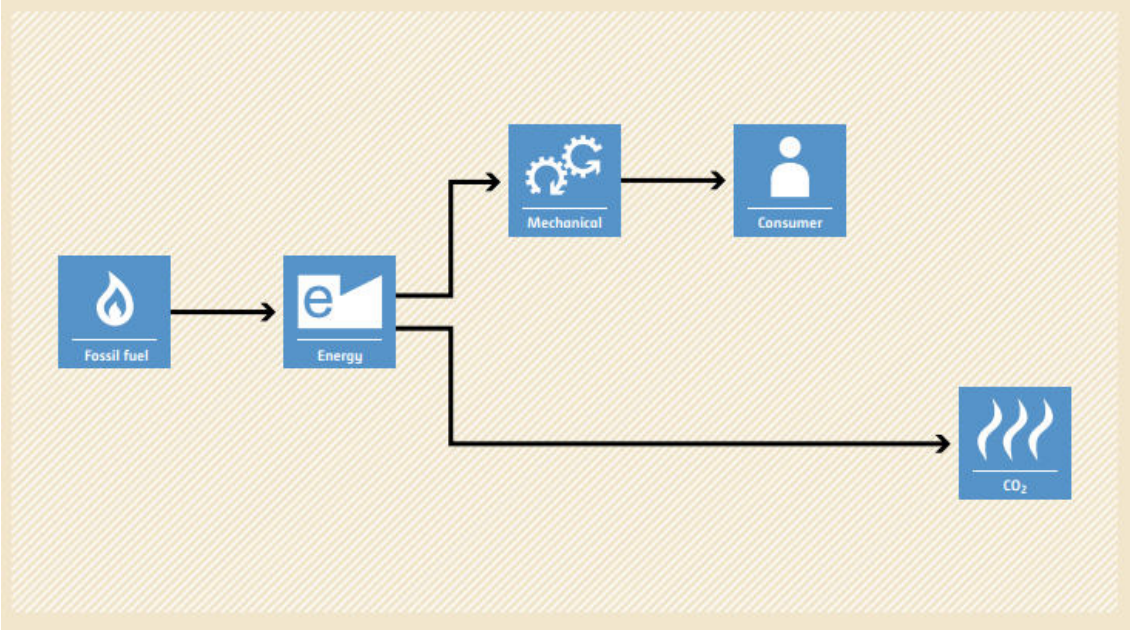
Important parameters

Monitored

• An annual check of all systems or a sample thereof to ensure that they are still operating;
• Annual hours of operation can be estimated from total output (e.g., tons of grain milled);
• If applicable: quantity of each type of energy sources consumed (e.g., biomass, fossil fuel). Net calorific value and moisture content of biomass.

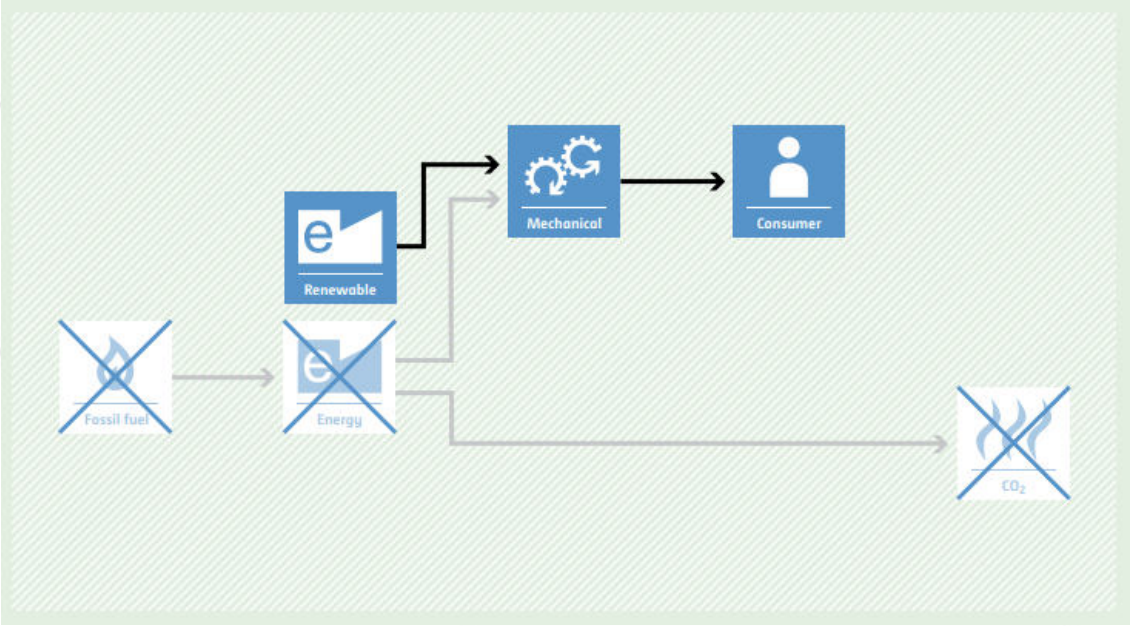
Baseline scenario

Mechanical energy would be produced using fossil-fuel-based technologies. Under a suppressed demand scenario, diesel-based generator(s) or pump(s) is deemed to be the baseline.



Project scenario

Mechanical energy is produced (with or without electricity) using renewable energy technologies.



AMS-I.C. Thermal energy production with or without electricity

Typical project(s)

Thermal energy production using renewable energy sources including biomass-based cogeneration and/or trigeneration. Projects that seek to retrofit or modify existing facilities for renewable energy generation are also applicable.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of more-GHG-intensive thermal energy production, displacement of more-GHG-intensive thermal energy and/or electricity generation.

Important conditions under which the methodology is applicable

• Thermal energy and/or electricity production using biomass-based cogeneration and trigeneration system is eligible;
• If solid biomass is used, it has to be demonstrated that solely renewable biomass is used. If charcoal or biomass fuel is used, all project or leakage emissions (e.g., release of methane) from the fuel production have to be considered;
• If project equipment contains refrigerants, then the refrigerant used in the project case shall have no ozone depleting potential (ODP).

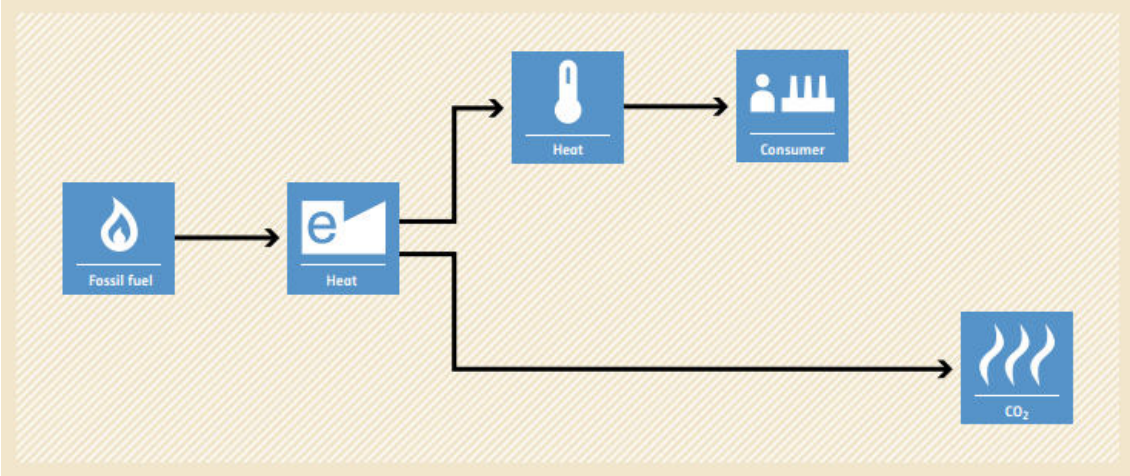
Important parameters

Monitored

• The moisture content of biomass of homogeneous quality may be fixed ex ante or monitored for each batch of biomass if the emission reductions are calculated based on energy input;
• Thermal energy (mass flow, temperature, pressure for heat/cooling) delivered by the project and the amount of grid and/or captive electricity displaced;
• Quantity of biomass and fossil fuel consumed;
• Net calorific value of biomass shall be determined once in the first year of the crediting period;
• The chilled water mass flow-rate for chiller(s);
• Cooling output of baseline chiller displaced as a result of the installation of project activity;
• Quantity of refrigerant used to replace refrigerant that has leaked.

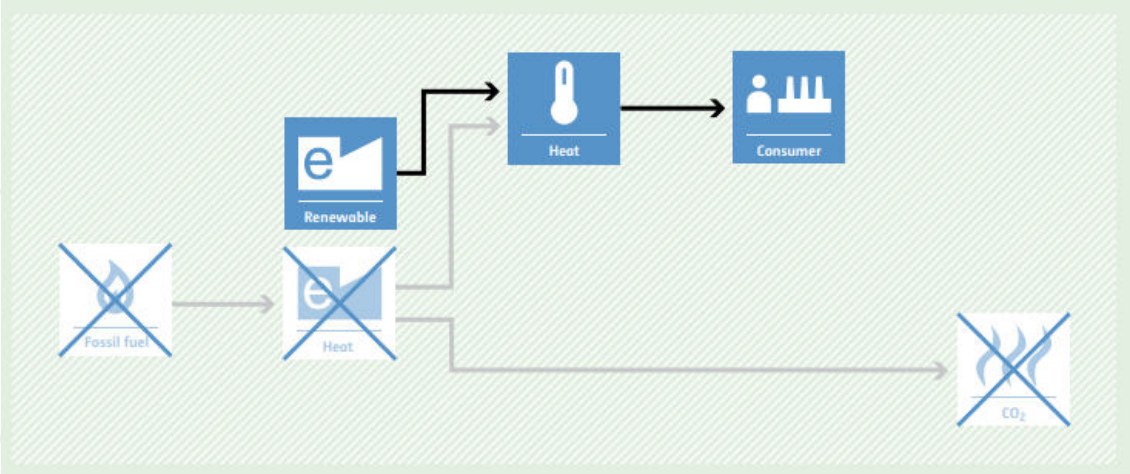
Baseline scenario

Energy generation (thermal heat and / or electricity) by more carbon-intensive technologies based on fossil fuel. In case of retrofits or capacity addition, operation of existing renewable power units without retrofit and capacity addition.



Project scenario

Energy generation by installation of new renewable energy generation units, by retrofitting or replacement of existing renewable energy generation units as well as by switch from fossil fuel to biomass in modified existing facilities.



AMS-I.D. Grid connected renewable electricity generation

Typical project(s)

Construction and operation of a power plant that uses renewable energy sources and supplies electricity to the grid (Greenfield power plant) or retrofit, replacement or capacity addition of an existing power plant that uses renewable energy sources and supplies electricity to the grid.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of electricity that would be provided to the grid by more-GHG-intensive means.

Important conditions under which the methodology is applicable

• Combined heat and power generation is not eligible (AMS-I.C. can be used here);
• Special conditions apply for reservoir-based hydro plants.

Applicability conditions BCR

1. BCR Standard does not include hydroelectric power generation with dams use.

Important parameters

At validation

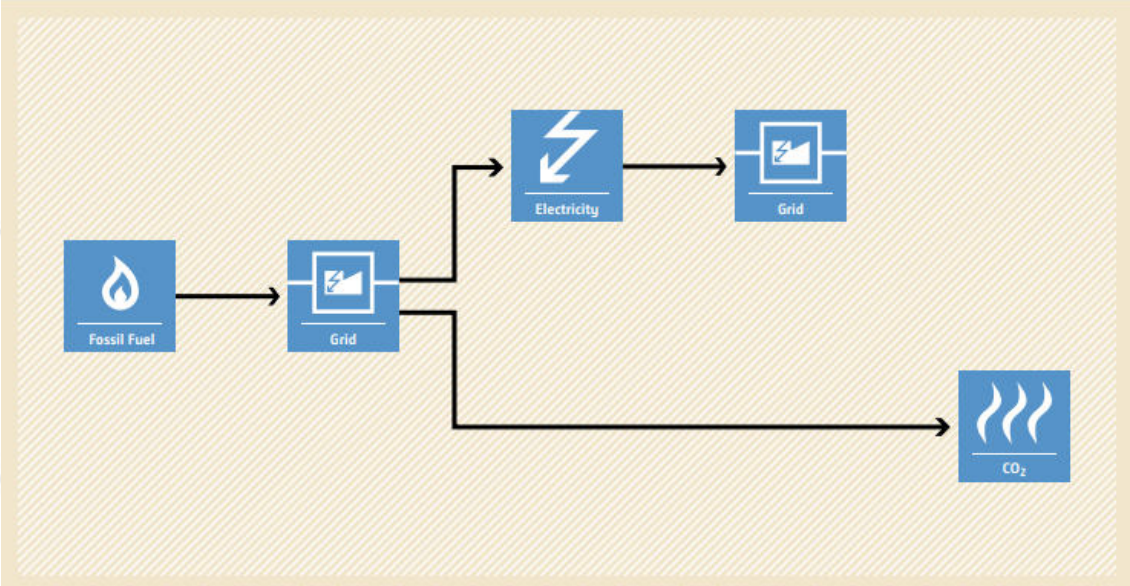
• Grid emission factor (can also be monitored ex post);
• Moisture content of biomass of homogeneous quality shall be determined ex ante.

Monitored

• Quantity of net electricity supplied to the grid;
• Quantity of biomass/fossil fuel consumed;
• Net calorific value of biomass shall be determined once in the first year of the crediting period.

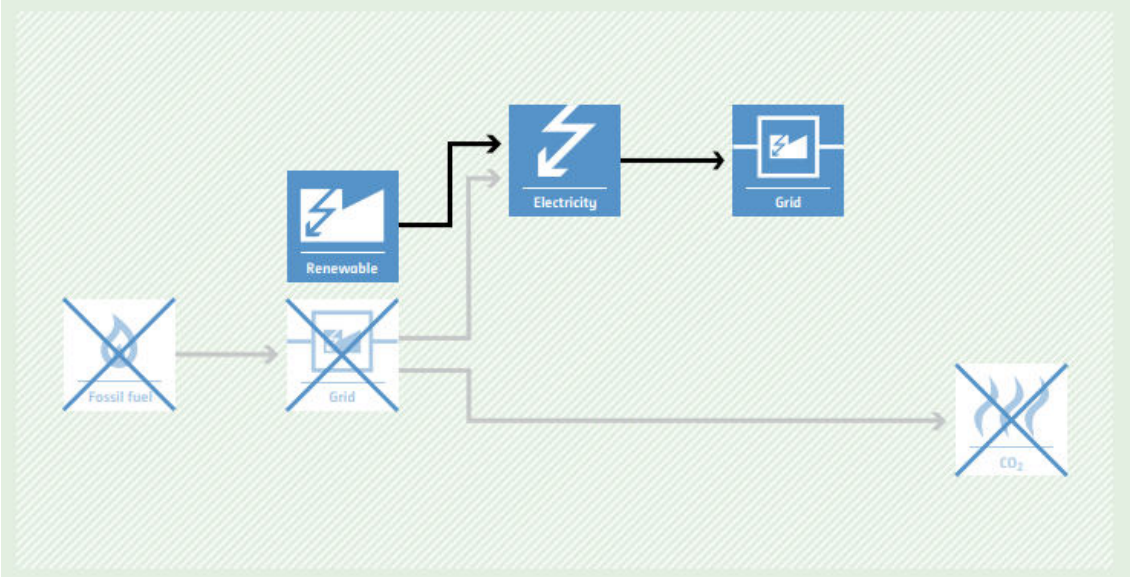
Baseline scenario

Electricity provided to the grid by more-GHG-intensive means.



Project scenario

Electricity is generated and supplied to the grid using renewable energy technologies.



AMS-I.E. Switch from non-renewable biomass for thermal applications by the user

Typical project(s)

Generation of thermal energy by introducing renewable energy technologies for end users that displace the use of non-renewable biomass. Examples of these technologies include, but are not limited to, biogas stoves, bio-ethanol stoves, solar cookers or passive solar homes.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of more-GHG-intensive, non-renewable biomass-fuelled applications by introducing renewable energy technologies.

Important conditions under which the methodology is applicable

• It shall be demonstrated that non-renewable biomass has been used since 31 December 1989;
• Project appliances are continuously operated or replaced by equivalent service appliances.

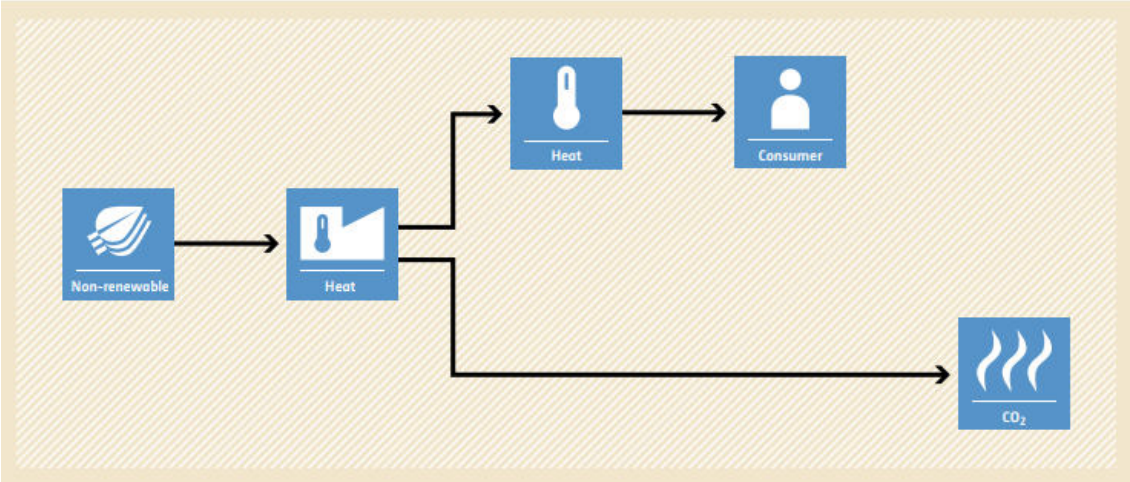
Important parameters

Monitored

• Average annual consumption of woody biomass per household or per person in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent;
• Fraction of woody biomass saved by the project activity that can be established as non-renewable biomass, as per the methodological tool "calculation of fraction of non-renewable biomass";
• Leakage: the amount of woody biomass saved under the project that is used by non-project households/users (who previously used renewable energy sources) shall be assessed from surveys.

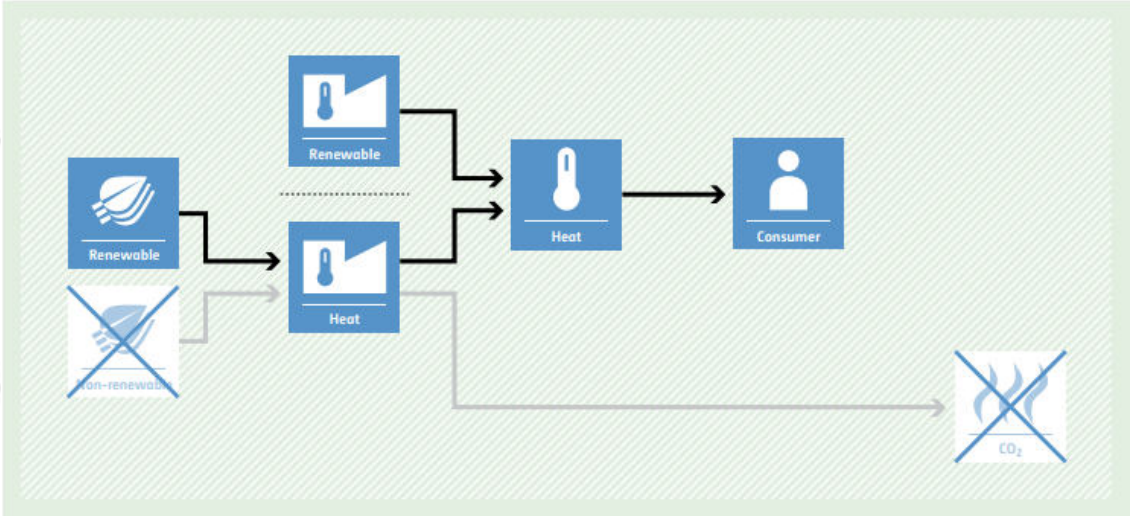
Baseline scenario

Thermal energy would be produced by more-GHG-intensive means based on the use of non-renewable biomass.



Project scenario

Use of renewable energy technologies for thermal energy generation, displacing non-renewable biomass use.



AMS-I.F. Renewable electricity generation for captive use and mini-grid

Typical project(s)

Production of electricity using renewable energy technologies such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s).

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of electricity that would be provided to the user(s) by more-GHG intensive means.

Important conditions under which the methodology is applicable

• The project will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit;
• Electricity is produced by installing a new power plant (Greenfield) or by capacity addition/retrofit/replacement of (an) existing plant(s);
• Special conditions apply for reservoir-based hydro plants;
• Cogeneration projects are not eligible.

Applicability conditions BCR

1. Only picocentral, mini-power and small hydroelectric plants (PCH), i. e., with less than 20,000 kW installed capacity. Also, the operation shall be run-of-the-river, either on not connected and interconnected areas. Besides, if the PCH diverts the river flow, it shall guarantee a permanent environmental flow on the natural riverbed. Finally, PCH with reservoirs or dams are not included.
2. Geothermal and tidal energy sources are not included.

Important parameters

At validation

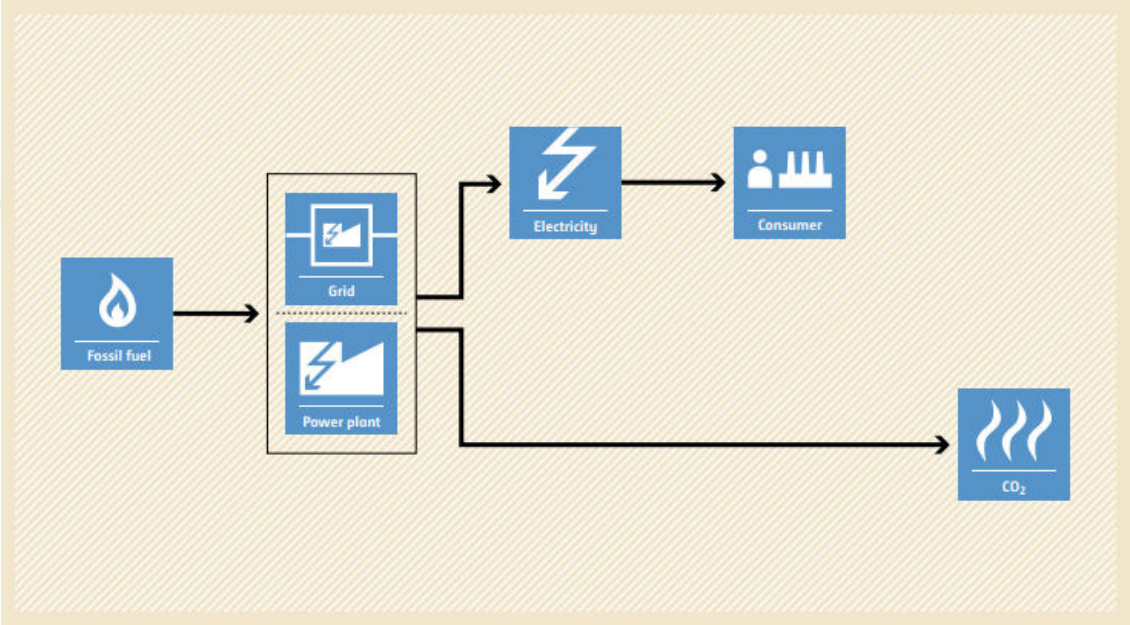
• If applicable: grid emission factor (can also be monitored ex post).

Monitored

• Net electricity generation, quantity of fossil fuel and biomass consumption.

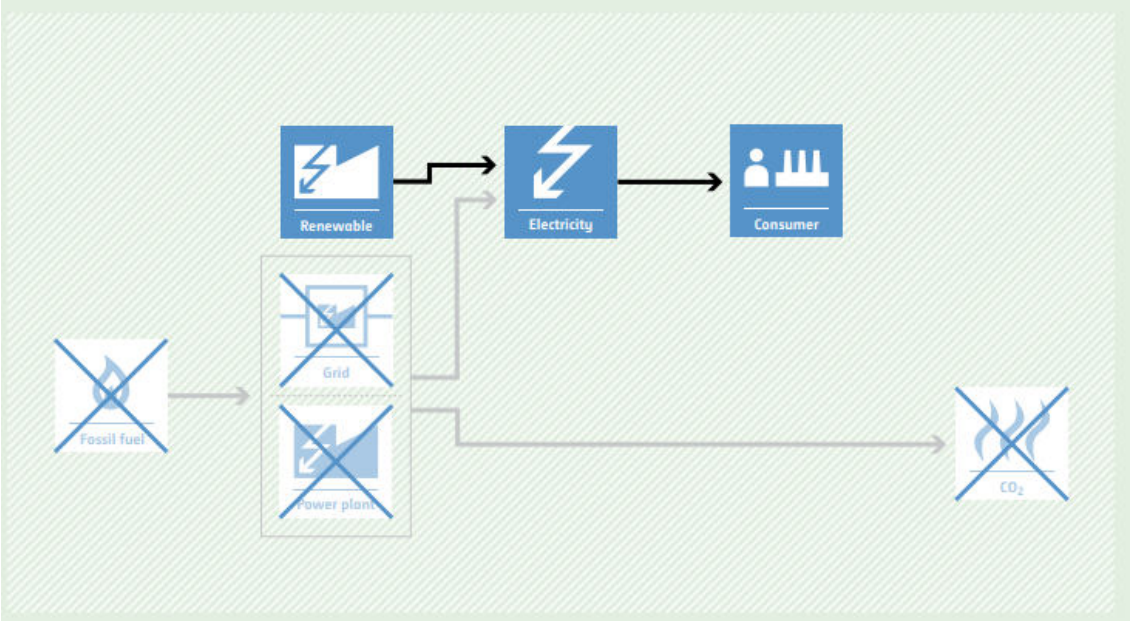
Baseline scenario

Electricity would have been supplied by one or more energy sources such as a national or a regional grid or a fossil-fuel-fired captive power plant or a carbon intensive mini-grid.



Project scenario

Electricity is supplied using renewable energy technologies.



AMS-I.I. Biogas/biomass thermal applications for households/small users

Typical project(s)

Activities for generation of renewable thermal energy using renewable biomass or biogas for use in residential, commercial and institutional applications. Examples of these technologies that displace or avoid fossil fuel use include, but are not limited to, biogas cook stoves, biomass briquette cook stoves, small-scale baking and drying systems, water heating, or space heating systems.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of more-GHG-intensive thermal energy generation.

Important conditions under which the methodology is applicable

• Each unit (e.g., cook stove, heater) shall have a rated capacity equal to or less than 150 kW thermal.

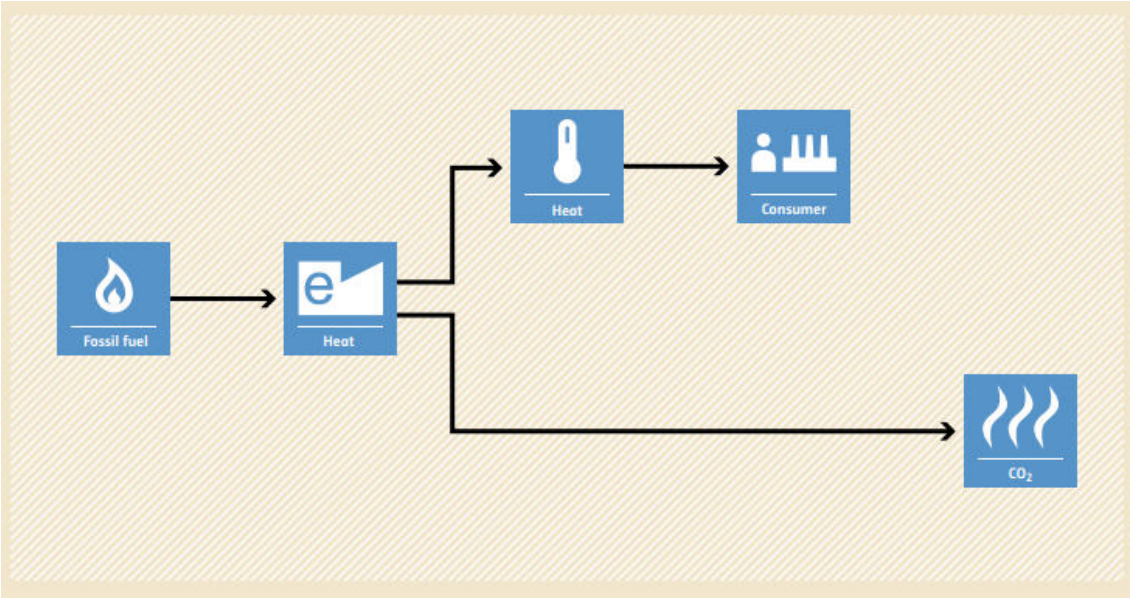
Important parameters

Monitored

• Number of thermal applications commissioned;
• Proportion of thermal applications that remain operating in year y;
• Annual consumption of fossil fuel in the baseline and project;
• The net quantity of renewable biomass or biogas consumed by the thermal application in year y;
• Net calorific value of biomass type.

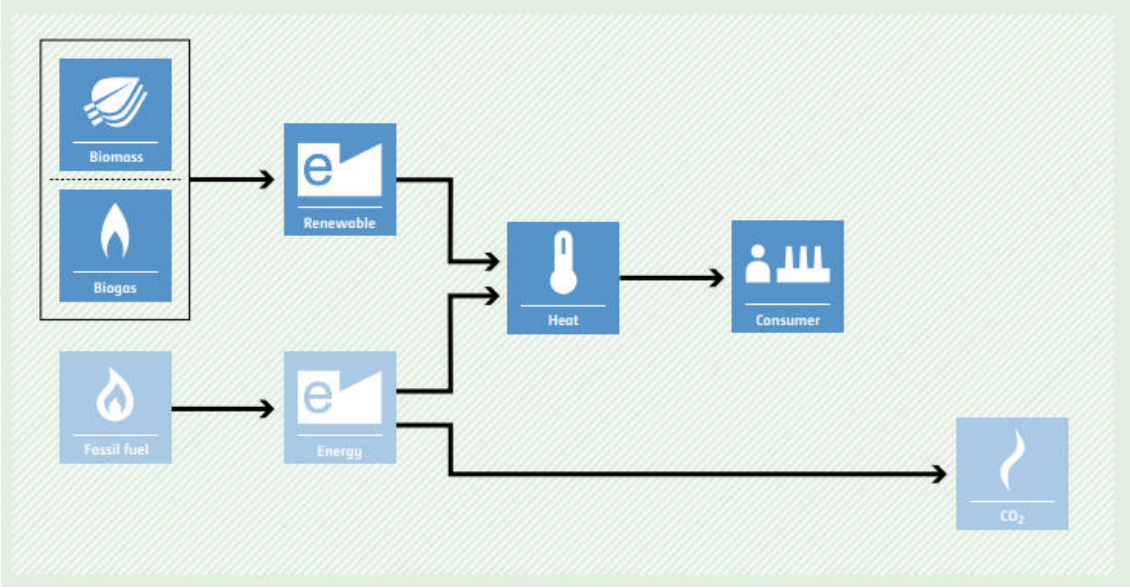
Baseline scenario

Thermal energy production based on fossil fuel.



Project scenario

Thermal energy generation by renewable biomass or biogas. Fossil fuel may continue to be used.



AMS-I.J. Solar water heating systems (SWH)

Typical project(s)

The installation of residential and commercial solar water heating (SWH) systems for hot water production.

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of electricity or fossil fuel that would otherwise have been used to produce hot water.

Important conditions under which the methodology is applicable

• Two types of projects included in this category: retrofits and new construction;
• Commercial SWH systems shall include operational indicators that may be easily interpreted by the intended users of the systems and that indicate that water is being heated by solar energy.

Important parameters

At validation

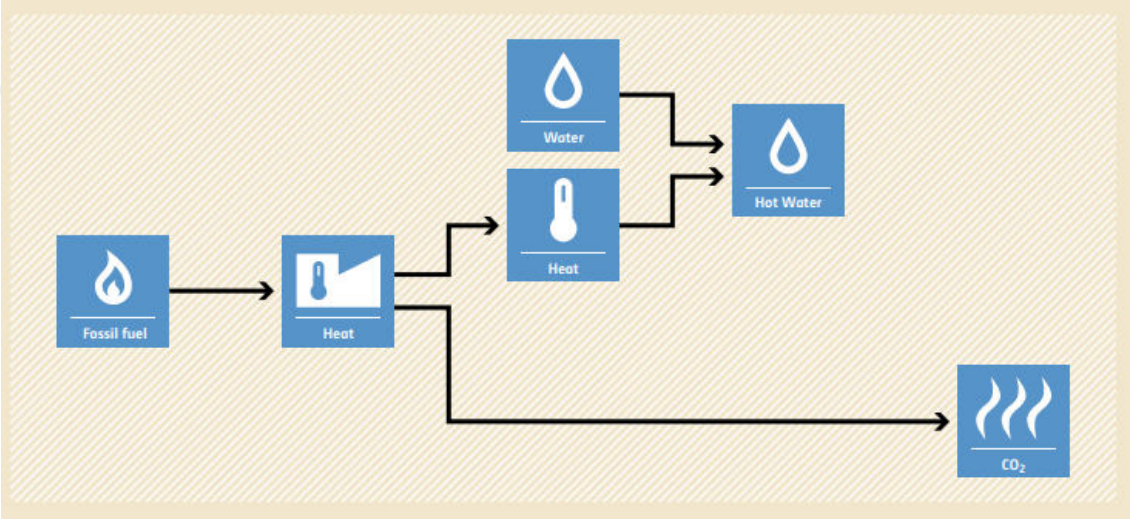
• Emission factor of the baseline fuel and/or grid;
• Where applicable:
– Efficiency of the baseline unit which is consuming fossil fuel or electricity;
– Solar insolation level;
– Time of hot water demand.

Monitored

• Where applicable, hot water consumption pattern, inlet/outlet temperature, characteristics/specifications of the project system;
• Retention rate of the project system;
• Collecting area of the solar panel;
• Auxiliary fuel consumption by the project system, where applicable.

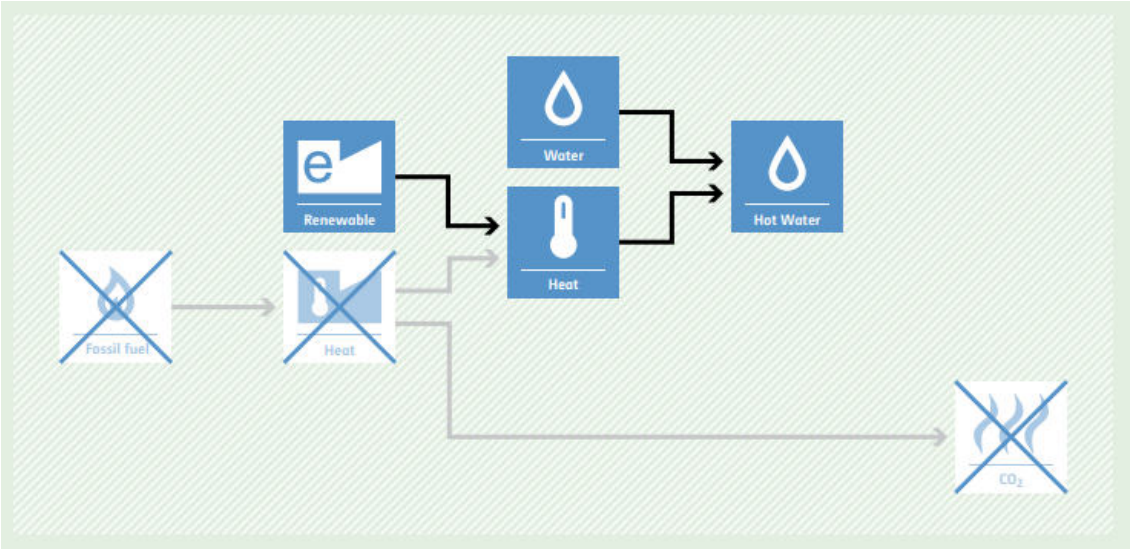
Baseline scenario

Hot water production is based on fossil fuel/electricity consumption.



Project scenario

Hot water is produced by solar energy.



AMS-I.K. Solar cookers for households

Typical project(s)

Project activities that introduce solar cookers to individual households to be used for household cooking purpose.

Type of GHG emissions mitigation action

• Renewable energy.
Use of solar cookers will reduce or displace use of fossil fuels or non-renewable biomass.

Important conditions under which the methodology is applicable

• Solar cookers shall be demonstrated to be designed and constructed according to the requirements of a relevant national or international standard;
• A local organization shall be involved on an ongoing basis to assist in promoting and facilitating the continued use of the cookers.

Important parameters

At validation

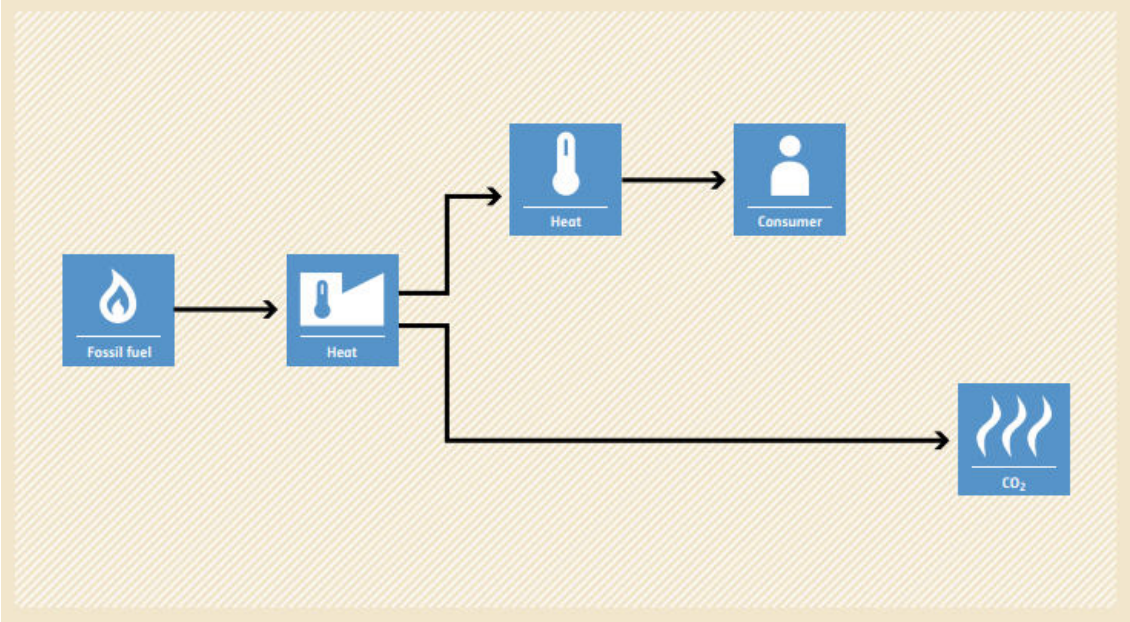
• Annual consumption of baseline fossil fuel (can also be monitored).

Monitored

• Number of households provided with solar cookers;
• Proportion of provided solar cookers still operating.

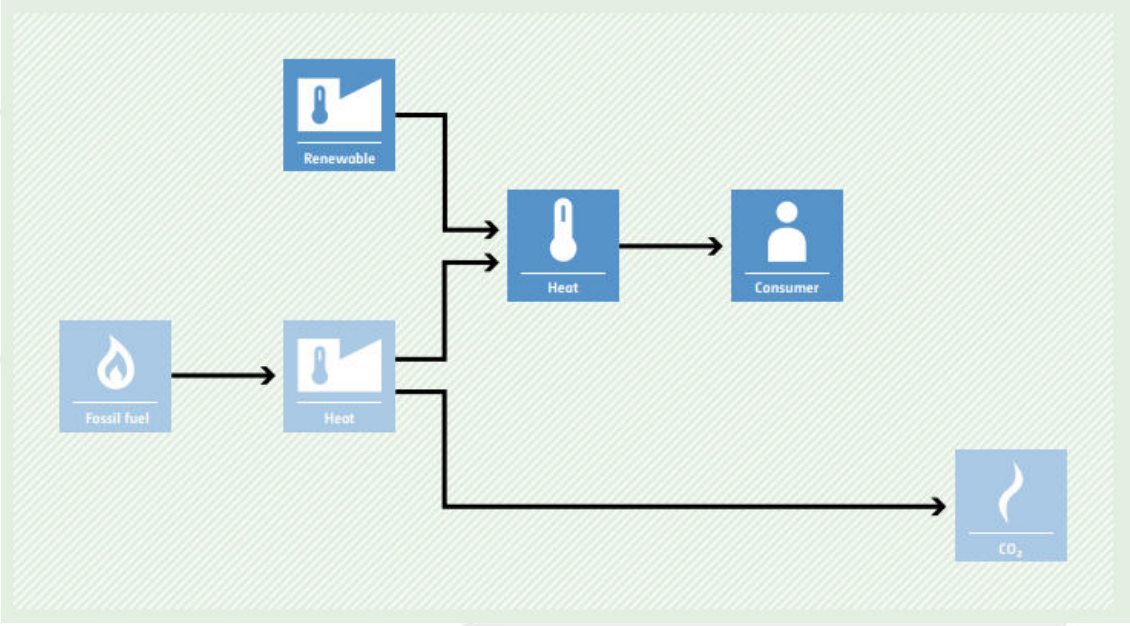
Baseline scenario

Fossil fuel(s) or non-renewable biomass are used for cooking purposes.



Project scenario

Fossil fuel(s) or non-renewable biomass are replaced by solar energy.



AMS-I.L. Electrification of rural communities using renewable energy

Typical project(s)

After the project implementation, rural communities are supplied with electricity from renewable-based systems (e.g., solar home systems, renewable mini-grid).

Type of GHG emissions mitigation action

• Renewable energy.
Displacement of fossil fuel use.

Important conditions under which the methodology is applicable

• 75% (by numbers) of the end-users shall be households;
• End-users were not connected to a national/regional grid;
• Project equipment complies with international standards or comparable national, regional or local standards/guidelines.

Applicability conditions BCR

None.

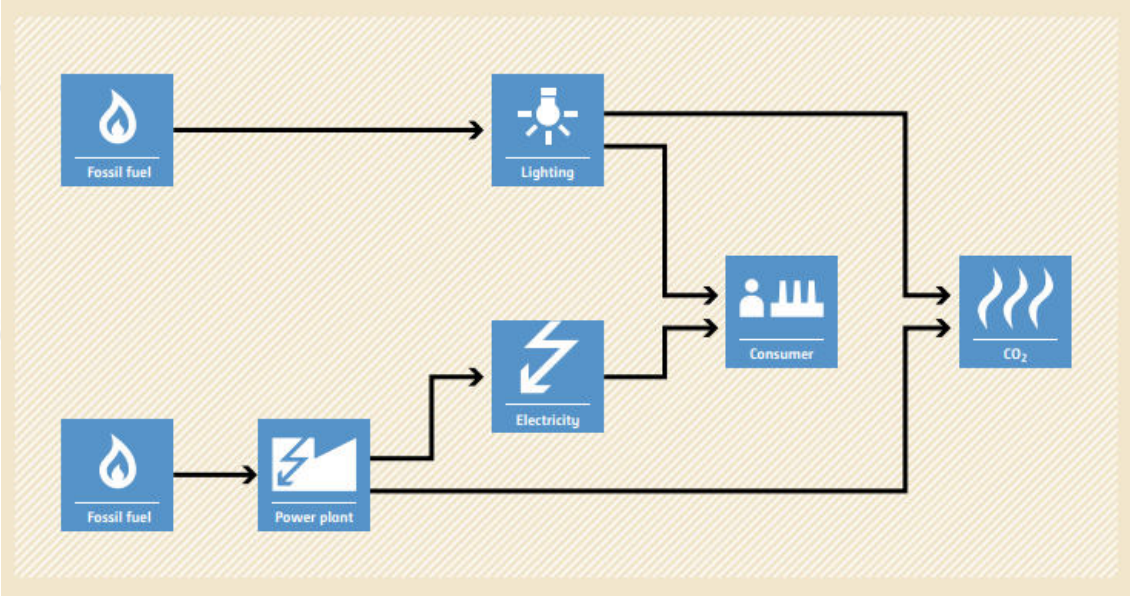
Important parameters

Monitored

• Measure or estimate the net amount of renewable electricity delivered to all the end-use facilities;
• Installed capacity of renewable electricity generation systems.

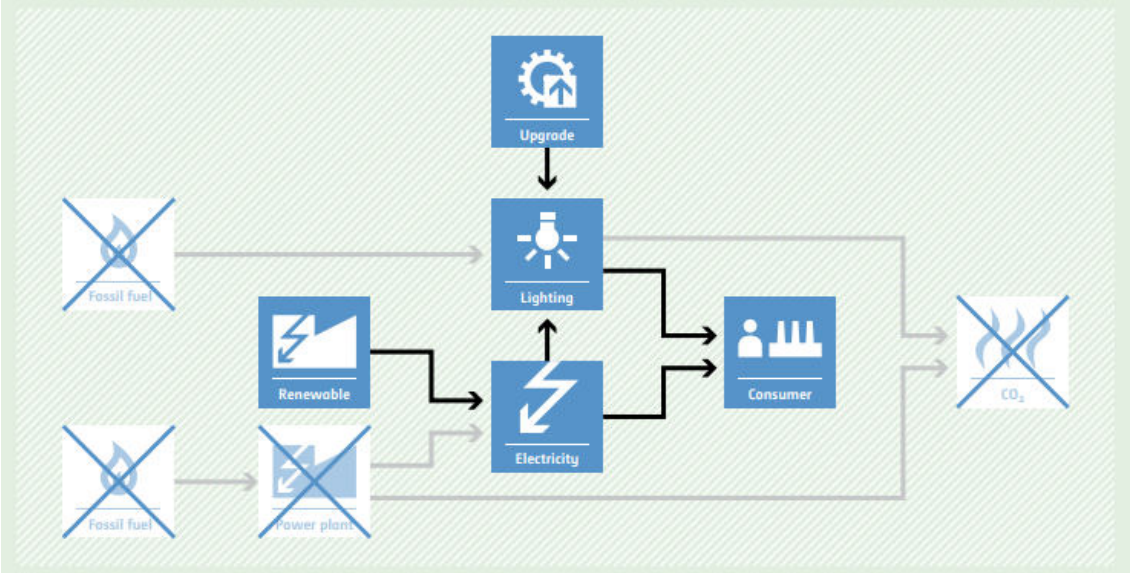
Baseline scenario

In the absence of the project activity, the end users would have used fossil fuel based lighting and stand-alone diesel electricity generators for appliances other than lighting (e.g., TV).



Project scenario

End users are supplied with electricity from renewable based energy systems (e.g., solar home systems or renewable mini-grid).



AMS-III.AR. Substituting fossil fuel-based lighting with LED/CFL lighting systems

Typical project(s)

Activities that replace portable fossil fuel-based lamps (e.g., wick-based kerosene lanterns) with battery-charged LED or CFL based lighting systems in residential and/or non-residential applications (e.g., ambient lights, task lights, portable lights).

Type of GHG emissions mitigation action

• Renewable energy;
• Energy efficiency.
Displacement of more-GHG-intensive service (lighting).

Important conditions under which the methodology is applicable

• Project lamps whose batteries are charged using one of the following options:
– Charged by a renewable energy system (e.g. a photovoltaic system or mechanical system such as a hand crank charger);
– Charged by a standalone distributed generation system (e.g. a diesel generator set) or a mini-grid;
– Charged by a grid that is connected to regional/national grid;
• When the LED/CFL lighting system has more than one LED/ CFL lamp connected to a single rechargeable battery system, each LED/CFL lamp may be considered as one project lamp;
• At a minimum, project lamps shall be certified by their manufacturer to have a rated average operational life of at least:
– 5,000 hours where project lamps are assumed to operate for two years after distribution to end-users (i.e. emission reductions are not credited beyond two years). Under this option, ex post monitoring surveys to determine the percentage of project lamps in service in year y are not required;
– 10,000 hours where project lamps are assumed to operate for up to seven years after distribution to end-users (i.e., emission reductions are not credited beyond seven years). Under

this option, more stringent requirements (e.g., test on light output, ex post monitoring surveys) are specified;
• Project lamps shall have a minimum of one year warranty;
• The replaced baseline lamps are those that directly consume fossil fuel.

Applicability conditions BCR

1. Only projects with renewable energies associated activities, or that, as a result of the project activities, replace fossil fuels by NCRE.

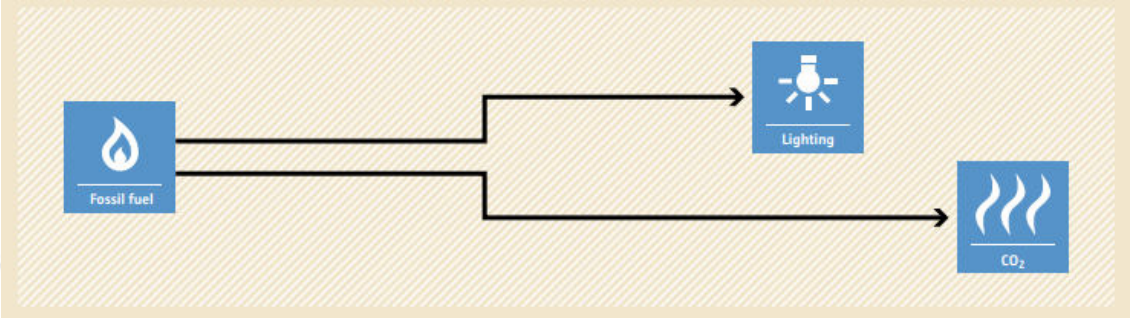
Important parameters

Monitored

• Recording of project lamp distribution data;
• In some cases ex post monitoring surveys to determine percentage of project lamps distributed to end users that are operating and in service in year y.

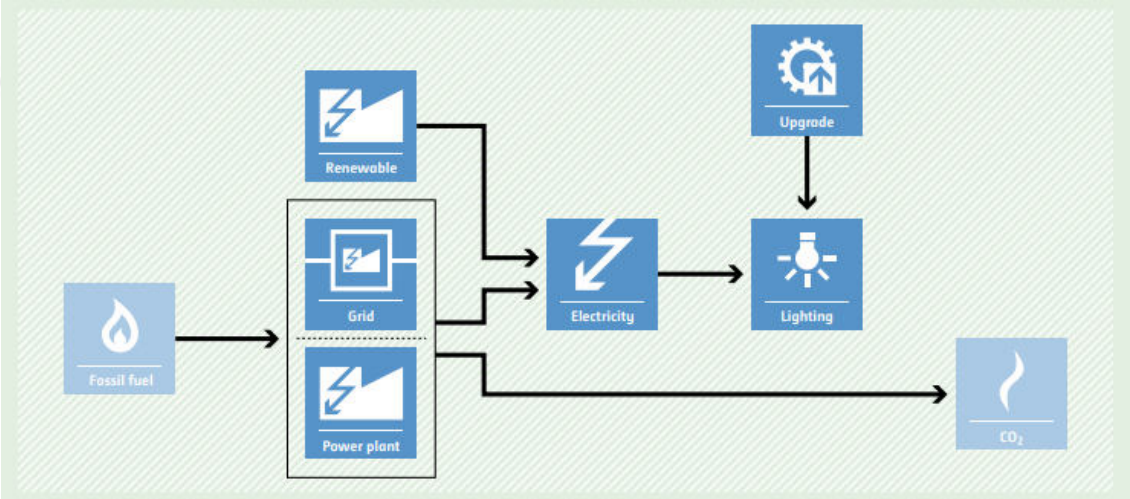
Baseline scenario

Use of fossil fuel-based lamps.



Project scenario

Use of LED/CFL based lighting systems.



AMS-III.BL. Integrated methodology for electrification of communities

Typical project(s)

Rural communities that are supplied with electricity either from renewable energy or hybrid energy systems (e.g., wind-diesel) or through grid extension which displace fossil fuel use, such as fossil fuel-based lighting systems, stand-alone diesel generators and diesel-based mini-grids.

Type of GHG emissions mitigation action

• Displacement of fossil fuel use.
Low-carbon-intensive grid/mini-grid electricity displaces high-carbon-intensive electricity or lighting services.

Important conditions under which the methodology is applicable

• Limited to communities with no access to a national or regional grid;
• At least 75% of the end users (by number) shall be households.

Applicability conditions BCR

None.

Important parameters

At validation

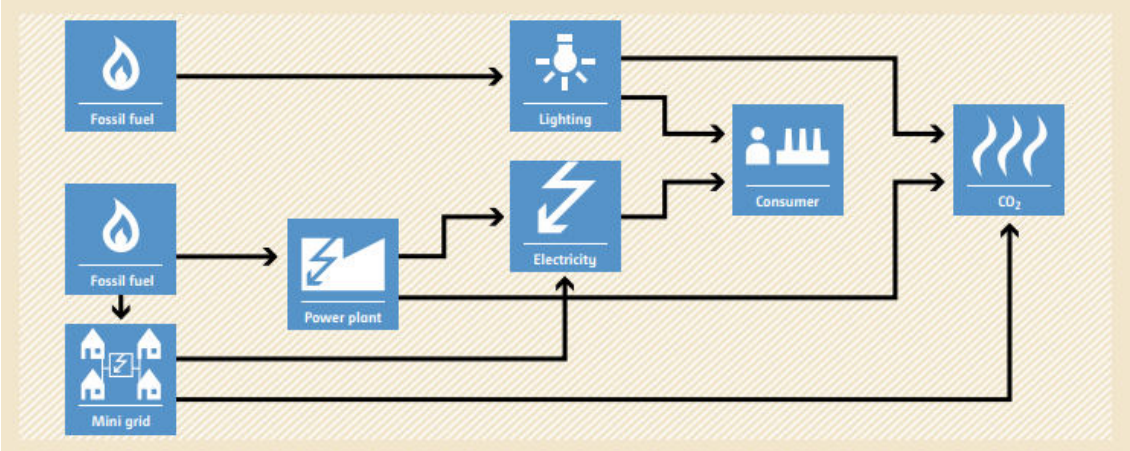
• The physical location and consumption level of each consumer using survey, and the classification of consumer type by their electricity consumption and project technology/measure implemented;
• Default emission factors as provided in the methodology.

Monitored

• Electricity consumption need to be monitored using one of the following options (i) Metering (standard electric meter or pre-payment meter), (ii) Sample survey (e.g. stratified random sampling), (iii) Distribution metering and consumer numbers and (iv) Deemed consumption;
• In case of consumers (e.g. commercial consumers, small, medium and micro enterprises, public institutions, street lighting, irrigation pumps) having electricity consumption more than 1000 kWh/year, consumption is necessarily monitored through metering.

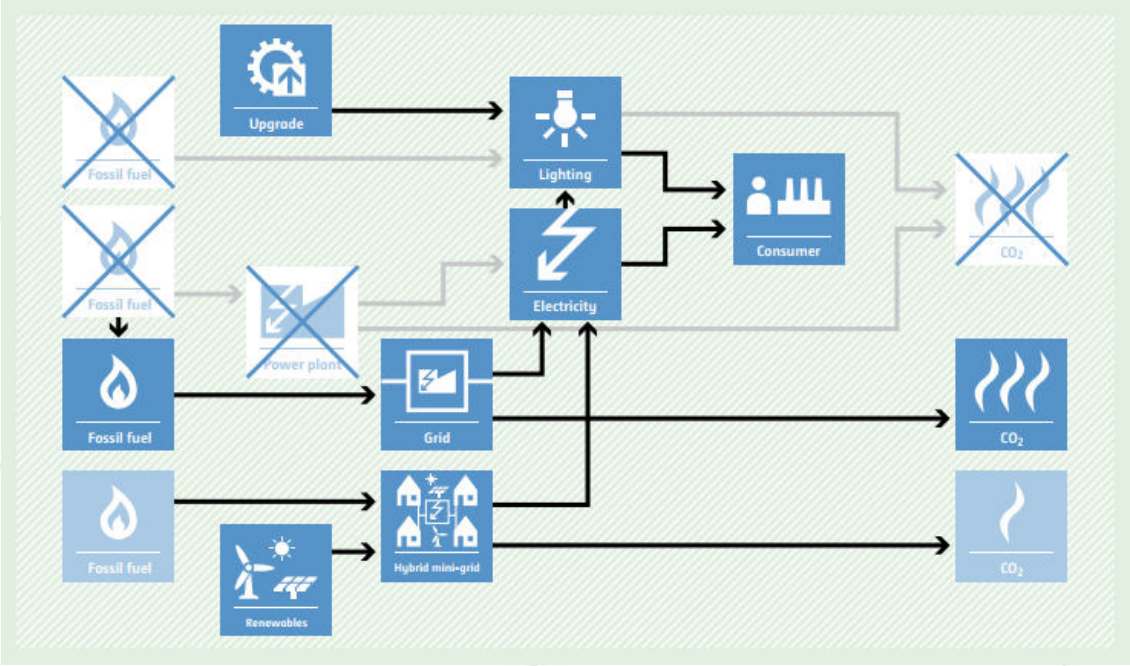
Baseline scenario

In the absence of the Project activity, the end users would have used fossil fuel-based lighting, stand-alone diesel electricity generators for appliances other than lighting (e.g., TV) or would have been supplied by carbon intensive mini-grid.



Project scenario

Consumers are supplied with electricity by new construction of renewable energy system or hybrid energy system or rehabilitation/refurbishment of renewable energy system or connection to a national or regional or mini-grid.



B. CDM methodological tools

CDM methodological tools to take into account are listed next[25]

i. Tools for the demonstration and assessment of additionality: Tool 01, demonstration of additionality. Tool 02, combined tool to identity the baseline scenario and demonstrate additionality. Tool 19, demonstration of additionality of microscale project activities. Tool 21, demonstration of additionality of small-scale projects. Tool 23, additionality of firsts-of-its-kind Project activities.

ii. Tool 03, tool to calculate project leakage CO2 emissions from fossil fuel combustion.

iii. Tool 05, baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation.

iv. Tool 07, tool to calculate the emission factor for an electricity system.

v. Tool 10, tool to determine the remaining lifetime of equipment.

vi. Tool 16, Project and leakage emissions from biomass.

vii. Tool 22, leakage in biomass small-scale project activities.

viii. Tool 24, Common practice.

ix. Tool 27, investment analysis.

x. Tool 30, calculation of the fraction of non-renewable biomass.

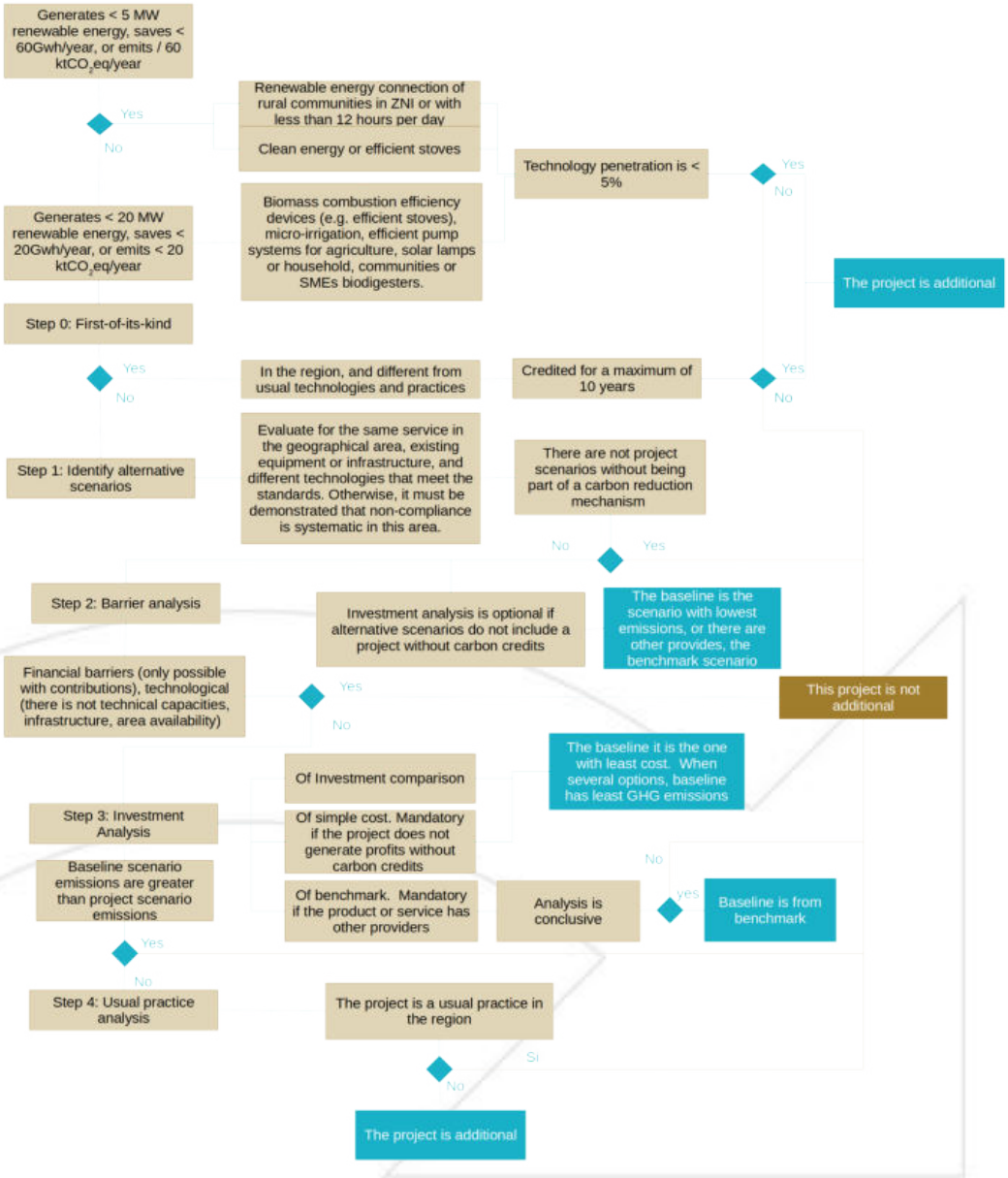
xi. Tool 32, positive list of technologies.

The next appendices present a summary of up-to-date tools as at these guidelines publishing date. The project proponents shall make sure of using last versions.

[25] CLEAN DEVELOPMENT MECHANISM. Tools [Online].

a. Tools 01, 02, 19 y 23: Baseline identification and additionality

Figure 2. Additionality Analysis



Source: Adapted from CDM tools analysis

Figure 2 is a summary of additionality assessment steps. This diagram is based tools 01, 02, 19 and 23.[26, 27, 28, 29]

b. Tool 03: project or leakage CO_2 emissions from fossil fuel combustion

Following tool 03[30], emissions associated with fossil fuels combustion are based on the amount of fuels combusted by the CO_2 emission coefficient of those fuels.

CO_2 emission coefficient per mass or volume mass has two options of calculations, as follows. The first is the preferred approach:

- Based on fuel type chemical composition
- Based on heat net calorific value and CO_2 emission factor of the fuel type

Parameters monitored

Quantity of fuel type. Use either mass or volume meters, calibrated transducers, sonar, and piezoelectric devices. End users are households, communities, or small and medium enterprises (SEMs), may estimate amount of fuel using invoices or bills, equipment data adjusted by efficiency, the highest value for the same calendar period of the previous years, or a representative sample.

Weighted average of mass fraction in fuel type. Values should be provided by the fuel supplier in invoices, or if not available, weigh measurements by project participants. In the late, laboratories should have ISO17025 accreditation or similar standards, measuring each fuel delivery to obtain weighted annual values. This value shall be verified with IPCC default values.

Weighted average density of fuel type. Same as the previous parameter, the value provided by the supplier, measurements of default data by region o country from trustworthy sources.

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[26] CLEAN DEVELOPMENT MECHANISM. TOOL01: Tool for the demonstration and assessment of additionality [Online]. UNFCC, 2012. Available on: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf
[27] CLEAN DEVELOPMENT MECHANISM. TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality. Version 05.0.0 [Online]. UNFCC, 2017. https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf
[28] CLEAN DEVELOPMENT MECHANISM. TOOL19: Demonstrating additionality of microscale project activities [Online]. UNFCC, 2018. https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v9.pdf
[29] CLEAN DEVELOPMENT MECHANISM. TOOL23: Additionality of first-of-its-kind project activities [Online]. UNFCC, 2015. https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-23-v1.pdf/history_view
[30] CLEAN DEVELOPMENT MECHANISM. *TOOL03.* Op. Cit. p. 3-5.

Weighted average net calorific value of fuel type. As in previous parameters. IPCC default parameters may be used, at the upper limit of the uncertainty at a 95% confidence interval.

Tool 07: Tool to calculate the emission factor of an electricity system[31]

The emission factor or "combined margin" (CM) is the result of a weighted average of two emission factors pertaining to the electricity system: "operating margin" (OM) and "build margin" (MB)". The CM is equal to the emission factor of the electricity mix or matrix of the grid[32].

$$EF_{year} = CM_{year} = w_{OM} \times EF\_\mathrm{OM}_{year} + w_{BM} \times EF\_\mathrm{BM}_{year}$$

Equation 1. Emission factor

Where

w_{OM} and w_{BM}	Weighting of operating and building margin emissions factor, they sum 1.
EF_OM_{year}	Operating margin CO_2 emission factor. It is a weighted average per energy unit of all energy sources in the grid (tCO_2 / MWh), excluding low or zero operational cost plants (renewable energies), based on national statistics from last year.
EF_BM_{year}	Build margin CO_2 emission factor. It is usually a weighted average of emissions factors of a selected group of power plants, that represent the 5 more recently constructed plants or at least 20% of power units built. If the project can demonstrate a more accurate sampling, it can use it. If the grid imports or exports electricity to or from other grids, it shall apply a correction factor to the BM, unless it demonstrates that without correction is the most conservative option or that the correction is negligible.
Steps	

[31] CLEAN DEVELOPMENT MECHANISM. Tool 7 to calculate the emission factor for an electricity system [Online]. UNFCC, 2018. Available on:https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[32] It is the combined generated energy by type in the interconnected national electricity system; either hydroelectric, thermoelectric, renewable, other. It changes each year because generation is dependent of installed capacity and climatic conditions, the energy and fuels market, and regulatory changes.

1. Identify relevant electrical systems
2. Decide if to include off-grid power plants
3. Select a method for calculating Operation Margin (OM)
4. Calculate emission factor according to the selected method
5. Calculate the building margin emissions factor (BM)
6. Calculate the combined margin emissions (CM)

c. Tool 10: Tool to determine the remaining lifetime of equipment

Tool 10[33] establish three options. Unless there is an expert evaluation, Project proponents shall demonstrate that operation and maintenance practices are appropriate, that there are no periodic replacement schedules that reduce equipment lifetime, and that the equipment has no design fault or defect and did not have any industrial accidents due to which it cannot operate at rated performance levels:

1. Use manufacturer's information for the technical lifetime of equipment and compare it to the date of first commissioning. It is necessary that:
   - Information is available
   - There is not periodic replacement scheduled by the industrial facility
   - If retrofit was undertaken by the manufacturer, it should provide a revised estimation of the technical life
   - Apply the original technical life at the time of equipment installation, as long as assuming a shorter lifetime is conservative
2. Obtain an expert evaluation. He has to analyze:
   - The operational history of the equipment to identify the past performance, equipment retrofits, failures/accidents, capacity upgrades/degradations, replacements, etc.
   - The current Operation and maintenance practices
   - Documented specific sectoral/industry practices for replacements
   - Conducting tests on the equipment, such as magnetic particle examinations, ultrasonic testing, metallurgical analysis, etc.
3. Default values

[33] CLEAN DEVELOPMENT MECHANISM. Tool 10: Tool to determine the remaining lifetime of equipment [Online]. UNFCCC, 2009. Available on: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

Equipment	Default value for technical lifetime
Boilers	25 years
Steam turbines	25 years
Gas turbines, up to 50 MW capacity	150.000 hours
Gas turbines, above 50 MW capacity	200.000 hours
Hydro turbines	150.000 hours
Electric generators, air--cooled	25 years
Electric generators, hydrogen cooled or water-cooled	30 years
Wind turbines, onshore	25 years
Wind turbines, offshore	20 years
Diesel/oil/gas fired generator sets	50.000 hours
Transformers	30 years
Heaters, chillers, pumps, etc. Used in HVAC systems	15 years

d. Tool 16: Project and leakage emissions from biomass

Based on tool 16[34].

Emissions from biomass use	Emissions from a change in project activities
Biomass from dedicated plantation	
Sources	Scenarios
1. Organic soil loss It is determined by soil media. It is a function of factors defined in tool 16, related to temperature, humidity, soil type, soil management, and use, area, crediting period. 2. Soil management N_2O and CO_2 emissions, given by nitrogen fertilizers, soil amendment by liming,	1. Plantation area was or would have been abandoned 2. Plantation area was used prior to implementation but project plantation Will be accommodated for, provided at least the same level of service during project activity, within the land area included in the project boundary: the same level of the annual production of crops, the same number of cattle, same settlements, improved practices.

[34] CLEAN DEVELOPMENT MECHANISM. TOOL16. Project and leakage emissions from biomass [Online]. UNFCCC, 2017. Available on: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v4.pdf

dolomite, urea, other carbon-containing agents	Emissions: For scenarios 1 and 0, they are zero.
3. Energy consumption Emissions from fossil fuel consumption in cultivation practices and biomass processing plants. They can be neglected in small scale projects.	3. Project activities will displace other agricultural activities. Project participants should assess leakage possibility by monitoring the following indicators: Percentage of families of the community involved or affected Percentage of the total production of the main product within the project boundary displaced due to the cultivation of biomass
4. Clearance or biomass burnt It depends of the amount cleared or burnt, root-shoot ratio and area of the stratum of land subjected to clearance or fire	
5. Biomass transport In small scale projects, if the specific methodology does not indicate something different, and transport distance is less than 200 km, they can be neglected	Applicability and emissions: For large-scale projects, displacement of activities IS NOT ALLOWED. For small-scale projects: ◦ If displacement is less than 10%, leakages are negligible ◦ IF it is less than 50% and greater than 10%, leakages are 15% of emissions reductions ◦ If it is greater than 50%, the CDM methodology is not appropriate
Biomass from residues	
1. Energy consumption Energy consumption associated GHG emissions due to thermal and mechanical processing of the biomass In a small-scale project, if the methodology does not specify different indications, they may be neglected.	1. Biomass residues that are dumped or left to decay mainly under anaerobic conditions, e. e., on fields 2. Biomass residues are dumped or left to decay under clearly anaerobic conditions, i. e., landfills that are deeper than five meters 3. Biomass residues that are burnt in an uncontrolled manner without utilizing them for energy purposes
2. Biomass transport	

In a small-scale project, if the methodology does not specify different indications, and the distance is less than 200 km, biomass transport emissions may be neglected.

4. Biomass used for energy and non-energy applications, or the primary source of the biomass residues and/or their fate cannot be identified

   Emissions: Scenarios 1 to 3 have minimal GHG emissions and they are neglected.

Applicability: scenarios 1 to 3 shall demonstrate there is surplus of biomass residue in the project region which is not utilized. The total quantity of that type of biomass residues annually available in the project region is at least 25 per cent larger than the quantity of biomass residues that is utilized annually in the project region.

5. As fuels in other applications

Emission: it is assumed that an equivalent amount of fossil fuels, on energy basis, would be used if biomass residues are diverted from other users.

Applicability: it is mandatory if biomass residues were processed (drying, pelletization, shredding, briquetting), and if the residue is scarce in the region.

e. Tool 32: Positive technologies list

The positive list of technologies is established in tool 32[35]. A positive list of technology includes technologies that confer automatic additionality, provided that the project exclusively applies them, and demonstrate fulfillment of related conditions specified in tool 32.

[35] CLEAN DEVELOPMENT MECHANISM. TOOL 32. Op. Cit. p. 4-7.

 **Large-scale non-conventional renewable energy**	**Biomass energy** 
In SIN • Photovoltaic, solar • Thermic, solar • Wind off-shore The installed capacity of the grid, either isolated or interconnected has to be less or equal to 50 MW, or 2% of the total capacity of the grid. This condition is true for Colombia as at 2020.[36] **In ZNI,** besides previously listed: • Biomass gasification/biogas • Biomass internal gasification Combined cycle BIGCC	Landfill gas recovery • It has to generate up to 10 MW electricity or heat for internal or external consumption Methane recovery in wastewater treatment • Meets the host country regulation • There is no regulation in the host country • There is no capacity increase in the wastewater treatment • NO other alternative economic activity is expected to be undertaken on the land of the existing lagoon • Biogas is used to generate electricity in one or more power plants, and the total nameplate capacity is below 5 MW
Small scale	**Household, communities and SMEs**
Small scale projects located on ZNI, can include the following technologies, provided they are below 100 kW • PCH • Micro/Pico wind turbine • Building-integrated wind turbines	• Biogas digesters for coking • Micro-irrigation • Energy-efficient pump-set for agriculture

[36] ACOLGEN. Installed capacity in Colombia [web page]. Bogotá. Available on: https://www.acolgen.org.co/

f. Standard 5: Sampling and surveys for CDM project activities

Main considerations are described, taking into account standard 5[37] and the guidelines[38] for project and program of activities' sampling and surveys of the CDM.

Sampling plan	
Content	**Confidence**
Description, assumptions, and justification ***1. Sampling design*** • Objectives and confidence requirements • Object population • Sampling method • Sample size • Location ***2. Data to collect*** • Field measurements: times and frequency • Quality control: procedures • Analysis: how data will be used ***3. Implementation:*** Schedule, resources, personal	*Small scale projects:* 90/10, 90% confidence. +/-10% precision *Large scale projects* 95/10 Confidence and precision are given using relative units when parameters are a proportion, for example, success rate (p) or failure rate (1-p) of cookstoves Or they are given using a relative term when the parameter of interest is a mean. **Stratification:** It is to divide population in groups, under parameters of interest, for example, they geographic location.
Sampling types	Sample size
Random sampling: of the total population **Systematic sampling:** a selection of elements from an ordered sampling frame	Sample size depends on the confidence, expected values, and standard deviation, based on previous projects or pilots.

[37] CLEAN DEVELOPMENT MECHANISM. Sampling and surveys for CDM project activities and programmes of activities—- Version 08.0. [Online]. UNFCCC, 2019. Available on: https://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid48.pdf
[38] CLEAN DEVELOPMENT MECHANISM. Guideline: Sampling and surveys for CDM project activities and programmes of activities. Óp. Cit. p. 4-9. Available in: https://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid48.pdf

Stratified random sampling: several subpopulations, a simple random sample from each of these

Cluster sampling: the population is divided into sub-groups (clusters) and they are randomly selected rather than individual elements

Multi-stage sampling: random sampling of units from randomly selected clusters

When the sample size is not enough to the required confidence value, corrections may be applied:

- Discounting of emissions reductions by
  - Taking the most conservative of the confidence interval
  - Discounting by no less than three times (x39 the percentage precision points missed (i.e. if the required precision is 90/10 and he attained precision is 90/11, then GHG emissions reduction estimates are discounted by 3 per cent)
- Using default values given by methodologies

Surveys	
Types	Requirements
In person: using paper or digital tools **Remote:** data sensor, telephonic interview, email survey, web or SMS based platform	• Appropriate justification • Appropriate and clear to the target population • Adequate answer rate • With procedures that, without the influence of the survey type, obtain representative data and reduce sampling errors • Clarity about required capacities of interviewers

History of the document

Type of document

Guidelines Energy sector

Version	**Date**	**Document Nature**
1.0	September 14, 2020	Initial document
1.1	July 1, 2022	Actualized version BioCarbon Registry and related documents Editorial changes